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THE LIFE HISTORY OF RIEFFER'S HUMMINGBIRD  
(*AMAZILIA TZACATL TZACATL*) IN PANAMA  
AND HONDURAS.<sup>1</sup>

BY ALEXANDER F. SKUTCH.

(Plates VIII-X.)

UPON his arrival almost anywhere in the lowlands of Central America, the first Hummingbird which the traveller with an interest in ornithology is likely to encounter is a medium-sized species with brilliant, metallic green body and head, a bright chestnut-brown tail and a long, slender, slightly curved, black bill, known to the scientific world as *Amazilia tzacatl tzacatl* (De la Llave), to Americans by the book name Rieffer's Hummingbird, and to the natives by no name of specific distinction at all. It is a bird of wide distribution, and from below the equator in Ecuador it ranges northward through twenty-eight degrees of latitude and, crossing the Tropic of Cancer, is found in the lower Rio Grande Valley in Mexico.<sup>2</sup> A single individual was once captured alive on the northern side of the river near Brownsville, Texas, but apparently its presence in United States territory is rare or accidental.<sup>3</sup> From the hot, humid lowlands of the Caribbean coast of Central America and Colombia to the cool plateaus of Bogotá and Guatemala City, this adaptable creature finds itself at home. It seems everywhere to prefer open country to the dark, sunless lowland forests. At every point I have visited in the humid Caribbean lowlands of Central America, in Panama, Honduras and Guate-

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<sup>1</sup> Studies of the life histories of tropical American birds, No. 2.

<sup>2</sup> Ridgway, *Birds of North and Middle America*, V. p. 408, 1911.

<sup>3</sup> Bendire, *Life Histories of North American Birds*, p. 223. 1895.



RIEFFER'S HUMMINGBIRD (*Amazilia tzacatl tzacatl*) INCUBATING IN A BOUGAINVILLEA BUSH. ALMIRANTE, PANAMA, MARCH 6, 1929.

mala, I have found it the chief and most abundant Hummingbird in the clearings about the habitations of men, and in the banana plantations. In fact, it is the only species of Hummingbird which in these regions seems really a characteristic inhabitant of the lawns, gardens, orchards and ornamental plantings about the settlements. Other kinds, which dwell in the forests or the scrubby second growth, may frequently venture into such clearings, at times in large numbers, as when some favorite tree happens to be in blossom, but their visits are usually transitory, and I have not yet found one nesting there. On the other hand, I have never encountered *Amazilia* within the confines of the heavy lowland forests. Accustomed as we are to birds which frequent indifferently the orchards and gardens, as well as our lighter and more restricted woodlands, it is difficult for one who has not visited the tropics to conceive how strong a barrier to the wanderings of resident birds is formed by the edge of the forest. There are dozens of forest dwelling species, especially among the smaller birds, which one may never see a hundred feet inside the clearings, while the majority of those which prefer the latter habitat, and among them *Amazilia*, show an equal aversion to the depths of the forest. On Barro Colorado Island in Gatun Lake, Rieffer's Hummingbird has made itself at home in the narrow clearing which surrounds the laboratory buildings, separated by a broad expanse of open water from the clearings on the opposite mainland, but apparently rarely penetrates the forest which presses in closely on all hands.

About the habitations of men, where these Hummingbirds seem most at home, they spend their time probing for insects or nectar in the great red blossoms of *Hibiscus sinensis*, which is everywhere a favorite shrub for hedges, dooryards and the town plaza, or else in the blue trumpets of the *Thunbergia* which scrambles over fences and up the sides of houses; or they hover before the coral vine, the blue flowers of *Clitoria*, or the blossoms of some fruit tree. At other times they enter the banana groves and poise beside the long, pendent inflorescences, where they probe the white blossoms clustered beneath their heavy red bracts, swarming with the little, black, stingless bees which gather their pollen and rich nectar. In the early morning one may see them bathing on the dewy surface of the broad banana leaves, over which they glide with vibrant wings,

gathering up the heavy dew drops in their plumage. They are no more sociable than other kinds of Hummingbirds, and dart fiercely at another of the same or a different species if he ventures too near, but the bird attacked almost invariably retreats at the first dashing onslaught, closely followed by the pursuer, and I have never witnessed two birds engaged in an encounter face to face.

Their nesting period, as Mr. Cherrie<sup>1</sup> remarks, probably covers every month of the year. In one part or another of the Caribbean lowlands I have found nests with eggs in every month except July, October and November, and my records include nestings in both the wet and dry seasons. Near Almirante, in western Panama, I encountered my first nest of this species just as the bird was beginning to construct it on December 19, 1928, the height of the rainy season in Bocas del Toro province. Thence, until my departure in early June of the following year, I found 17 nests, all but one in the immediate vicinity of the house I at that time occupied. The majority of these were encountered during the drier weather, which began in January and continued until May. My friend Mr. J. H. Perman reports finding a nest here in July, 1930. On the grounds of the Lancetilla Experiment Station near Tela, Honduras, although the species was quite abundant, I did not discover so many nests as at Almirante. During a seven months' residence here, I found or was shown six nests, one (which was never completed) in April, one each in May and June, two in August and one in September. On Barro Colorado Island in the Canal Zone I found a nest in which the first egg was laid January 11, 1931. Although the nesting period, for the species as a whole, is unusually long, even for tropical birds, and is peculiar in including both the dry and rainy seasons, I do not know how many broods each female may raise, or what period the breeding activities of a single individual may cover. We are faced with the same problem in regard to other species which breed at two widely separated periods or through the greater part of the year, the Ground Doves of the genus *Columbigallina*, for example. Several possibilities are thinkable—the same individual may breed at intervals throughout the year, or she may have two widely separated nesting periods,

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<sup>1</sup> G. K. Cherrie. A preliminary list of the birds of San Jose, Costa Rica. *Auk*, Vol. IX, pp. 322-329. 1892.

or each individual may have a particular season in which it nests year after year, while another nests periodically in an entirely different season—but for no single species, so far as I am aware, has the problem been definitely settled.

The nests of *Amazilia* are usually placed in trees or bushes in the clearings where the birds reside, without any distinct preference for any particular type. Frequently a thorny lime or orange tree is chosen, or a Bougainvillea vine, but as often a thornless kind is selected for the nesting site. Sometimes even a low herbaceous plant is favored. I have found their elevation to vary from 2 to 20 feet from the ground. The open cup is constructed in a variety of situations, but almost invariably on some slender support. If some variety of citrus tree has been chosen, it may rest in the angle between an upright branch and one of its large thorns (Plate IX, fig. 1), attached to both by cobweb, or in another kind of plant it may be placed in the axil of a slender leaf-stalk, or in the angle between a thin horizontal branch and a vertical stem. Sometimes a leaf alone suffices for its foundation. One of the most attractively situated I ever found was attached near the drooping tip of a large frond of the thorny peijabaye palm (*Guilielma utilis*), another was fastened to the palmately compound leaf of the Brazilian rubber tree, a third straddled the slender rhachis of the pinnately compound leaf of an akee (*Blighia sapida*), supported on either side by the opposite leaflets. At times the bird selects a very inadequate foundation. I once found a nest attached to a frail and decaying twig which in its descent from somewhere higher in the tree had caught on a horizontal branch and hung loosely beneath it, draped about with the fronds of a slender, creeping species of polypody fern which covered the bough and dropped in festoons below it. The one requirement of a nesting site is a horizontal support sufficiently slender to be grasped by the bird's feet—for from such a perch the building operations are always begun—close to some vertical or oblique support to which the side of the nest may be anchored. Frequently the nest is situated above or close beside a path along which people are constantly passing.

The nest is an open cup, formed exteriorly of weathered strips of grass, leaves, bits of weed, fibres and the like, and abundantly lined with soft, felted plant down, the whole bound together by cobweb

liberally supplied. The outer surface is tastefully decorated with gray lichens and green mosses, which sometimes are allowed to hang in long, waving festoons beneath it. Rarely, as in the nest I found on Barro Colorado Island, this ornamentation is very sparingly applied, so that the prevailing color of the exterior is grayish or tawny, from the fibres and down employed in its construction. Sometimes an otherwise beautiful nest is marred by a long piece of a withered grass leaf, used in building the foundation, carelessly allowed to hang beneath it. The eggs, which are invariably two, are laid on alternate days and are pure white, oblong or oblong-ovate in shape.<sup>1</sup>

The moss and lichen covered nests blend so well with the green foliage among which they are usually placed that it would be extremely difficult to find them, especially when the white eggs are hidden by the emerald bird, if the female sat more closely. The locations of several nests, which otherwise I should probably never have found, were betrayed by the birds' darting off as I passed within a few yards of them. The instinct which leads the birds to build a nest which blends so well with its setting lacks fulfillment in a corresponding instinct to utilize this advantage by remaining motionless. Perhaps at the approach of really formidable enemies other than man the female does remain motionless on her nest, but when most small creatures, lizards or birds even many times her size venture too near, she merely darts at them and usually puts them promptly to flight. Individual birds, however, differ greatly in the closeness with which they cover their eggs and young. One female, the closest sitter of all I found, whose nest was built in a young lime tree in a nursery where men were frequently at work, would allow me to approach within arm's length before deserting, to return within a few minutes and settle down on her eggs directly before me if I waited quietly at this distance.

## II

I could scarcely have desired a nest located more conveniently for study than the first of this species I ever found. I was at the

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<sup>1</sup> Dimensions of a typical nest: External diameter  $1\frac{3}{4}$  inches, external height  $1\frac{1}{4}$  inches; internal diameter  $1\frac{1}{4}$  inches, internal depth  $\frac{7}{8}$  inch. Eggs (3 clutches measured): average  $0.55 \times 0.34$  inches, largest  $0.56 \times 0.34$  and  $0.55 \times 0.36$ , smallest  $0.53 \times 0.34$ .

time engaged chiefly in work with the microscope in a little frame building which served as office and laboratory at the now abandoned experimental station of the United Fruit Company beside the great Changuinola Lagoon, twenty miles from Almirante, Panama. On the afternoon of December 19, I raised my head from my work and noticed a Hummingbird, of a kind still unknown to me, perched on the petiole of a ramie plant (*Boehmeria nivea*) just outside the window, scarcely three yards from where I sat, and separated from me only by a screen. An oddness in her manner of perching attracted my attention, and looking more intently, I perceived something light colored almost hidden beneath her. When she flew off, I went out to examine her perch and found there a little tuft of plant down, fastened in the angle between the hairy petiole and the stem with cobweb, a piece of white thread, and several hairs from the cattle which grazed all about the small enclosure. During the succeeding days, as I sat at my work-table poring over bits of banana tissue, *Amazilia* labored steadily at her growing nest. The rite of adding a new bit of material followed an invariable routine. Returning with a tuft of down in her slender bill, she would alight softly on the incipient nest, push in the stuff where it was needed, and then proceed with the shaping of the structure. She bent down her head, and moving around and around, with her long bill shaped the substance to the contour of her body. As she pressed the yielding down more closely to her breast, she erected the bronze-green feathers of her crown, and her folded wings vibrated as though she thrilled in anticipation of the completed nest and the nestlings it was intended to cradle. Then she sat facing in a set direction, and from the way her body bounced up and down, I concluded she must be kneading the material together with her toes, although, being hidden beneath her, I was unable to see them in action. Sometimes she would dart away and then, as though the kneading and shaping had not been done to her satisfaction, return with empty bill to continue the moulding operations. So, as the nest grew, it became just large enough to fit snugly about the central portion of her body, leaving neck and head, rump and tail, protruding beyond its rim.

Hummingbirds of this species do not seem to have any prescribed order for the addition of the various elements of which the nest is

composed. This particular bird began with a wad of down, then bound around it strips of fibrous vegetable material, such as grass blades softened by partial decay, and fastened them there with cobweb. Others begin with strips of grass and banana leaf epidermis, adding the down later when they can get it. It seems to be merely a matter of convenience, or luck in finding the proper materials. I once found a nest built entirely of fine grass and pieces of weeds, but so devoid of lining that the eggs touched the branch on which it rested. This was doubtless because down for the lining was not available, and under favorable conditions the downy lining is added simultaneously with the fibrous materials which impart rigidity to the structure. Although the lichens and mosses appear to be merely an ornament of the nest, and do not constitute an essential part of the structure, they are often added before the foundation portions of the walls are completed.

As with other species of Hummingbirds, the female carried on all of her household duties without assistance from her mate. The two sexes are not distinguishable with certainty on the wing, but I never saw a single instance where two birds took an interest in the nest or its contents—unless indeed one was trying to rob it, as we shall describe later. By the twenty-second, the bird had made a good start, but during the ensuing four days the rain fell in torrents, soaking the unfinished structure, and during this period the builder made few visits to her work, and accomplished little. On the twenty-sixth, drier days returning, she resumed her work with renewed ardor until, twelve days after its commencement, the nest had been completed, and the first white egg was entrusted to it. She incubated the single egg sporadically during the following day but the next was not deposited until the second day after. The solitary mother brooded faithfully (Plate IX, fig. 2), and after sixteen days (the usual period) both eggs hatched.

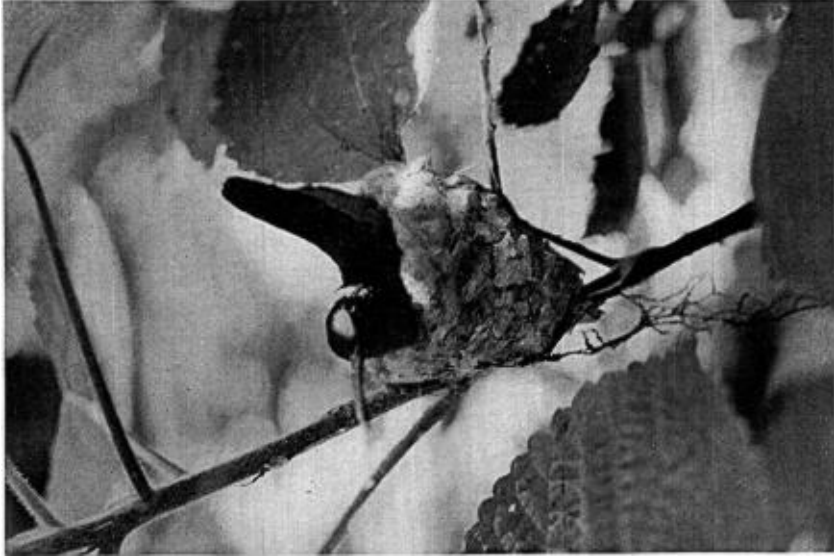
The newly emerged nestlings were like ugly grubs, blind, black-skinned, and naked except for two lines of short, tawny down extending the length of the back, one on either side of the middle line. The slender bill of the adult was represented by a mere bump, hardly longer than that of a newly hatched Pauraque (*Nyctidromus albicollis*). At intervals one of the graceless creatures reared up spasmodically, opening wide its yellow-lined mouth in a voiceless



call for nourishment, to sink again exhausted, with drooping head, into the nest. The mother's time for the first week was divided between brooding and feeding her offspring, which she did in the customary manner of the family, by regurgitation. Sitting upright on the rim of the nest, she thrust the rapier-like bill into the nearest gaping mouth, pushing it down until it seemed that it must pierce the entrails of the nestling. Then with a convulsive jerking of the body she regurgitated a portion of the contents of her crop into that of her infant. Both nestlings were as a rule fed at each return to the nest, and often each was given food twice, alternately. When the nestlings are older, sometimes each is fed four times at a single visit of their mother. After feeding, she usually returned to brooding, repeatedly thrusting out her long, white tongue as she sat on the nest. Though during the day she flew off, twittering her complaint at my too near approach, at night she would permit me to advance and touch her on the nest, in the beam of a flashlight.

With these constant ministrations the youngsters grew amazingly, and at the age of six days, when the beady black eyes first began to peep out of the still-naked head, and the bill had lengthened considerably, they quite filled the bottom of their downy cup. The next day the eyes were fully open, and the tawny tips of the feathers began to protrude from their sheaths. When the nestlings reach this stage of their development, the mother ceases to cover them at night, but withdraws to perch at a distance. Before retiring on that seventh night of their lives, I went out to look at the nestlings, and to my disgust found their dead bodies swarming with small brown ants, the fierce, stinging kind called "Fire Ants" by the natives, which filed up and down the stem of the ramie plant, swarmed over the nest and fed on their flesh. I have little doubt that the ants attacked the nestlings while they still lived, for I had seen them receive food early that afternoon, and on another occasion witnessed still smaller ants attack living nestlings of Passerini's Tanager (*Ramphocoelus passerinii*). The swarms of ants continued to flow over the nestlings until their flesh was entirely consumed, and nought but a little heap of tiny bones remained in the nest.

Five days after this massacre of innocents, I was bent over my microscope when I heard a whirr of wings close by, and looking up,



LEFT.—NEST AND EGGS OF RIEFFER'S HUMMINGBIRD. THE NEST IS SUPPORTED BY A LARGE THORN OF A LIME TREE. TELA, HONDURAS, SEPTEMBER 7, 1930.

RIGHT.—RIEFFER'S HUMMINGBIRD INCUBATING IN A NEST SUPPORTED BY THE PETIOLE OF A LEAF OF THE RAMIE (*Boehmeria nivea*). ALMIRANTE, PANAMA, JANUARY 5, 1929.

noticed a Rieffer's Hummingbird pulling fibres from a soft hemp cord which I had left hanging from one of the slats of the shutter of my work window. Poised on vibrant wing, she pulled backward and away from the house, while her brilliant green throat gleamed in the afternoon sunlight, and her tail sent forth intermittent flashes of chestnut as she spread and closed it in controlling her flight. Then she darted away with the fibres in her bill, but soon returned and, poising before the deserted nest in the ramie, pulled out a billful of down. I followed her flight around to the small cashew tree which stands close beside the porch on the other side of the building. In a crotch near the top of this tree a new nest had been begun. The bird worked rapidly, tearing away large billfulls of down from the old nest and incorporating it into the new. She also hovered beneath the rafters of the porch roof, seeking strands of cobweb as binding for her nest, and paid repeated visits to the cord for fibres. The nest was completed and the first egg laid after a week's work. The second egg followed two days later, but for some unknown reason the bird failed to incubate, and for a week the eggs lay cold in the nest. Then it was attacked by a different Rieffer's Hummingbird, which pulled it to pieces, for the sake of the down it contained, to use in the construction of her own nest nearby. I feel confident that the bird which built this nest in the cashew was not the individual whose nestlings had been devoured by the ants, for she was occupied with a second nest in the same tree at the time the other was incubating her second clutch of eggs in the ramie.

Six weeks passed after the death of the nestlings, and all that remained of the nest in the ramie was its basal portion, a shallow cup of grass and fibres with hardly any lining, darkened and discolored by the weather. Then on March 4 I found a single egg resting on the hard, impacted base, but fresh bits of grass had been added to the walls around it, increasing their height, and new lichens decorated the exterior. Even after the second egg had been laid, on the following day, the bird continued to build up and line the old nest, until it appeared as solid and comfortable as when new. I suspect, from Hummingbirds' known attachment to their nesting sites, that it was the original builder returned to attempt once more to raise a brood in her old nest.

For the first few days after the eggs hatched, everything about

the nest proceeded normally, but even before the nestlings opened their eyes to the light of day, the first of a long series of tribulations visited them. The leaf on which the nest rested had in time died and become detached, but the nest, bound to the leaning stem with fibres and cobweb, merely pivoted around to the lower side, where it hung at an angle precarious to its tender occupants. I straightened it out and fastened it in place with pins. Other leaves above the nest fell a few days later, and the naked nestlings were exposed to the full glare of the afternoon sun. They sat with necks stretched upward, mouths widely gaping, and glassy, staring eyes. Once I saw the mother perch on the rim of the nest with wings partly spread, attempting to shield them from the sun's rays, but her position was not well calculated and her shadow unfortunately fell to one side of them, and they continued panting. Later she covered them on the nest, but one nestling, pushing its head out between her wing and body, continued to gasp. Fearing they might succumb, I attempted to arrange a shade, but I had not yet learned the toughness of young Hummingbirds.

When the first-born nestling was a week old, its body began to bristle with the pin-feathers and the eyes opened. By the following day the tips of the feathers began to protrude from their sheaths, and that night for the first time the mother passed the night apart from her offspring. The young birds had now become a trifle crowded in the nest, and the next day I noticed that the structure had begun to split downward from the rim. A few hours later I looked up from my work just in time to witness a most lively scene. The whole side of the nest had given away, dropping one of the nestlings to the ground, while the second was slipping down, but struggling desperately to crawl back onto what remained of its ruined home. Clinging by its feet, it attempted to support and raise itself by hooking its short bill over the remnant of the structure. The excited mother hovered above it, a piece of down held in her bill, as though attempting to save at least a trifle from the general debacle. I watched until the squirming nestling hung by a single foot, then hastened out to secure the dangling bird and pick the other uninjured from the ground, while the mother retired to the electric wire overhead and continued her distressed twittering. From a circular piece of brown paper I fashioned a shallow cone, which I tied to the

stem of the ramie as near the position of the fallen nest as practicable, and lined it with raw cotton. Then I placed the squirming nestlings in their artificial cradle which, after a little hesitation, was accepted by their mother, who soon returned to feed them.

I soon received a striking demonstration of the accuracy and persistency of a bird's sense of location. Returning to feed her youngsters, from force of habit the mother poised first in the position of the old nest, now completely fallen, then after a moment dropped to the artificial structure a few inches lower down. Even after visiting the nestlings several times in their new abode, she continued to hover first before the old position, neglecting for the moment the actual nest in plain sight.

I marvelled at the vitality of the young Hummingbirds. Exposure to the sun, a four-foot fall, repeated handling by fingers many times larger than themselves, had not killed them. Now a still more severe ordeal awaited them—twenty-four hours of rain with hardly a let up, and some beating tropical downpours in the interval. The mother had definitely ceased to cover them, and the scant foliage of the ramie which remained above the nest afforded slight protection. After a night of this severe punishment, I watched them through much of the dreary day. When the heavy downpours came, and the big drops beat ceaselessly upon them, the two-week-old birds sat in the improvised nest with eyes closed and bills pointing straight to heaven, shaking their heads from side to side when struck by a particularly large drop. Their budding plumage gave little comfort, and the cool rain soaked them to the skin. *Amazilia* attended them faithfully the whole day. At intervals between the heavy showers she came, her black bill dusted with the white pollen of the banana flowers in which she had been probing, perched on the rim of the paper cup, and fed her wet offspring. Often one or the other or sometimes both of the nestlings refused to accept nourishment, when she gently touched its bill once or twice with hers as though to coax it to take food, but often it was too wet and miserable to be tempted. At each visit she ran over the plumage of the nestlings, or a part of the nest, with her tongue, an act I never witnessed in dry weather, and from the way her throat worked, I concluded she was sucking up some of the excess water. And with these unflinching maternal ministrations, the un-

fledged birds pulled through the ordeal. Then I began to understand something of the secret of the wide distribution and great abundance of the species. Their nesting habits appear very imperfect, for the nest seems to sacrifice utility to beauty, and in a region where a large proportion of the birds build some sort of covered nest to protect its occupants from burning sun and beating rain, theirs is open to the sky, and moreover is too small to accommodate the two nestlings until they are ready to leave it. Their success as a species resides rather in the inherent toughness of fibre of the nestlings, coupled with the indefatigable attentions of the devoted mother.

Before leaving the nest, the fledglings acquired the plumage of the adults, although the colors were not so bright, and tufts of brown down still adhered to the tips of the green feathers, giving them a rather rough appearance. Two days before their departure from the nest, when I attempted to touch them they would ruffle up their feathers and attack a finger with their bills, which were still considerably shorter than the adult's. The first bird flew off as I was examining the nest, at an age of 21 days. The folded wings spread and began to whirr, in a moment it rose into the air and, uttering a low twitter as it went, flew away until it was lost from sight among the bananas. The maiden flight showed power and control. The second bird left two days later, aged 22 days. The mother continued to feed them by regurgitation for a number of days after their departure, but I am unable to state just how long.

The nestling period of these birds was perhaps a few days longer than normal because of the untoward circumstances attending it. In the case of another nest I watched in Panama, the nestlings took flight at the ages of 19 and 20 days, respectively. From a nest near Tela, Honduras, the nestlings departed at ages of 18 and 19 days, respectively, while from a second nest both departed at the age of 19 days.

### III

*Amazilia* sits lightly on her nest, and a greater portion of her body protrudes above it than is the case with most other birds (see Plate VIII and Plate IX, Fig. 2). This is the outcome of the closeness

with which she moulds it to the central portion of her body, and then often continues to add down to the interior after the eggs have been laid, further decreasing the size of the cavity. The nestling, at the time of its departure, is almost as large as the adult, and naturally the two are very much crowded in the small nest (Plate X, Fig. 2). Before they depart, the wall is always more or less flared outward by the pressure of their bodies, while one or the other is forced to an uncomfortable position on the rim. Especially when the nest is softened by water during rainy periods, it is sometimes literally burst asunder by the pressure of the growing bodies it contains. In one case which came under my observation, the nest split down the side, then turned almost inside out and dropped its two helpless occupants on the ground. I found them next morning, after a showery night, in the grass beneath the ruined structure, among wandering fire ants which probably would eventually have devoured them had I not replaced them on the remains of their nest, where they sat a week more before they were able to fly away (Plate X, Fig. 1).

Two or three of the attempts to build a nest which I witnessed seemed to be the work of young or inexperienced birds, and were soon abandoned by the builders. On the riverwood tree growing beside the old lagoon behind our house I found a nest which had been started on a slender, unbranched horizontal twig. Since there was at that point no leaf or other lateral projection to prevent its slipping sideways, it grew into a lopsided affair and the position was abandoned as untenable. At another time I saw a bird try to attach material in the angle formed where the end of a leaf happened to touch a neighboring branch. The leaf slipped down and split the little wad, and the bird made a new attempt to build, equally futile, not far off. Doubtless these were the first ill-considered attempts of young birds to build.

A surprising aspect of the Hummingbirds' behavior, as I watched them near *Almirante* during the early part of the year 1929, was the persistency with which they pilfered material from each other's nests. Among birds which nest in colonies, from primitive species like cormorants and herons to highly specialized oropéndolas, the removal of material from neighbors' nests, either by stealth or by force, is a common and well known misdeed, but among species

whose nests are solitary, and there is probably no bird less social than the Hummingbird, the pilfering of nest material, so far as my reading and personal observation go, rarely occurs, and is never sufficiently prevalent to interfere seriously with the success of reproduction. Around our house at the research station, however, larceny of this kind was shockingly prevalent, and I believe that about half of the failures to rear a brood are to be attributed to this aberration of instinct. The condition was probably local and possibly even seasonal. It was induced to a large extent, I think, by the inadequate supply of down for lining the nests, added to the close proximity in which the nests were placed, sometimes 100 feet or less from each other, which made robbery easier than a long expedition afield to gather down. To this may be added the bird's passion for bringing more down to a nest which contains its full complement of eggs, and is already quite adequately lined. The balsa trees growing along the banks of the lagoon which ran in front of the house might have furnished excellent material, but the nearest of these was several hundred yards distant, and the long, prismatic pods did not begin to ripen and shed their masses of silky, resilient down, in which the seeds are embedded, until the peak of the nesting season had passed. Because of the shortage of down, eggs were sometimes laid in nests constructed entirely of pieces of grass and weed, ornamented with a few bits of moss and lichen, but devoid of any lining, which was added later as opportunity arose.

The presence of eggs in a nest did not render it sacred to other Hummingbirds. I have already mentioned the destruction of a nest which contained two eggs, but these eggs had been abandoned a week before another bird began to pull out the down for her own nest. A little more than a month later a second nest was begun on a lower branch of the same small cashew tree. Because of repeated depredations by another Hummingbird, this nest progressed very slowly; by the time the first egg was laid, there was only a very precarious bed to receive it, and it rested in contact with the limb. The owner continued to build up the nest around the egg, but the vandalism of the other bird (or possibly there were several) continued, until the egg, deprived of all support, fell to the ground and broke.

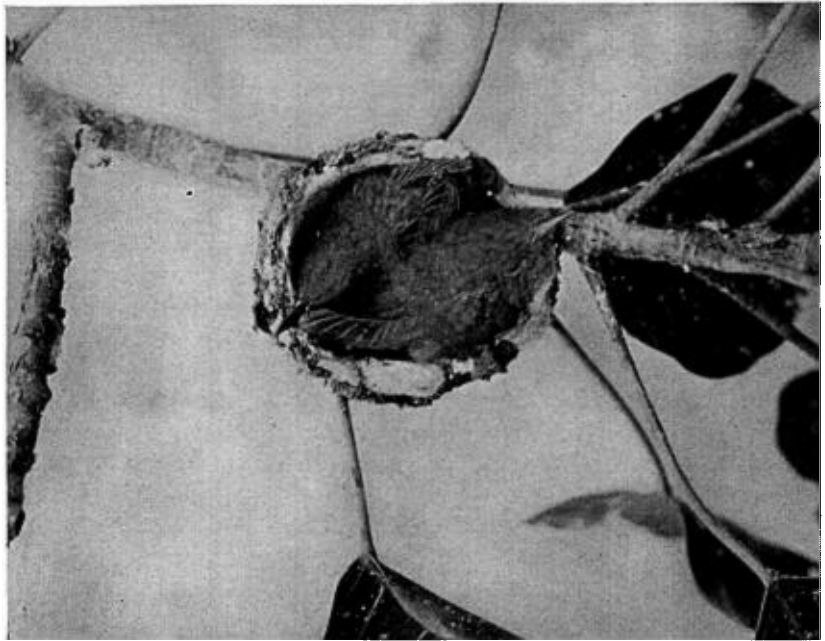
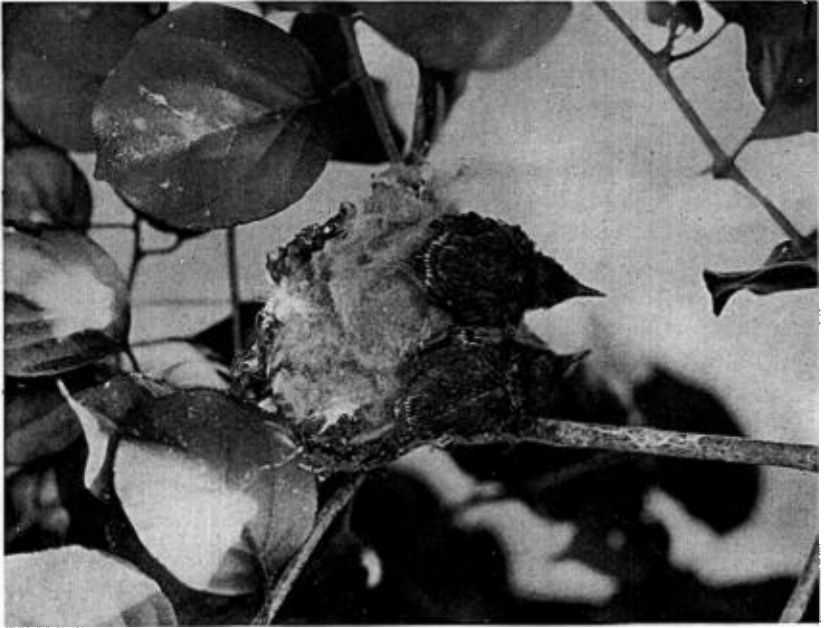


The bird which I finally caught in the act of helping herself to the ingredients of this nest had herself a remarkable history, and was the worst sufferer from the practice of pilfering with which I became acquainted. Her own nest, or rather the beginning of it, was situated in a crotch near the top of a gnarled and spreading cashew tree which stood in a corner of the lawn, about 50 yards distant from the last. The behavior of the bird, which I watched closely, seemed to indicate that she was young or inexperienced in the art of nest building. I first noticed a small tuft of fluffy material in the cashew tree on the morning of February 26, and later in the day witnessed the bird adding to it. The following morning all but a few shreds of the accumulation had vanished. On the next morning, again, I saw the bird carrying material to the same crotch, but by noon there was little to show for her efforts. I resolved to spend the afternoon in an attempt to clear up the mystery. Early during my vigil, the bird sat for half an hour on her mere rudiment of a nest, and a little later a freshly broken egg lay on the ground beneath the tree. Its fall escaped my notice. The bird had been so impeded in her building that when the moment for the deposition of the egg arrived she had no adequate nest to receive it, and it fell to waste on the ground. Thereafter, throughout the afternoon, she made frequent trips to and from the nest, each time bringing fresh materials which were added according to the usual routine. Having shaped the nest with bill and feet, she would fly to a twig not far off, pause there a few moments and then, apparently not satisfied with her work, return and repeat the whole procedure. Once she went through this performance four times in quick succession, without the addition of any new material. Frequently, too, she would hover beside the nest, remove some loose particle in her bill, then, alighting on the nest, return it once more to the structure. Once a bit of down fell away and as it wafted downward she darted from the nest, quick as thought, caught it deftly in her bill, and returned it to a place in the pile. At intervals she hovered before the blossoms of the hibiscus bush which stands nearby, or probed the little cashew flowers with the tip of her long bill, then rested for a while on one of its limbs. On the whole, she worked faithfully, but by four o'clock the result of her toils was a loose and untidy aggregation of fibres, bits of dead grass and down,

not yet worthy of the name of nest. Whatever had been taking advantage of her efforts failed to appear this particular afternoon, and as the sun was sinking low I went off, disappointed. I returned at sunset only to find that the marauder I had so desired to surprise had been busy in my absence. The crotch was almost bare and the bird, her maternal instincts again frustrated, perched stoically on a nearby twig.

For the next two weeks she continued her fruitless efforts to build. Doubtless she would have acted more wisely to have shifted the site of her endeavors to some distant tree or bush, but she showed the strong attachment to a locality characteristic of her kind. During the interval she moved the site of the intended nest to a crotch farther from the center of the same tree, then back to the old location, then once again to the new, but all to no advantage, and she seemed foredoomed to failure.

Later she began her nest among the branches of an avocado tree which grew close beside the cashew, but the change of location brought with it no change of fortune, and once more she moved back to her original site in the cashew. Here, one cloudy morning toward the end of March, I witnessed the most cunning act of thievery I have ever seen a bird perform. Time and time again I have watched Montezuma Oropéndolas (*Gymnostinops montezuma*) snatch long banana fibres from each others' nests, and even bills, but there was a straightforwardness in their manner which betokened an absence of guile. The present instance was different. The Hummingbird had just added a billful of material to her incipient nest—it never advanced beyond this stage—and darted off to pluck a lichen from the bark of a neighboring avocado tree. A strange Rieffer's Hummingbird flew up at this juncture and evidently observing the builder of the nest, which was in plain sight, perched on a twig low in the cashew tree. Here she sat so quietly that when the other returned she failed to notice the intrusion,—else she would without doubt have asserted her lordship over her domain—but calmly attached the lichen to the nest. No sooner had the unsuspecting bird flown off when the thief coolly advanced from her retreat and, hovering before the mass of down, pulled out a sizable billful and darted out of sight. When the owner of the nest returned, she continued her futile building as though nothing had gone amiss.



UPPER. RIEFFER'S HUMMINGBIRDS, 13 DAYS OLD, RESTING ON THEIR NEST (SHOWN IN PLATE I) AFTER ITS COLLAPSE. MARCH 25, 1929.

LOWER. RIEFFER'S HUMMINGBIRDS, 16 DAYS OLD, IN THEIR NEST IN A *Ficus religiosa*. TELA, HONDURAS, SEPTEMBER 8, 1930.

On another occasion a Tody Flycatcher (*Todirostrum cinereum finitimum*), the same whose nesting I described in an earlier paper,<sup>1</sup> made an inroad on this Hummingbird's accumulation of down. The Flycatcher happened upon it during the course of an exploration of the bark of the cashew tree for any cobweb which may have lurked in its crevices, to use in constructing his own nest not far distant, and when he came across this rich mine of suitable material did not hesitate to make the best of his find, returning twice to carry away more material. Thus a tuft of white milkweed silk, which I had seen the Hummingbird carry off from the nest of another, eventually found its way into the Tody Flycatcher's pendent nest. Since the material of the Flycatcher's first nest was employed in the construction of a second after the nestlings in the former met with disaster, and the second, found unsatisfactory, was torn apart to furnish substance for a third, it is interesting to speculate of how many different nests this tuft of milkweed silk may have formed a part.

For at least 31 days, according to my notebook, this long-suffering Hummingbird continued her attempts to establish a nest. I first made her acquaintance on February 26, her last attempt was observed on March 29. I have records of twelve fresh beginnings of her nest, each of which was more or less completely obliterated, and I have little doubt that she suffered many more reverses which I failed to observe, since her efforts to build were more or less continuous, and I made no attempt to chronicle all of her varied fortunes. She alternated between four different building sites, two in the cashew tree and two in the avocado which grew beside it, and made at least eight changes of location between these four positions, probably at least several more which I failed to record. As time went on, her behavior disclosed increasing bewilderment and distress. Often with empty bill she would return to the barren crotch where she had been building, and with feet and bill go through all the motions of shaping invisible materials to her body. She seemed to suffer a strong hallucination of the presence of the stuff she had previously added. Sometimes, after adding material in the usual manner, she began to fly off, but immediately returned to sit on it, then flew off and returned, for half a dozen times in

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<sup>1</sup> Auk, Vol. XLVII, pp. 313-322. 1930.

succession, seemingly afraid to leave her nest unguarded. One morning she seemed undecided as to which of two sites in the avocado tree to entrust her efforts, for she went through all the motions of building in one, then flew to the other side of the tree and repeated the procedure in the other empty site, then back once more to the former. After several such alternations she at length settled on one, and continued to build there for the remainder of the day. Her efforts at a nest became increasingly lax, and her successive attempts were mere formless masses of the usual constituents. Likewise her instinct to defend her territory became benumbed, and she permitted Anis and other birds to rest on her premises. Finally, toward the end of March, her feverish efforts to perform her biological duty ceased, and no nest ever graced the gnarled limbs of the cashew tree.

The attachment of the Hummingbird to a particular nesting site is not usually quite so strong as that of the poor bird whose fortunes we have just followed. Usually, so far as my observation goes, the bird selects as its own a rather restricted area, and if the first nest is destroyed, builds again not in the identical site, but in a similar site a short distance off. The new nest may be begun less than a week after the destruction of the old.

About half of the failures to rear offspring which came under my notice at Almirante were, I believe, to be attributed to the thievish propensities of the birds themselves. At the height of the nesting season in February and March, birds would begin to build, perhaps get as far as laying one or both eggs, and then the nest mysteriously disappear. Although in most of these cases I did not happen to be present when the nest was broken up, it is hardly likely that an egg-eating animal would have carried off or devoured the nest, and in several instances, one of which I have already mentioned, the eggs were found beneath the ruined nest in a condition which indicated that no attempt had been made to consume them. A summary of the fate of the 17 distinct nests (not counting of course the many attempts of the bird which tried so long to build in the cashew tree) which I observed at the research station near Almirante, gives an idea of the tremendous difficulties under which the birds labored here. The much smaller number of nestings which came to my notice at Lancetilla, Honduras, were attended by much greater success.

	<i>Almirante</i>	<i>Lancetilla</i>
Total number of nests begun.....	17	5
Number of nests in which one or both eggs were laid.....	13	4
Total number of eggs laid.....	24	8
Number of nests in which both eggs hatched..	5	3
Number of nests in which one egg hatched....	1	1
Total number of nestlings born.....	11	7
Number of nests in which young were raised...	3	3
Number of nestlings raised.....	6	5

Surprisingly small as it is, the number of nestlings which lived to leave the nest at Almirante would have been smaller still had it not been for my timely intervention, to which four of the six nestlings which survived owe their lives,—the two for which I made the artificial nest, and the pair which were picked up from the ground after their nest's collapse. Had I been the detached observer merely, the Hummingbird population at the research house would have been augmented by but two from all the seventeen nests which I found. Since two eggs are invariably laid in each nest if everything goes well, the total possible number of fledglings was 34. In reality, even if every bird had been successful in raising two birds in each nest, the actual increase in population would have been smaller than this, for many nests were made only because previous ones had been destroyed, and had success attended every nesting, there would have been a smaller number of nests. Mr. Woods<sup>1</sup> in his study of Costa's Hummingbird (*Calypte costae*) in California, found that only 19 young were fledged out of 29 nests containing eggs, or a possible 58 birds. This is a much better record than that of the Almirante birds, but not nearly so good as that of the much smaller number at the Lancetilla Experiment Station. Like myself, Mr. Woods saved an unstated number of nestlings by fastening up their nests, and here also success of reproduction would have been still smaller without human intervention. But I doubt whether it is possible, in studies of this kind, to form a just estimate of the actual success of reproduction of the species in any region. Those nests which are the first to be found by the student are probably just the ones most likely to be encountered by the birds'

<sup>1</sup> Robert S. Woods. *The Hummingbirds of California.* Auk, Vol. XLIV, pp. 297-318. 1927.

enemies, and hence give an exaggerated idea of the dangers which beset the nest. Those nests so well concealed that they escape observation would probably, had we any way of knowing their outcome, make a better showing.

A comparison of the results of Mr. Wood's study of Costa's Hummingbird with mine of Rieffer's Hummingbird indicates that the lengths of the important periods in the history of the nest are essentially the same in the tropical and temperate zone species. The normal incubation period for both is 16 days. The young Costa's Hummingbird remains in the nest from 20 to 23 days, Rieffer's Hummingbird from 18 to 23 days. Costa's Hummingbird, too, has the habit of laying its eggs before the nest has been completed, and some of the nests become broken down at the sides and flattened out before the young are ready to leave them.

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