

LIFE HISTORY OF LONGUEMARE'S HERMIT HUMMINGBIRD.

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The name "hermit" has been applied to hummingbirds of the genus *Phaethornis* and a few other genera which are usually dull and brownish but sometimes green in coloration, and have long, curved bills. Although not more unsocial than other hummingbirds, they perhaps deserve the name because of the modest, hermit-like garb of most of them, and because as a rule they dwell obscurely in the deep shade of the forest undergrowth or of dense thickets, instead of displaying glittering raiment in the bright sunshine.

Longuemare's Hermit *Phaethornis longuemareus* is very small even among hummingbirds, measuring less than four inches in length, well over half of which are accounted for by its long, curved bill and long tail. The upper plumage is dull metallic bronze or greenish bronze, darker on the head, and becoming chestnut on the rump and upper tail-coverts. The tail feathers, increasing greatly in length from the outer to the central pair, are bronze in colour with broad cinnamon or, in the case of the middle pair, whitish tips. On each side of the head behind and below the eye there is a conspicuous blackish patch, margined above and below by a streak of pale buff. The chin and throat are dusky, the remaining under-plumage cinnamon of varying shades. The bill is largely dull black, becoming yellow on the base of the lower mandible, and the eyes are dark. The female resembles the male except that her chin and throat are paler, more like the posterior under-parts; but the sexes are difficult to distinguish in the field. Van Tyne ('Univ. Michigan Mus. Zool. Misc. Publ.' 27 (1935): 21) gives the weight of a female from El Petén, Guatemala, as three grams.

The species ranges from southern Mexico to Brazil, the race *saturatus* through most of Central America, from Guatemala to the Canal Zone. Like other birds of the Humid Tropical Zone, in southern Central America it is found on both sides of the Cordillera, but in northern Central America is restricted to the Caribbean side. Ranging upward from sea-level, in the Térraba Valley of Costa Rica (where chiefly I have studied the bird) it is still abundant at 2500 feet, and in the Reventazón drainage of the same country I have seen it occasionally at 4500 feet—far higher than I have ever met the bigger Buff-browed Hermit *Phaethornis superciliosus*. The favourite habitat of Longuemare's Hermit is in the shade of tall but dense second-growth thickets and light woodlands. In such vegetation the singing assemblies of the males are nearly always located; and here, too, I have found most of my nests. Although it enters primary rain-forest, it is most often found near the edges, and is not nearly so much of a forest dweller as the Buff-browed Hermit.

Often it leaves the thickets which are its headquarters to visit neighbouring plantations, as of bananas or coffee, and even dooryards where flowering shrubs or herbs invite it. Although hummingbirds as a whole are not so closely restricted to the forests or to the clearings as many of the smaller birds of other groups, Longuemare's Hermit is particularly adaptable to diverse habitats even among hummingbirds.

FOOD.

Like nearly all hummingbirds, Longuemare's Hermit sucks nectar or extracts minute insects from the corollas of a great variety of flowers, before which it poises in air on wings vibrating so rapidly that they are invisible to the human eye, which detects only a vague haze in the midst of which the slender brownish figure seems to float. It is fond of the little violet flowers of *Stachytarpheta*; and where this flowering shrub of the vervain family has been planted to form hedges, the brown hermits are almost sure to appear, especially in the evening twilight. Although they often visit the great six-inch-wide scarlet blossoms of *Passiflora vitifolia*, displayed during the dry season near the ground from basal branches of vines which clamber high into the trees, the little hermits seem unable to reach the nectar secreted at the bottom of a deep well protected by a peculiar collar embracing the gonophore; and they content themselves with the secretions of the accessory nectaries situated on the bracts, or else pluck small insects attracted to these sweets. These big passion flowers are a specialty of the larger hermits, *P. superciliosus* and the green *P. guyi*, whose longer bills suffice to reach the floral nectary.

When visiting flowers with very long and slender corolla tubes, Longuemare's Hermit may reach the nectar by forcing its bill through the tissue of the tube rather than by inserting it into the mouth in the "legitimate" fashion. One morning in May, in a low, moist thicket on my farm in the Térraba Valley, I watched a hermit visit the bright red blossoms of the Costa Rican skull-cap *Scutellaria costaricana*, whose corolla tubes are almost two inches long and very slender, at the top measuring only an eighth of an inch in diameter. The hummingbird did not find it convenient to push her curved bill down the length of the almost straight narrow tube. To avoid this necessity she pierced the delicate red tissue in the lower portion of the corolla and, sticking her bill through the perforation, more easily reached the nectar. Her manner of penetrating the side of the corolla tube seemed simple enough, but actually called for nice judgment and a high degree of precision in her movements. Hovering on vibrating wings, she merely set the point of her bill against the outside of the tube and then apparently flew forward until it broke through. The point of the bill had to be placed exactly in the middle of the narrow tube; if a small fraction of an inch to one side or the other it slipped off and, instead of penetrating the tissue, went by the outside, as I saw happen more than once. After she had pierced the side of the tube toward her, the

little hummer had to elevate her body and bend down her bill so that it would slip down the passage-way to the nectar and not jab through the other side of the tube into the outer air—an accident which I did not see occur. The operation demanded amazing skill and coordination. The hummingbird pierced several times each of the mature corollas in the showy inflorescence of the tall mint.

TAMENESS.

I watched the hermit at her nectar-feast while standing close beside the shrub. After she had darted away, I took the little head of bright red flowers into my hand for a closer examination. While I held it so the bird returned and poised beside them, two to three inches from my fingers, fanning my face with her wings. I stood immobile, hoping that she would continue to perforate them in my hand, but after a moment she darted away and vanished.

Such close approaches to man are by no means rare with Longuemare's Hermit. Repeatedly, in widely separated parts of the bird's range, I have had the curious experience of being subjected to close scrutiny by the tiny hummer. These inspections of my person were most often made while, machete in hand, I cut my way laboriously through the undergrowth of the riotous second-growth vegetation in which the hermit dwells in the warm lowlands. Of a sudden a low humming sound close to my ears would cause me to rest from the struggle to move ahead through the stubbornly resisting tangle and to look about me. There, half an arm's length from my face, would be the inquisitive hummer, hovering motionless on swiftly moving wings, gazing intently at this unfamiliar monster that had invaded its domain. By swift darts it would change its point of motionless hovering to view me from various angles, sometimes making the circuit of my body, and often coming so close that its wings created a grateful stir of air against my heated cheeks. Then, its tour of inspection over, with a sharp "cheep" it would dart off and vanish into the depths of the thicket, where I could follow only with the greatest difficulty. It would not be surprising if hummingbirds, which must work with their eyes quite close to the flowers they probe, the insects they catch, or the nests they build, are somewhat near-sighted, and must closely approach the objects they wish to examine in detail.

If the little hermit takes liberties in examining a man in a manner that, if practiced by another human, would be little short of embarrassing, it is not averse to having the tables turned upon itself. Years ago, when I was beginning to learn the names of the Central American hummingbirds, one of these hermits was cooperative as few birds are. Although I had watched many individuals hovering before the flowers, it was difficult in these circumstances to distinguish the finer details of colouration of so diminutive a bird. After completing their visit to the blossoms they would dart swiftly beyond view, never pausing to rest in my sight. But one evening I had the good fortune to come upon a hermit perching on a low twig of a bush in a scrubby pasture.

When I advanced to within four or five feet of the bird he remained motionless, so, taking notebook and pencil, I wrote a description of what I could see of his plumage while his back was turned toward me. I then moved cautiously nearer, and since still he did not budge, I suspected that he was injured in some way, or perhaps held captive by some gummy substance on the twig. Approaching to within a foot, I leaned forward until I could clearly distinguish his dusky chin and throat and the orange-buff of his foreneck. Becoming more confident, I was about to reach forward to pick up the bird for a still more minute examination when, in a twinkling, he spread his wings and darted away.

Shortly before this a Longuemare's Hermit collided with the screen that enclosed an extension of the porch of the house in which I dwelt. Flying rapidly toward the trees and bushes it could see on the other side of the projecting porch, it drove its slender bill into a mesh of the screen and was caught. Some of the numerous hummingbirds of several kinds which met this accident died horribly before they were discovered hanging in the screen and released; they did not survive long when the sun shone brightly upon them. But this hermit, more fortunate than many another which met the same mishap, managed to extricate its bill and fly away even before I could capture it for the purpose of carefully examining its plumage before releasing it.

VOICE AND COURTSHIP.

As with other species of hummingbirds that have been adequately studied, the hermits do not pair, and the males take no part in the building of the nest or the care of eggs and young. A number of males gather in a group to sing after their own fashion and make their position known to the females. The courtship assembly is usually situated beneath a lush, humid thicket or in second-growth woodland with thick undergrowth, or, more rarely, beneath primary forest, especially near the edge where the undergrowth of bushes and vines is most dense. Here, amid vegetation so entangled that a man can scarcely advance without opening a path with a long knife, each singing male rests upon a low slender perch, often a thin vine or dead twig, and usually from a few inches to two feet above the ground. The tiny brownish hummingbirds are exceedingly difficult to detect in the dim light, against the background of brown litter that carpets the earth, and amidst dead leaves caught up on the bushes and vines, of much the same colour as themselves and usually considerably bigger. If it were not for their habit of wagging their tails rhythmically up and down as they sing, one could scarcely ever catch sight of the diminutive performers. But the moving whitish tip of the dark tail at length catches the attentive eye and reveals the bird's position. This tail movement is not peculiar to the adult males; females, and even fledglings, exhibit it while perching.

The song of Longuemare's Hermit, although certainly not a brilliant nor a melodious performance, is at least more lively than the unending monotonous

squeaking, all in the same key, of its larger relatives, the Buff-browed Hermit and the Green Hermit. With his long, slender, curved black bill pointing obliquely upward, his throat swelling with his voice, his tail beating up and down to keep time—now rapidly through a wide arc, now slowly with slight amplitude—the tiny bird delivers a measured “chip chip chip chip”, followed by a rapid, lilting “do da do da”, uttered in a higher pitch. Or at times the whole refrain consists of five notes, the first two uttered deliberately, the final three more hurriedly; and now and again the song diminishes to a whisper. The vivacious little ditty has a pleasant swing and cadence, although the voice is too high and thin to sound melodious to human ears; and at the height of the season it is tirelessly repeated over and over throughout the long day, in bright and gloomy weather. The birds are not particularly shy while they sing, and, indeed, will often tolerate without moving a surprising amount of the noisy severing of vines and branches, the snapping of dead twigs under foot, without which a man can scarcely change his position amid such tangled undergrowth. But if one advances to within two or three yards of a songster, he rises on invisible wings slowly, like a toy balloon released from the hand, and lightly settles down on another perch at no great distance, to resume his interrupted chant. From time to time he flies out of sight to seek refreshment, for flowers are usually scarce amidst the dense undergrowth, and the courtship assembly is located without regard for immediate sources of food.

Because of the great difficulty of seeing the little hermits amidst the dense, dimly-lighted undergrowth, and their habit of shifting to sing on another perch if disturbed, I have not been able to satisfy myself as to the number of participants in a courtship assembly. It may be spread over fifty yards or more; and as one stands in its midst he hears numerous small voices arising from unseen throats on every side. These assemblies are active through most of the year. In the basin of El General in southern Costa Rica the hermits become silent at the height of a severe dry season when flowers are scarce. In 1948, when the dry season was prolonged, the courtship assembly near my house was silent for a little over two months, from about 12 February to 19 April. In 1949, with a still more severe dry season, the period of silence was much the same, lasting from about 12 February to 13 April. In the wetter year 1947, when my observations were less systematic, these birds were already singing freely by 6 April. By April renewed rainfall has caused an increase in flowers and verdure. In addition to this dispersal of the assembly during the driest and leanest part of the year, I have noticed at this same group a diminution of vocal activity in the midst of the wet season, from late August or early September through October, which is often our rainiest month. On some days during this period the hermits sing chiefly in the early morning, and on others, especially in September, I have failed to hear them. Otherwise I can count on hearing their scattered chorus during any month and at almost any hour of the day. If the site is undisturbed each assembly is fairly permanent,

the birds singing year after year in the same area, some of them almost in the same spots. The assembly close to my house is now at least five years old.

As with other species of hummingbirds that perform in courtship assemblies, I have not succeeded in learning in detail what takes place when a female arrives. The difficulty consists, in the first place, of distinguishing males from females under the actual conditions of observation and, secondly, of keeping the birds long in view after they begin to move. While I watched one of the hermits singing on a perch not over six inches above the ground, another, possibly a female, flew up and poised on wing in front of and a little above him. The songster rose above his perch and hovered in the air, facing the other. After a moment of this the two darted away together and were at once lost from view amidst the dark foliage. Such has been the invariable outcome of all the pursuits of this nature that I have witnessed. Possibly the participants of some, or even most, of these chases are both males, one of which has trespassed upon the other's domain. But that the males do not seriously fight with or injure each other we may be certain from the fact that they are soon back again, singing as gaily as ever on the same perches.

I spent the morning of 4 August 1947 in a hide, watching a nest of an Orange-billed Nightingale-thrush *Catharus aurantirostris* situated beneath the grove of tall second-growth trees near my house where the assembly of hermits is located. Two of the hummingbirds habitually sang on low perches within view of my little wigwam. Several times I saw one of these birds, and another of unknown sex and domicile, hover face to face in the air and, hanging so on vibrating wings, float gradually upward, one at times a little above the other. Then they would break this formation and dart away so swiftly that I could not tell which was pursuer and which pursued. At another time one rested on a low twig, about a foot from the ground, while another hovered in front of and above it. First the performer floated nearly upright in the air, a little above the stationary one, while it swung from side to side through an arc of not over one foot. Then it altered its posture, bringing its body into a horizontal position, with its head and spread tail bent strongly upward, giving the whole hummingbird a crescent form, the horns pointing skyward. In this curious pose it wafted from side to side, at the same time rotating back and forth through 180 degrees to change the direction it faced. Or it might rotate so while scarcely changing its position in the air. Suddenly performer and audience darted away. The stationary member of this couple occupied a perch often used by the more assiduous of the two songsters in sight of the hide; but whether the songster was displayed to by another hummingbird, or whether he displayed before one which had come to occupy his perch, I could not determine.

On 29 March 1945 I had the good fortune to witness, in the forest on my farm, a still more marvellous display by a Longuemare's Hermit. At half past eight in the bright sunny morning I found an individual, which I took to be a female, resting upon a slender dead twig about a foot above the ground,

while another of her kind, apparently a male, floated a few inches above her upturned head, on wings vibrating so rapidly that they were invisible. Both his head and tail were curved strongly upward, giving him a crescent shape ; or at times he reminded me of a tiny boat, with sharply upcurved bow and stern, floating upon an invisible liquid. With his wings making a sharp humming sound, as of a bumble-bee, he continued to float a few inches above and slightly in front of the female, oscillating gently back and forth over a distance of a few inches, and at the same time more slowly up and down. Every few seconds he turned an about-face, and at longer intervals revolved rapidly through a complete circle, or even made a turn and a half. He varied the performance by shooting rapidly and wildly back and forth, a distance of a foot or two, while his wings set up a louder, more insistent buzzing. After each of these interludes of more vigorous display, he settled back again to the quieter floating above the female, with gentle oscillations back and forth and up and down, and frequent rotations in the air.

After I had watched this spectacular performance for several minutes, it occurred to me to time it. The hummingbird carried on in the same fashion for five minutes more by my watch. He must have displayed in my presence for nearly ten minutes ; and I do not know how long he had been performing before I arrived on the scene. What wonderful endurance of wing he had !

To me, looking down from above, the hermit's most conspicuous colour was the chestnut of his rump and upper tail-coverts. But to the female, viewing him from below, his cinnamon breast and whitish thighs, the feathers of which stood out in prominent tufts, must have been his outstanding features. During the whole duration of the performance she kept her long bill pointed straight up towards him, and when he dashed back and forth in longer arcs moved her head to follow.

At last the tiny acrobat darted away through the underwood ; and then she to whom he displayed promptly winged away too. This was to all appearances a courtship ceremony that I had watched ; yet at this point there had never to my knowledge been a singing assembly, and now at the end of a severe dry season the courtship assemblies were inactive. Although this memorable episode took place in the forest, where courtship gatherings are in this vicinity seldom found, dense second-growth woods were close by.

On 3 October 1947, while cutting a trail through heavy forest in the lowlands near the Pacific coast of Costa Rica, between Palmar and Golfito, I witnessed a similar performance. A stand of great-leaved *Heliconia*—a banana-like plant—occupied an opening in the forest, and here a female hermit rested on a twig near the ground, while a male hovered above and a little in front of her, his head and tail bent strongly upward to give him the usual crescent form. He oscillated from side to side and also rotated about a vertical axis, while the perching female held her head tilted upward toward him. I do not know how

long the hermit had been performing before I found him so engaged, but a minute or so after my arrival he alighted upon the female's back, whereupon she moved to avoid him and came to rest a short distance away from her first position. The male resumed his display above her, then once more tried to settle on her back. But again she flew away, this time beyond my sight, and he also vanished. Here, too, there was no courtship assembly, at least at this season. In October, as already mentioned, the courtship assemblies are rather inactive higher up in the foothills ; but I do not know whether this would apply to the coastland in the same region.

THE NEST.

The hermit's nest is fastened beneath the drooping end of a leaf with a pointed tip more or less concave on the lower surface. Of the 13 occupied nests that I have seen, 12 were attached to the fronds of small palms, the other to a leaf of a coffee bush. The palms chosen for the support of the nest are usually of a kind armed on stem, leaf-stalk and midrib with a multitude of long and exceedingly sharp, needle-like, black spines. As a rule the hummingbird selects for the attachment of her nest the long, tapering extremity of one of the twin terminal divisions of the frond ; but one nest was fastened to the tip of a lateral pinna, and another was attached to the tips of two adjacent lateral pinnae which had been drawn together. In height these 13 nests ranged from 3 to 6 feet above the ground, but only two were above 5 feet.

Seven of these nests were found, from 1945 to 1949 inclusive, in one small area on my farm in El General, at about 2500 feet above sea-level. This area comprises a knob of elevated ground between a bend in a creek and a gulley which was probably an earlier bed of this stream, for water flows through it when the creek is very swollen, and both sloping banks of the gulley. The knob and gulley are shaded by tall, slender, second-growth trees, beneath which grow many small spiny palms, shrubs of various species, and tangles of the climbing *navajuela* sedge (*Scleria*), with grass-like leaves that cut like razors. Surrounding this spot favoured by the hermits for their nests are a small coffee plantation shaded by *Inga* trees, a small banana grove, and ample second-growth woods and tall thickets. About a hundred yards distant there has been throughout these years a courtship assembly of the males. The most widely separated of the nests in this group are about forty yards apart.

Of the other nests, one was found a short distance within primary forest and another at the edge of the forest, where it adjoined old second-growth woodland and had dense undergrowth. One was among bushy undergrowth near the shore of a small island in the Río Pejivalle, another on the deeply shaded rocky shore of the Río Peña Blanca—both rushing mountain streams. One was suspended beneath a coffee leaf in a small plantation at an altitude

of 2800 feet above sea-level. One was in a clump of palms left in a narrow clearing newly made in the forest near the Pacific coast.

The hermit's nest matches in shape the tapering apex of the leaf beneath which it is fastened. It is roughly an inverted cone, not entirely hollow, but with a deep pocket in its base, which is turned upward. The materials of the nest are varied. One was composed of light-coloured vegetable down, tawny pappi, long chestnut-coloured scales from the fronds of tree-ferns, some shreds of inner bark, some long, slender fragments of fern-fronds and monocotyledonous leaves, a few tufts of green moss, and cobweb for binding. Another was made chiefly of brown fibrous materials, fine coiled tendrils, bits of moss, and dry flowers from the *Inga* trees that shaded the coffee plantation where it was situated. Cobweb in liberal quantities is an indispensable ingredient in all the nests. Not only does it bind together the materials, but it is the only thing used to attach the structure to the leaf, over the back of which it forms a close, light-coloured reticulum contrasting strongly with the dark green of the leaf-tissue. It is constantly renewed during the period of incubation.

The nests measure about $1\frac{3}{4}$ inches in diameter at the top in the direction parallel to the surface of the leaf and $1\frac{1}{2}$ inches in diameter perpendicular to this. In height they are more variable, measuring from $2\frac{1}{2}$ to 4 inches, without including the peculiar "tail". The inside diameter is about 1 inch, inside depth $1\frac{1}{8}$ inch. The "tail" may be a loose, slender, downward prolongation of the apex of the inverted cone, composed of fern-scales and other materials such as form the outer layer of the nest itself, all bound together with cobweb, and if so constructed it is not remarkably long. Or it may consist chiefly of a single long, narrow, dry grass-blade, or some other bit of dry vegetation resembling a straw, in which case it may be nearly a foot in length and hang far below the body of the nest. Some nests have practically no "tail". Some nests contain no lining on the side of attachment, so that the breast of the incubating bird touches the green tissue of the supporting leaf.

I have found only two of the hermits' nests before completion. At the first, which was about half finished, the hummingbird worked very little on the morning I watched, visiting her structure only four times during the course of $2\frac{1}{2}$ hours. On each visit she apparently brought cobweb, which was difficult to detect in her bill. Flying up to the nest, she hovered beside and almost in contact with it. Then, still floating with rapidly beating wings, she slowly revolved around the drooping tip of the leaf, thereby passing the strand of cobweb over the back of the leaf and firmly attaching the nest. Once she made two complete revolutions about the leaf in a counter-clockwise direction, and later she made three complete turns in the same direction. On another visit she made a single revolution in a counter-clockwise direction, then reversed in the air and made a complete turn in the opposite direction. The work on this nest languished during two or three days, then it was rapidly completed and an egg laid.

A small amount of cobweb and fern-scales attached to the other apex of the same bifurcate palm-frond showed that at first the hummingbird was confused by the similarity of the two potential sites for her nest; but soon she concentrated her work on one alone. In another instance, too, the second apex of the frond which supported the nest bore a small accumulation of material placed there by the hummingbird. One morning in July, in the grove where most of my nests were found, I watched a hermit fly rapidly from tip to tip of the fronds of the small spiny palms, clinging for a moment beneath each pointed apex and then going to another, until she had visited five or six.

At the second nest, found before completion, my observations were far more satisfactory. This nest was situated beneath the tapering tip of a lateral division of a frond of a small spiny palm growing near the edge of a narrow clearing in the forest near the Pacific coast. When I discovered the bird at work early on the morning of 6 December 1947 she was apparently just beginning to build, and had accumulated a small mass of seed-down, moss, bits of fibre, and brown scales from the stipes of tree-ferns, all attached beneath the tip of the leaf with cobweb. By the following morning the mass had grown somewhat and had taken the form of an inverted cone, but there was still no trace of a cavity. During the hour between 6.43 and 7.43 the hummingbird brought material 21 times; but in the half hour from 7.53 to 8.23, when the sun was higher and beat down hotly into the clearing, only five times. Arriving with down, a bit of moss or fibrous stuff, the bird clung to the edge of the mass, at the side, and stuck the new material into the nest, the whole time rapidly beating her wings to sustain herself and never resting her weight wholly upon the delicate tuft of down and fibres. If she came with cobweb she hovered first in front of the growing nest, then, always facing the structure, on beating wings she floated around the back of the leaf, making a complete turn about it and laying down a strand of cobweb that served to bind the mass in place. At times she revolved twice around the tip of the leaf-segment, the while dropping gradually lower, and wrapping two spiral turns of cobweb about the leaf and the nest. Usually she went in a clockwise direction, but at times she reversed her course when in the midst of a turn. All of the hummingbird's building was done while she poised in the air; she never sat on the nest's foundation in the manner of hummingbirds which build upon a branch or in a crotch.

By the morning of 8 December the nest had grown larger and I could detect the beginning of the cavity. I watched for the hour from 6.56 to 7.56 and saw the hummingbird bring material 12 times, all before 7.30. Now when she came with a tuft of material she sat on the nest with folded wings for a few moments while she tucked it in place. She also sat on the nest while, with sideways movements of her head, she wiped cobweb from her bill to the outside of the structure; but at other times she flew around the back of the nest to apply the strands to the supporting leaf, as on the preceding morning. On 10 December I watched the hermit's nest from 6.10 to 7.10. She came

to the nest and brought material only once during the hour when on previous mornings she had worked actively. Her nest seemed to be finished after about four days of building. She was always alone; I did not once see her accompanied by a mate.

THE EGGS.

Of my 13 nests (one of which was used twice) 12 contained two eggs or nestlings; the other two had each a single nestling, probably a survivor of a brood of two. In three nests the interval between the laying of the first and second eggs was two days, but in another nest it was only one day. The eggs are deposited early in the morning. At Nest 10 the first egg was laid before 6.35 on 23 July and the second between 5.40 and 6.35 on 25 July. At Nest 11, which was finished on or about 10 December, the first egg was laid before 6.20 on 12 December. During the following night the bird slept on the single egg. She laid the second between 5.30 and 6.35 on 14 December. At Nest 5 the second egg was deposited before 6.30 on 24 April. The minute eggs are pure white, long and slender, with little difference at the two ends—oblong rather than ovate. Both of those in one set measure 11.5 by 7.1 millimetres; both eggs in another set 11.9 by 7.9 millimetres.

There appear to be two annual breeding periods, of which the principal begins with the return of the rains in April and continues into August, while the second starts toward the end of the long wet season in November and terminates at the beginning of the dry season in January. The distribution of my nests by months of laying (as observed or calculated) is as follows: April, 2; May, 1; June, 4; July, 3; November, 1; December, 3. With the exception of two of the December nests, all were found in the basin of El General at the head of the Térraba Valley in Costa Rica, 2400 to 2800 feet above sea-level. One December nest was situated beside the Pejivalle River on the Caribbean slope of Costa Rica at about 2000 feet above sea-level, and another December nest near sea-level on the Pacific coast, between Palmar and Golfito. The months in which I have seen no nests with either eggs or young correspond to those when singing is quite suspended, as in dry February and March, or when it is very much reduced, as in wet September and October.

INCUBATION.

The female alone keeps the eggs warm. The leaf, which forms a green roof over her head, shelters her and her offspring from rain, and does much to conceal them from the prying eyes of enemies, also imposes severe restrictions in the posture she may assume while sitting. Many birds like to vary their orientation in the nest, sitting now facing in one direction and now in another, thus apparently easing their long hours of incubation. The hermit beneath her green canopy is limited to just one way of sitting, and that in a posture

which to human eyes appears so strained and uncomfortable that we wonder how she can maintain it as long as she does. She sits invariably with her breast toward the leaf where the nest is attached, her head thrown far back and her bill tilted almost vertically upward. This is the only way she can find room for her long bill without making a perforation to let it pass through the tissue of the leaf in front of her—a solution of the problem which seems never to have occurred to her kind. Her tail is also tilted obliquely upward at the side of the nest away from the leaf, where the rim is lowest. Ensnconced in the deep, downy pocket, she seems bent almost double, the back of her head almost touching the upper surface of her tail. The tips of her wings project above the nest's rim slightly forward of the tail, almost filling the narrow space between this and the back of her head. Although this looks like a tortured posture, the hermit doubtless does not find it so, for she may sit practically immobile for an hour or more. Her larger relatives, the Buff-browed Hermit and the Green Hermit, sit always in the same fashion in their nests fastened beneath leaves, and since their far longer bills cause them to bend their heads even farther back, their posture seems still more strained.

And how does the little hummingbird manage to get out of this confined space where she seems so deeply and tightly ensconced? Although it hardly seems possible, and I cannot explain all the details, somehow she manages to start her wings vibrating in this space, which appears too narrow to allow movement. Slowly rising higher, she increases the amplitude of her wing-beats and floats off the nest obliquely upward and *backward*. As soon as she is clear of the leaf she reverses the direction of her flight and darts forward and away. Her return is as neatly accomplished as her departure. She flies directly and unhesitatingly down into her cosy pouch, never alighting on the rim in the manner of heavier birds less skilful on the wing. When she folds her wings she is already incubating her eggs. The pensile nest rises slightly as she flies out of it, and sinks a little when it again feels her slight weight.

During the night one hermit slept with her head drawn down into the nest but not turned back nor buried in her feathers. Her exposed bill, rising obliquely, touched with its tip the left margin of the supporting leaf. From what little I have seen of other sleeping hummingbirds, especially Cuvier's Hummingbird *Phaeochroa cuvieri*, they slumber with their heads exposed and bills pointing forward, whether on or off the nest.

One completed nest which seemed in perfect condition never, so far as I could learn, contained an egg. A possible cause of the hermit's failure to use it was the very strong inward curvature of the supporting palm-leaf just above the attachment of the nest. She would have been obliged to sit in it with her head bent even more strongly backward than is normal.

One hermit which I watched for six hours in the morning took nine sessions on her eggs, varying from 13 to 67 minutes in length and averaging 27.2 minutes.

Her ten recesses ranged from 5 to 22 minutes and averaged 10.4 minutes. She devoted 72 per cent of the six hours to incubation. Another bird that I watched for four hours took seven sessions ranging from 17 to 27 minutes in length and averaging 21.4 minutes, and an equal number of recesses varying from 10 to 18 minutes and averaging 13.3 minutes, thus covering her eggs for 62 per cent of the time. I did not see either of these birds turn or adjust her eggs with her bill.

During the course of incubation the hermit continues to bring materials to her nest in the manner of the other hummingbirds that I have watched. Usually when returning with something in her bill she first settles in the nest, then tucks the bit of down or cobweb into the rim in front of or beside her. But at times, coming with a skein of cobweb in the tip of her long bill, she only half settles in the nest, or merely hovers close in front of it, then circles on wing around the back of the leaf, one or even twice, ending her revolutions by dropping into the nest in the usual manner, then perhaps wiping her bill against the rim. Thereby she continually extends fresh strands of cobweb from the nest to the leaf and keeps the attachment firm. The first hermit that I watched while she incubated brought material nine times in six hours and thrice passed cobweb about the back of the leaf. The second hummingbird brought material only twice during four hours of the morning, and once wrapped cobweb around the tip of the supporting leaf.

The hermits are not shy at their nests. While I stood close beside one nest measuring the eggs, the owner suddenly arrived with a piece of moss in her bill and plopped into the nest ten inches from my face. After sitting so close beside me for a minute or two, she rose from her nest and hovered all around me, scrutinizing me from a distance of less than one foot. Then she darted suddenly away. Another hermit with nestlings examined me almost as closely while I stood beside her nest. The hermits will go about the business of their nests with apparent unconcern while the watcher sits unconcealed four or five yards away.

At two nests the incubation period, measured from the laying of the last egg to the hatching of the last nestling, was 16 days. At a third nest (No. 10) the first egg was laid before 6.35 on 23 July and the second between 5.40 and 6.35 on 25 July. One egg hatched between 7.00 and 18.00 o'clock on 8 August and the other between 7.45 and 18.00 on 9 August, giving an incubation period, for the last egg, between 15 days 1 hour and 15 days 12 hours. At the first of these nests, where the interval between laying the first and second eggs was two days, one hatched more than 26 hours before the other. At the second nest, where the eggs were laid on consecutive days, the two hatched more than 12 hours apart; and at Nest 10, where again the eggs were laid on alternate days, the interval between the hatching of the first and second was 14 hours or more. This indicates that the first egg receives a good deal of incubation before the second is laid; at one nest the bird was seen to sleep on the single egg.

THE NESTLINGS.

The newly hatched hermits are minute, pink-skinned creatures, naked except for a double row of little tufts of tawny down along the centre of the back. Their tightly closed eyes form little black bumps and their rudimentary bills are whitish. The empty shells from which they escape are not promptly removed by their mother in an intentional fashion, but are sometimes brushed from the nest as she rises from it. If they remain they are gradually broken into fragments which work down into the soft lining of the nest and are found there after the young birds' departure. When less than a day old the sightless birdlings orient themselves with their heads toward the side of the nest that is attached to the leaf. This is the position which they will consistently maintain until they can fly; it was the invariable orientation of their mother while she hatched them out, and which she continues to assume while brooding them. In sitting with head constantly inward, the hermit hummingbirds resemble the Royal Flycatchers *Onychorhynchus mexicanus*, of which both the incubating female, and the nestlings from a tender age, always rest in the shallow niche in their long pensile nest with heads at the back and tails in the doorway.

Thus to feed her nestlings the mother hermit must reach over their backs; when they have become so big that their heads reach above the nest's rim at meal time it can be seen that they bend them strongly up and back to receive the food. The meals are of course pumped up in semi-liquid form from the parent's crop, as is customary with hummingbirds. The mother inserts her long bill into a nestling's throat while hovering beside the nest on rapidly beating wings, exactly as though she were sucking nectar from the corolla tube of a flower. Sometimes, especially while the nestlings are very small, she touches and appears to hold with her feet to the nest's rim while delivering food, although her wings continue to beat as rapidly as when she hovers free in the air, and she seems to depend principally upon them to maintain her position. After the nestlings are bigger, she usually delivers their meals while floating in the air, without touching the nest at all. When the nestlings are older these aerial feedings may continue from 20 to 25 seconds, during which she may give food to each youngster twice, alternately, or sometimes twice to one and only once to the other. Two nestlings, respectively one and three days old, were fed four times in two hours of the early morning; when twelve and fourteen days old they received food four times in an hour. To inspect the nest after the termination of a meal, or at the end of a period of brooding, the mother hovers on wing an inch or two above it instead of standing on the rim. Once I saw a Rieffer's Hummingbird *Amazilia tzacatl* regurgitate food to her nestlings while poised on the wing beside the nest; but she was excited by the camera I had focused upon it; and normally these, and all other hummingbirds that I have watched, except the species of *Phaethornis*, deliver food while resting on the nest's rim, not from the air.

When the nestlings are about ten days old their eyes begin to open, their skin has become darker, and their feathers start to unsheath. At the age of fifteen or sixteen days they are fairly well clothed. When completely feathered they resemble the adults, with the same pointed, whitish-tipped tails and blackish facial bands. A little natal down still adheres to the tips of their feathers. From one nest the two youngsters left, apparently spontaneously, when 20 and 21 days old. The second flew from the nest between 7.00 and 10.30 in the morning. During the interval between the departure of the first and second nestlings I several times found the latter resting sideways in the nest, that is, with the length of the body parallel to the surface of the supporting leaf rather than at right angles to it—the only exception to the rule that the occupants always face the leaf which has come to my attention.

The nestlings linger in their swinging cradle until they can fly well. When I revisited another nest that had been discovered after the eggs hatched, the two well-feathered nestlings flew out, going very well. One covered about 25 feet before coming to rest on a twig, where it remained a good while, constantly turning its head from side to side and rhythmically wagging its white-tipped tail up and down, after the fashion of the adults. The other landed on the ground about the same distance from the nest.

A nest from which nestlings about two weeks old and unable to fly mysteriously disappeared on 9 May again held two eggs on 5 June. But the second attempt to rear a family in this nest was no more fortunate than the first; and five days later the ill-fated structure was found on the shore of the river above which it had hung, its eggs lying broken on the rocks close by. Of nine nests of known outcome, only three were successful, producing five fledglings. Since some of these nests contained incubated eggs, or even nestlings, at the time of discovery, they were already a partially selected group, so that actual success in reproduction is probably less than the 33 per cent indicated by these scanty data. One nest containing two eggs was deserted; another with two eggs fell, whether because of interference or of the failure of its attachment (it was an old nest). Three nestlings died in their nests. The fate of those which disappeared prematurely is not known.

SUMMARY.

1. Observations on Longuemare's Hermit were made in Guatemala, Honduras and Costa Rica.
2. Males gather in courtship assemblies usually amidst dense second-growth. Each has a favourite perch, where he performs through the day.
3. They sing through most of the year, except from the height of the dry season in February until the rains start in April, and again at the height of the wet season in September and October.
4. The courtship display, an intricate aerial dance above the perching female, is described.

5. The downy nest is built by the female (largely on the wing) beneath the tapering tip of a palm-frond, or other leaf, 3 to 6 feet above the ground. Cobweb binds the nest to the leaf.

6. The normal clutch is two eggs, laid at about 6 a.m. on alternate or sometimes consecutive days.

7. Occupied nests were found in every month except February and March, September and October (when the males are not in song).

8. The female alone incubates, sitting with breast toward supporting leaf, head thrown far back. To leave, she flies upward and backward; to return, she flies directly down into the pocket of the nest.

9. Incubation period 15–16 days; nestling period 20–21.

10. On the day of hatching, the blind nestlings orient themselves with heads towards the leaf, and so remain until they fly. The female feeds them while she hovers—as though visiting a flower—reaching over their backs and regurgitating into their throats.