LIFE HISTORY OF THE VIOLET-HEADED HUMMINGBIRD

BY ALEXANDER F. SKUTCH

ONE of the smaller members of its family, the Violet-headed Hummingbird (*Klais guimeti*) is about three inches in length. On the male the forehead, forepart of the crown, chin and throat are intense violet or deep blue, according to the angle from which they are viewed. The remaining upper plumage is metallic bronze-green. The central feathers of the rounded or slightly notched tail are silvery bluish-green; the remaining rectrices are similar basally but dull black on the terminal half and narrowly tipped with light gray. The remiges are dusky purple. A white spot behind each eye gives the bird an alert, wide-awake aspect. The under plumage posterior to the throat is largely brownish-gray, spotted or flecked with green, especially on the sides. The less intensely colored female differs from the male in having the forehead and crown paler and bluish rather than deep violet and no blue or violet on the throat, her under plumage being gray, tinged with metallic green or bronze-green on the sides and flanks. In both sexes the bill, straight and of moderate length for a hummingbird, is largely black. This attractive bird was dedicated in 1843 by Mm. Bourcier and Mulsant to M. Guimet, a chemist of Lyons in France who invented a peculiar blue dye also known by his name.

Distribution and Floral Preferences

The Violet-headed Hummingbird ranges from Honduras through Costa Rica and Panamá to eastern Ecuador and Perú. In the central part of the Cordillera de la Costa of Venezuela it occurs from 200 to 850 meters (656 to 2789 feet) above sea level (Schäfer and Phelps, 1954:75). In Costa Rica, where alone I have met it, this hummingbird is found chiefly in the upper portions of the Humid Tropical Zone, between 1000 and 3000 feet above sea level (Carriker, 1910:551), on both sides of the Cordillera. Strangely enough, I did not become acquainted with it during my first year and a half in the valley of El General, where I watched birds chiefly from about 2800 feet upward. Nor did I meet it in the six months which I spent near San Isidro del General, around 2200 feet, in 1939. But the following year, working in the valley of the Río Pacuar in the same region, I found a number of nests at about 2500 feet above sea level, and through these I became familar with the female of the species. Still, I saw no males well enough to write a description until a year later, when I found them in the valley of the Río Reventazón on the opposite or Caribbean slope of Costa Rica. Here they were abundant around 2800 feet above sea level, along with a multitude of other hummingbirds of a number of species, and with bees, butterflies and hawk moths,

VIOLET-HEADED HUMMINGBIRD
(Klais guimeti)

Male (left) and female (right), life-size. From a water-color by Don R. Eckelberry.

about the long rows of *Stachytarpheta*, a straggling shrub of the vervain family much used as a hedge plant in this locality.

Largely because of the attractiveness of this plant to hummingbirds, and despite its unkempt, straggling habit of growth unless kept so closely trimmed that it can scarcely flower, I planted a hedge of *Stachytarpheta* about the house which I built in 1941 in El General, by the Río Peña Blanca at about 2500 feet above sea level. When my hedge began to flower early in the following year, the Violet-headed Hummingbird was, appropriately, the first member of the family that I saw visiting its blossoms. At about the same time I discovered my first singing assemblies of the males, both near my house and at a distance of several miles.

In my experience, the Violet-headed Hummingbird is a species of peculiar distribution, fairly swarming in certain localities, yet in others nearby it is lacking, or at least so rare as to escape detection. On the one hand I associate it with deep forest, where all but two of my nests were discovered, but on the other, with *Stachytarpheta* hedges about dwellings and in pastures, often far from any forest worthy of the name. On "Silver Spring" Plantation at Murcia, on the slopes high above the roaring Río Reventazón, there were thousands of feet of these hedges planted along the fence lines and through the pastures. They were 10 or 12 feet high, so dense that cattle could scarcely pass through them, and they flowered profusely at the periods of my visits in both June and September, as they do throughout the year unless there is a severe dry season. The farm was devoted to coffee, bananas and cattle, and there was no forest in the vicinity except a few shreds of it deep in the ravines which seamed the long, steep slopes. Here *Klais* was the most numerous of the hummingbirds which gathered about the hedges in such abundance as I have rarely seen hummingbirds elsewhere, except possibly in the clearings bright with flowering shrubs and herbs on the high mountains of Guatemala, at the beginning of the dry season when blossoms are most profuse. There seemed to be one Violet-headed Hummingbird for every 15 or 20 feet of hedge. When not hovering on invisible wings before the deep purple blossoms, they rested quietly on low perches in the hedge itself or in bushes close by it. There were individuals of both sexes, mature and immature, with fully adult males in the minority. The latter were arrestingly lovely when, while hovering before the compact cluster of tiny blossoms near the middle of the long, green, whip-like flower-spike, they pointed their bills toward me and the deep metallic violet of crown and throat burst upon me in full splendor.

Companions of the Violet-headed Hummingbirds, or rather their competitors for the sweet nectar of the *Stachytarpheta* flowers, were Rieffer's Hummingbirds (*Amazilia tzacatl*) with rufous tails, Lesser Violet-ears (*Colibri cyanotus*), Brown Violet-ears (*C. delphinae*), an occasional violet and

green Wood-Nymph (*Thalurania colombica*) or brownish Longuemare's Hermit (*Phaethornis longuemareus*) that ventured out from the thickets or the neighboring wooded ravines, rarely a Green Thorn-tail (*Popelairia conversii*), and in September lovely Snow-caps (*Microchera albo-coronata*), minute creatures amazingly attired in coppery purple with snow-white caps. The Rieffer's Hummingbirds often darted at the smaller Violet-headed Hummingbirds and made them retreat.

At my own hedge, situated hard by the forest, the Violet-headed Hummingbirds had somewhat different associates, chiefly Rieffer's Hummingbirds, Snowy-breasted Hummingbirds (*Amazilia edward*) in glittering green, Lovely Hummingbirds (*A. amabilis*), Elicia's Golden-tails (*Hylocharis eliciae*), plainly clad Cuvier's Hummingbirds (*Phaeochroa cuvierii*), Wood-Nymphs, and Longuemare's Hermits. In May and June Jacobin Hummingbirds (*Florisuga mellivora*), charmingly clad in blue and white, and, from July or August until February, the surprisingly ornate mites called Adorable Coquettes (*Lophornis adorabilis*) were present. The attendance of the Violet-headed Hummingbirds varied from year to year and from season to season. In some years they became very rare in March when the drought was most intense, which is inexplicable, because if the season was not too dry the *Stachytarpheta* displayed blossoms at a time when few other plants were in flower and one might expect its nectar to be in greater demand than ever; yet in years of more extreme drought it, too, was almost bloomless at this period. Possibly the majority of the Violet-headed Hummingbirds went elsewhere in search of food, leaving only a few; but I shall later give reasons for believing that they had not gone far. By 1948, my *Stachytarpheta* hedge, after a drastic pruning made necessary by its too-exuberant growth, so languished that it was replaced by a more prosaic privet hedge, with resulting great diminution in the number of hummingbirds about my dwelling.

Voice and Courtship

As with many other hummingbirds, the male Violet-headed Hummingbirds take no interest in the nest but pass the season of reproduction by singing day after day in one particular locality, often associating in this activity with others of their kind and sex to form a singing assembly. In El General some of these persistent "songsters" among hummingbirds perform throughout the year, except for a month or two of silence at the end of the dry season when flowers are least plentiful. Rieffer's Hummingbird and Longuemare's Hermit are examples of this class. Others, including Cuvier's Hummingbird and the Band-tailed Barb-throat (*Threnetes ruckeri*), perform only in the wet season. Still others sing chiefly in the dry season; of these, Elicia's Golden-tail and the Violet-headed Hummingbird are my best examples.

From 1942, my first full year on this farm, until 1952, a singing assembly

of Violet-headed Hummingbirds was located in the tops of some tall burío (*Heliocarpus*) and other trees at the corner of the pasture a short distance from the house. Here the diminutive songsters were most difficult to see because of interfering foliage. After a decade or more of occupancy this station was abandoned, probably because the second-growth woods had become too tall and heavy; but other assemblies are still maintained in parts of the farm more distant from the dwelling. After a long period of silence, I sometimes hear *Klais* sing a little while the sun is rising brightly into a cloudless sky on a fine morning in October or November, the last months of heavy rainfall. The hummingbirds now sing in a tentative fashion, not intensely as they will do a month or two later, and on dark and gloomy mornings they are not heard at all. The volume of song increases through December, which is usually a month of sunny mornings with light or occasionally heavy afternoon showers. In January, when these showers are fewer and shorter, the birds are in fullest chorus and continue throughout the day. With sunny skies and the soil still moist after eight or nine months of almost daily soakings, the flowers are now more abundant, especially in the clearings, than at any other period of the year. But as the dry season continues and the ground becomes desiccated, plants languish and produce scarcely any blossoms. Even in years when a few light showers have relieved the drought of February, March is a month of few flowers. Now, after continuing in full chorus through most or, in wetter years, all of February, the Violet-headed Hummingbirds enter a period of silence, although a few, perhaps more favorably situated with reference to food, continue bravely to perform in March, at least in years not too severely dry.

In April, after returning rains have refreshed the earth and revived drooping vegetation, the Violet-headed Hummingbirds sing freely again. Their renewal of song corresponds approximately in time with that of Rieffer's Hummingbird, Longuemare's Hermit and Elicia's Golden-tail, which have likewise been silenced by the drought, and with the beginning of singing by Cuvier's Hummingbirds, the wet season performer which has long been mute. But whereas most of these species will continue to proclaim themselves through many wet months, with the Golden-tail and the Violet-headed Hummingbirds, the dry-season singers, the renaissance is brief. May is a month of heavy rainfall and at times one of the wettest of the entire year; before it is far advanced both of these species have entered a long period of silence.

Here in that district of El General called Quizarrá, around 2500 feet above sea level, no bird of any family so advertises its presence by voice, during the early part of the dry season in January and February, as does the Violet-headed Hummingbird. The singing males perch conspicuously—if so diminutive a creature may rightly be called conspicuous—on slender dead twigs, at heights ranging from 15 or 20 to about 60 feet above the ground. Many of

them gather to form definite singing assemblies, although some proclaim their presence at a distance from other males of their kind. The situations favored for their singing perches are: (1) at or just within the edge of primary forest, (2) the edge of a tall second-growth thicket, (3) scattered trees (preferably dead) standing in a small clearing surrounded by forest, and (4) the fringe of trees along a river flowing through cleared lands. Although the females may nest along rivulets that traverse extensive tracts of unbroken forest, and the males do at times station themselves for singing in the tops of trees well within the forest, they definitely prefer the edges of clearings to continuous heavy woodland. I was impressed with this fact on an excursion through the forest from the Río Peña Blanca to beyond the Río Calientillo early in February, 1942. Although the trees along both sides of the rough trail, to a distance of 30 or 40 feet, had been felled to permit the drying sunlight and breezes to reach and desiccate the muddy track, I heard no Violet-headed Hummingbirds except where the way led through wider clearings (then far less extensive than today) made for agriculture, yet in most of these larger openings the hummingbirds were singing.

Just beyond the Río Calientillo, in a recently-made clearing already grown up with tangled bushes and vines more than head high, I found a singing assembly unusually favorable for observation. This group consisted of at least four males in full adult plumage. Three of these hummingbirds had their stations in as many dead trees, remnants of the original forest, which formed the corners of a roughly equilateral triangle of about 50 feet on a side. They perched on exposed dead twiglets, well above the surrounding low growth, at heights of about 25, 30, and 40 to 50 feet above the ground, respectively. The fourth member of the assembly rested habitually about 40 feet above the ground in a dead tree about 100 feet distant from one apex of the triangle formed by the posts of his neighbors. At times I heard the voices of Violet-headed Hummingbirds coming from more distant parts of the clearing, but I did not succeed in seeing these birds.

Whether he sings alone or as a member of a group, each Violet-headed Hummingbird is to be found at his post hour after hour, day after day, through most of the dry season. From early morning, through the warm hours when the bright dry-season sun pours down its fervid rays from the zenith, until the cool evening shadows steal out from the long, forested ridges, the glittering little bird continues tirelessly to repeat his spirited, simple chant, interrupting it only long enough to seek food or to repel a trespasser. In their long-continued, tireless singing, as well as in the high, exposed perches they prefer, the Violet-headed Hummingbirds remind me greatly of the Violet-ears (*Colibri* spp.) as I have heard them in the highlands of Guatemala, Costa Rica and Ecuador.

The song, sharp and rapid, possesses a certain elementary rhythm. Although there is considerable variation in the utterances of different individuals, none is really musical. As he sings, the hummingbird turns his head constantly from side to side, scarcely opening his bill. Occasionally one

member of an assembly will invade the territory of a neighbor, approaching quite near his singing perch. Then the aggrieved party dashes at the offender, and the two streak away almost too fast for the human eye to follow. But that the pursuit ends without either of the participants having suffered injury is proved by the fact that within a few minutes they are back on their usual perches, chanting as blithely as ever.

The function of these singing assemblies is undoubtedly to advertise the location of the males to the females, so that the latter may come and have their eggs fertilized at the proper time. Although Pitelka (1942) concluded that North American hummingbirds maintain territories especially with reference to a food supply, and these territories may secondarily serve as mating stations, this explanation is hardly applicable to such species as Rieffer's Hummingbird, White-eared Hummingbird, *Hylocharis leucotis* (see Skutch, in Bent, 1940), Longuemare's Hermit (Skutch, 1951) and other tropical species that I have studied. That in the Violet-headed Hummingbird, as in many others, the territory proclaimed with such untiring song is largely or wholly a mating station is attested by the following facts: (1) The males sing in assemblies at the season when the females nest, and through much of the remainder of the year they are silent. (2) These assemblies are not always near the richest supply of food. Although for six or seven years the *Stachytarpheta* hedge about my house attracted many Violet-headed Hummingbirds as a source of nectar, not one established a singing perch near the hedge. The nearest assembly, about 100 yards distant in the tops of the second-growth trees between the corner of the pasture and the forest—a locality poor in flowers—remained through all these years where it was when the hedge opened its first blossoms. If the hummingbirds sang to proclaim possession of feeding territories, one would expect them to sing at seasons when there are no nests, to station themselves in the midst of the richest available stands of flowering plants, and to disperse more uniformly instead of congregating in assemblies, so that each individual could enjoy his feeding ground with a minimum of interference by others of his kind. These expectations are all contrary to the observed facts.

Notwithstanding my conviction that these singing assemblies serve to facilitate the union of the sexes, neither in this nor any other of the hummingbirds whose assemblies I have watched have I learned just what happens when a female arrives. In the first place, in these hummingbirds the sexes can be distinguished when at rest only in favorable optical conditions, and when in flight not at all. The arrival of any other hummingbird on or near the perch of a singing male invariably sooner or later leads to a pursuit, and these chases nearly always carry the birds out of sight. Wagner (1954), however, described the elaborate aërial dances of which the male and female of a number of Mexican hummingbirds engage, after the female has been

attracted to the vicinity of the singing male. Yet apparently even he scarcely ever witnessed the consummation of these courtship rites.

Just as many birds sing more or less outside their breeding seasons, some even carolling not a little when flocking in their winter homes thousands of miles from the land where they nest, so the Violet-headed Hummingbirds may repeat their tuneless verses during the wet months when I have found no evidence of reproduction. At this time they do not station themselves on high perches, nor gather in assemblies, nor continue tirelessly through the day as though life depended upon their unremitting vocal efforts. On the contrary, they choose a humble perch near the flowers that attract them and perform now and then at their leisure, when feeling well fed and happy. I have noticed this sort of singing in my garden in the wet season—but not in the dry— and I observed it particularly at "Silver Spring" Plantation in the Reventazón Valley. Here in June the male Violet-headed Hummingbirds sang a good deal, especially in the early morning, usually from low perches in or near the *Stachytarpheta* hedges, such as they chose for resting between visits to the flowers. They were not collected into definite singing assemblies; indeed, the concentration of these hummingbirds was such that the whole mountainside might be regarded as one great assembly of both sexes. In September the hummingbirds were less vocal, and in neither month did I find a nest.

The Nest

In the valley of El General, the female Violet-headed Hummingbirds begin to build their nests in the dry month of February, if not earlier, and the latest nestlings of which I have a record took flight in mid-May. The nests are built in the forest, usually above a stream, or at times above a well-shaded mountain torrent flowing between pastures or second-growth woods a short distance from the forest. The 11 nests that I have seen varied in height from 3 feet 3 inches above a narrow forest stream to 15 feet above the ground in the forest a good distance from any watercourse. Eight of these nests were discovered between March 6 and 13, 1940, along the Río San Antonio (a tributary of the Río Pacuar, which is one of the headwaters of the Río Grande de Térraba) and a narrow affluent of the first which we came to call *La Quebrada de los Gorriones*—The Hummingbirds' Brook—from the number of hummingbirds' nests, all of this species, that we found along its course.

I was at that time engaged in botanical collecting for the Museo Nacional de Costa Rica, and these sparkling mountain streams, flowing in pristine loveliness through a great tract of unspoiled rain-forest, traversed my favorite and most productive collecting ground. Day after day I pushed farther upward along their rocky beds, proceeding slowly because of the difficulty of walking along the wild fluvial pathway, and because of the number of things

to be observed, collected and enjoyed. Each bend in the stream opened a fresh prospect of enchanting beauty: a pool of fluid crystal mirroring the wide-spreading crowns of stately tree-ferns; water slipping smoothly down a long incline of rock; a cliff overgrown with the richest profusion of ferns, aroids, bromeliads and orchids; or a long, straight reach bordered by the tall and slender trunks of noble forest trees whose boughs interlocked far overhead. Among the verdure along the shores were many plants new to me and some hitherto unnamed by botanists; here I first made the acquaintance of some notable birds, and saw novel aspects of others already known to me. Here, too, I first became familiar with the Violet-headed Hummingbird; and of all the discoveries that I made along these unforgettable streams, this was the most noteworthy.

The eight occupied nests of the Violet-headed Hummingbird were found incidentally by the lad who carried my plant press and myself, without making a particular search for them, for we were busy gathering botanical specimens. They were situated along about two and a half miles of the combined courses of the Río San Antonio and its affluent "The Hummingbirds' Brook," as nearly as I could estimate distances along so uneven a pathway. In addition to the eight nests with eggs or nestlings, we noticed about an equal number that were empty, some bearing signs that the young had flown from them, thus providing evidence that the nests which already held feathered nestlings, hatched from eggs laid at the beginning of February, were not the earliest. Probably nesting had begun in January, if not in December. A nest with young ready to fly was only four feet from one in which the female was incubating two eggs. Another nest with feathered nestlings was about 40 feet from a different nest with two eggs. This was a truly remarkable concentration of hummingbirds' nests. Occupied nests as close together as even the farther separated of these two pairs are exceedingly rare, and I have on only one other occasion found two nests of any species in comparable propinquity. In the forested parts of the tropics, the nests of most kinds of hummingbirds are extremely difficult to find; and I rarely see more than two or three of any one kind in a year, even of the species most abundant in the vicinity.

These nests along the forest streams were all situated on branches projecting over the water, usually on pendulous branchlets, at heights of from 39 inches to about 12 feet above the current. Of my three nests found in other localities, one was attached to a pendent branch of a vine growing over a sotacaballo (*Pithecolobium*) tree which leaned far out over the wider Río Peña Blanca; it was situated in an inaccessible position about 10 feet above the water and 20 feet out from the shore. The river was here about 50 feet broad, flowing impetuously over a channel strewn with great boulders.

Another nest, of which I watched the construction, was also attached to a vine of the same species that hung above the same river, in this instance about seven feet above the water and well out from the shore. The single nest found at a distance from a waterway was attached to a spray of the climbing fern *Salpichlaena volubilis* that dangled beneath a palm frond in the midst of the forest, at a height of 15 feet above the ground. These hummingbirds showed a definite preference for hanging sprays as supports for their nests.

The lower of the two nests above the Río Peña Blanca was discovered in front of my house early in the morning of February 18, 1946, when so recently begun that it was still only a small tuft of moss and spiders' silk, about an inch in diameter. It was most attractively situated among the glossy foliage of the dangling vine, an epiphyte of the heath family, one of whose short petioles helped to support it above the sparkling current of the broad, rocky stream, low and murmurous at this season. The hummingbird continued her building while I sat on a boulder in the channel only four yards away; but to disturb her less I thought it preferable to watch from a greater distance and took my post on a mossy rock by the shore. It was 7:18 when I settled down and began to keep count of her visits to the nest. She brought 10 billfuls of material, mostly cobweb and a little moss, in quick succession, then two more billfuls at longer intervals, then she stayed away for many minutes. Soon after 8:00 she returned and brought 12 billfuls as quickly as she could gather them, then went away. Between 8:18 and 9:18 she came with material only three times more, whereas in the preceding hour she made 24 visits to the nest. She had brief periods of concentrated activity in building, separated by long intervals of neglect, during which she might make a few sporadic visits to her nest.

The following morning I watched again from 6:50 to 7:40 and from 8:12 to 9:50, keeping count of the number of times the hummingbird brought material to her nest in five-minute intervals. The number varied from 0 to 7, with an average of 1.4. There was one period of 43 minutes (8:12 to 8:55) when she did not visit the nest. From 6:50 to 7:40 she brought material 25 times; from 8:12 to 9:50 she came 17 times. In the entire 2.5 hours she brought material 42 times. Now, in addition to moss and cobweb, the hummingbird came with silky seed plumes for the lining. On both mornings she worked in silence and no male of her kind ever appeared. On the morning of February 21 she was still bringing material, but her structure appeared to be almost completed. By the following morning it had not changed in appearance, whence I concluded that it was finished—as much as a hummingbird's nest can ever be said to be finished, before her eggs hatch. It had been built in four or five working days. No egg had appeared in it by March 3, and by March 11 it had vanished.

The completed nest of the Violet-headed Hummingbird is a tiny, thick-walled cup, composed largely of green moss, and lined with seed down that is usually buff in color. One nest was exceptionally high and appeared to have been built on top of another of the same kind. All the nests that I have seen were beyond hearing (with my ears) of the males singing in their assemblies, but at least three of them were only a short flight away from an assembly.

The Eggs

In one nest the eggs were laid with an interval of two days, the second of them before 7:30 a.m. Each of ten nests contained two eggs or nestlings. The minute eggs are white in color and ellipsoidal in shape.

In 10 nests in the valley of El General, about 2500 feet above sea level, eggs were laid as follows: in February, 5; March, 4; April, 1.

Incubation

I studied incubation at the nest so attractively situated on a spray of the climbing fern *Salpichlaena volubilis* that dangled below the frond of a small palm tree up which it had twined. This nest in the midst of the forest was the only one of the 11 which I have seen that was not above running water. But it was not beyond hearing of the Peña Blanca River, whose roar was carried to me over a distance of several hundred yards when the wind blew from that quarter. The second egg in this nest had been laid on February 26, 1944; hence, incubation had been in progress for 10 days when I began my vigil at noon on March 7. I watched until, at 5:35 p.m., the light in the forest became so dim that I could no longer distinguish the hummingbird in her nest; then I returned at the following dawn and continued to keep watch until 11:39 a.m.

For so small a bird, the Violet-headed Hummingbird sat for surprisingly long periods. The 11 sessions that I timed ranged from 15 to 77 minutes and averaged 40.6 minutes. The 12 recesses ranged from 6 to 28 minutes and averaged 15.2 minutes. She spent 72.8 per cent of the day on her nest. Her steady sitting, as compared with some other hummingbirds that I have studied (the White-eared Hummingbird, for example) was due in large measure to the fact that she devoted very little time to seeking additional materials for her nest, never, apparently, leaving her eggs for that particular purpose. During my entire watch she brought only three or four bits of material. The three contributions that I clearly saw in her bill were brought to the nest as she returned to resume incubation at 7:18, 7:39 and 8:19 a.m.—just the period of the morning when the other female built most actively. Her shortest sessions on the eggs were in the early morning, before nine o'clock, her longest in the late morning and the afternoon.

When leaving the nest, she rose on wing directly from her eggs, not first hopping upon the rim as heavier birds do. Sometimes, after rising a short distance above the nest, she darted back and forth and up and down in a most erratic fashion, going only a few inches, or at most a foot or so, before she abruptly changed her direction, and she continued this for several seconds before she flew out of sight. At times she would return with the same irregularly oscillatory flight. Could she be catching small insects invisible to me? I heard no sound from her except the humming of her wings. She did not once alight on the nest's rim to turn her eggs; if she adjusted them at all, it must have been done with her feet. No male of her kind appeared. Soon after her eggs were laid those in the assembly nearest to her suspended singing, as they usually do toward the end of the dry season.

Growing close around the nest were a number of bushes of *Cephaelis elata*, a rubiaceous shrub whose small white flowers are borne in dense heads surrounded by conspicuous red bracts. A male Wood-Nymph made periodic visits to these flowers through the morning. The incubating Violet-headed Hummingbird never attempted to drive him away. She was equally indifferent to a little Longuemare's Hermit and to a big Long-tailed Hermit (*Phaethornis superciliosus*) which made less frequent visits to the immediate neighborhood of her nest, appearing never to take the slightest notice of them.

From this, the only nest for which I knew the date of laying, one egg disappeared on March 13, 16 days after the set was completed. The nest was then abandoned.

The Nestlings

The two occupied nests situated only four feet apart in the same bush that overhung "The Hummingbirds' Brook" were the farthest upstream of all that we found in 1940. Two hummingbirds' nests so close together formed a discovery so unprecedented in my experience that it called for further observations. A well-feathered nestling had flown from one of these nests as we approached, but I was able to catch it and return it beside its nestmate, where, unexpectedly, it was cooperative enough to remain. The day was already far spent when we made this exciting discovery; and we were obliged, after watching only long enough to convince ourselves that the neighboring nest with eggs was also attended, to hurry downward ere the dense blackness of night caught us so deep in the forest and made movement along the rocky streambed too dangerous to be contemplated. But next morning I retraced my course over the long, rough way and learned more about the relations between these two hummingbirds which were such surprisingly close neighbors.

At other nests along this stream I had already found that if I sat quietly on a rock, at no great distance and without concealment, the female would soon return to attend her eggs or nestlings. So I settled myself on a rounded stone which commanded a good view of the two nests in the same bush. The well-feathered nestlings were bright, alert youngsters which frequently preened their green plumage and from time to time beat their wings into a haze while they clung to the bottom of the nest. When an adult of their kind came within sight, they seemed to be aware of her approach at once and were all attention, uttering clear droplets of sound in anticipation of food. Apparently they were not able to distinguish their mother from her neighbor, for they called in the same fashion at the approach of either. The incubating hummingbird, as far as I saw, paid no attention to the other's offspring. But she was somewhat afraid of her neighbor, the mother of the nestlings. When the latter approached, the other, if sitting, would dart from her eggs. Or sometimes

she would continue to incubate while the mother fed the nestlings liberally by regurgitation, only to fly away as the other departed. Yet the hummingbird with nestlings was not aggressive toward her neighbor with eggs.

As at the nest in the climbing fern that I watched some years later, on approaching their nests each of these hummingbirds would alternately dart and hover, shooting for a short distance now to this side and now to that, irregularly back and forth, and at the end of each abrupt shift in position it would hang momentarily upon wings beating too swiftly to be seen. The short, abrupt, erratic darts, the sharp and sudden changes in direction, reminded me strongly of the behavior of a Jacobin Hummingbird when catching gnats above a river, or of a hoverfly. Possibly these hummingbirds were indeed snatching a few last-minute morsels from the air—I could not make sure. After darting from one side of the nest to the other for a brief period, the hummingbird would suddenly plop down into it, or alight on the rim to feed the nestlings.

These two hummingbirds, like others of their kind whose nests I had watched downstream, sometimes came to hover close above me before going to their nests; or else, after feeding the nestlings, before darting away they approached to have a nearer view of the strange monster that was spying on them. At one of the downstream nests the mother, apparently without seeing me, arrived suddenly and alighted on the rim to feed her youngsters. Then, my abrupt movement in raising my field glasses attracting her attention, she immediately left the nest and came to hover close before me. Satisfied by this examination that I was not dangerous, she promptly returned to give the nestlings what she had brought for them. This and other examinations to which I have been subjected by hummingbirds of a number of species appeared to be deliberate and purposeful acts, prompted in some instances by simple curiosity and in others by concern for the safety of their nests and offspring. They suggest that hummingbirds may be somewhat nearsighted, which is not surprising when one considers the minute size of the nests they build and of the insects they pluck from the vegetation or catch in the air.

I continued to watch the two neighboring nests with that uncomfortable feeling I sometimes have in the woods of being myself watched by unseen eyes. Of a sudden, a long, black snake mottled with yellow slid down an oblique ledge on the fern-shaded streamside cliff rising to my right. It moved rapidly without a pause until it came to rest on a rock in midstream, almost beneath the two nestlings. There it lay motionless with its foreparts raised high, to all appearances gazing up at the young hummingbirds, and, without much doubt, trying to discover by what route they might be reached. Knowing from repeated past experiences the great fondness of the mica (*Spilotes pullatus*) for nestlings, I killed it.

My only comparable example of occupied hummingbirds' nests close together is that of two nests of Longuemare's Hermit (*Phaethornis longuemareus*) which in 1955 I found only 12 feet apart, attached beneath leaf-tips of low, spiny palms in the undergrowth of the forest. In many hours of watching while the two females incubated and attended nestlings, I never saw one pay the slightest attention to her close neighbor. Each acted as though the other did not exist. These observations accord ill with the rather widespread belief that hummingbirds are highly pugnacious and intolerant of each other. Perhaps many of the dashing pursuits that one witnesses among members of this family should be ascribed to playfulness, as I suggested long ago (1940), and as Wagner (1954) believes from his observations in México to be true.

On the morning of May 17, 1942, I had the good fortune to witness the spontaneous departure of the fledgings from the higher of the nests of the Violet-headed Hummingbird that were attached to vines dangling above the rushing current of the Río Peña Blanca. When I arrived at half-past ten they were restless, preening and moving about in their narrow nest, and sometimes beating their wings into a haze while clinging with their feet to its rim. The big white spot behind each shiny black eye made the youngsters appear keen-sighted and alert. After a while an Oleaginous Pipromorpha (*Pipromorpha oleaginea*), whose snug mossy nest hung from a slender dangling root on the opposite shore, flew into the vine that supported the hummingbirds' nest. Although the little olive-green flycatcher would not have harmed the young hummingbirds, her close approach alarmed them; and one suddenly rose from the nest and flew with ease, directing its course toward the boughs above the opposite shore, where I lost sight of it.

The other youngster, instead of fleeing when the pipromorpha came by, crouched down in the bottom of the nest, where for a few minutes it rested quietly. But soon becoming restless again, it preened, then stood on the nest's rim, and clinging tightly with its toes, vibrated its wings into a haze and rose up as though it would break away from its downy anchorage. Then it settled back into the nest once more. When a large black wasp flitted among the foliage close beside it, the nestling opened its bill as though to defend itself, and when the insect hovered nearer, it flapped its wings, ready to dart away if prudence demanded a retreat. Presently the mother hummingbird came to feed this nestling that remained at home, giving no indication that she noticed the departure of the other. After a few minutes she returned and fed this same youngster once more, with nectar sipped from the long, slender flower-tubes, coral-red tipped with white, of the climbing heath in which her nest was placed.

Then about half an hour after the departure of its nestmate, the second young hummingbird spontaneously rose from the nest and soared up to alight on a slender branch of the vine about a foot higher. After a brief rest here, it beat its wings again and slowly rose another foot into the air, to a twig less than a yard above the nest. Here it rested and preened for a while. Then it flew upward yet again, until it passed from sight amid the close-set boughs of the sotacaballo tree in whose shade it was reared.

The mossy nest had maintained its shape well during the month of drenching rains to which it had been exposed. It did not burst asunder, as nests of Rieffer's Hummingbirds not infrequently do in similar circumstances. A premature fall from the nest would have deposited the young Violet-headed

Hummingbirds in rushing waters from which escape would have been difficult. These fledglings, and all others that I have seen, closely resembled the adult female in plumage.

Summary

In Costa Rica the Violet-headed Hummingbird resides in the higher parts of the Humid Tropical Zone, chiefly from 1000 to 3000 feet above sea level. It is found both in heavy forest and in clearings, where it is especially attracted to flowers of the verbenaceous shrub *Stachytarpheta*. The distribution of this hummingbird is irregular; it abounds in certain districts, whereas in others a few miles away and still within its altitudinal range it is rare or absent.

The males gather in assemblies to sing, each on his favorite perch, which is usually a slender, exposed twig from 15 to 60 feet above the ground. The assemblies are situated at or near the margin of forest or tall second-growth, in a forest-rimmed clearing with scattered trees, or in the fringe of trees along a river flowing through cleared lands. The several members of an assembly choose posts about 50 to 100 feet apart.

The male's song is sharp and rapid but lacking in melody. Singing may begin sporadically on sunny mornings at the height of the wet season in October. Gradually increasing in amount, it reaches its peak in the sunny month of January, when the hummingbirds perform tirelessly throughout the day. As the ground dries and flowers become fewer, song wanes, until little is heard in late February and March. In April, when vegetation is again flourishing, there is a renaissance of song which lasts into May.

Singing is most profuse just before and while the females are nesting, whereas it is in abeyance through most of the long non-breeding season. The song-perches are often situated where there are few flowers, while they are absent from neighboring areas with abundant blossoms. Hence the males appear to sing to attract the females rather than to advertise possession of a feeding territory.

In El General nesting occurs from January (or possibly late December) until May, but nests with eggs are most abundant in the dry month of February. Of 11 nests, 10 were above streams, at heights of 39 inches to 12 feet above the current, and one was 15 feet above the ground in the forest at a distance from water. Most were attached to hanging vines or pendulous branchlets. Eight of these nests were found in a single week along about 2.5 miles of a narrow forest stream and its tributary. Here two occupied nests were 40 feet apart and another two were only four feet apart. The owners of these nests paid little attention to each other. No male was seen in the vicinity of any of the nests.

One female built most actively between 7:00 and 8:00 a.m. In one period

of 50 minutes she brought material 25 times, and once she came seven times in five minutes. The nest was built in four or five days. The nest is a tiny, thick-walled cup, composed largely of green moss and softly lined with light-colored seed down.

The set regularly consists of two, elongated, white eggs, which in one instance were laid two days apart.

One female, watched during the daylight hours from noon to noon, took 11 sessions that averaged 40.6 minutes, 12 recesses that averaged 15.2 minutes, and kept her eggs covered 72.8 per cent of the period of diurnal activity. She brought material to the nest only three or four times, all in the early morning.

One fledgling left the nest as a small, harmless flycatcher flitted past, and the other departed spontaneously, in the absence of its parent, half an hour later.

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