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## LIFE HISTORY OF THE CITREOLINE TROGON

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In earlier papers I have given accounts of the nesting of the Mexican Trogon (Auk, 59, 1942:341-363) and the Quetzal (Condor, 46, 1944:213-235). I have not previously published anything on those members of the trogon family which carve their nest chambers into termitaries, although the first trogons' nests that I found were in such situations. My earliest nest was one of the Massena Trogon (*Trogon massena*) discovered in Honduras in 1930. The eggs in this were lost; and in spite of much searching I found no other trogons' nests until 1932, when three belonging to the Black-headed Citreoline Trogon (*Trogon citreolus melanocephalus*) were discovered on Alsacia Plantation, near Los Amates in the valley of the Río Motagua in northeastern Guatemala. Here I had the good fortune to follow all stages of the nesting activities, from the excavation of the chamber to the flight of the young.

The Citreoline Trogons, of which several races have been distinguished, are distributed over a wide area extending from Sinaloa and southern Tamaulipas in México to the Gulf of Nicoya in western Costa Rica. In general they prefer more or less arid country, such as prevails over the long stretch of the Pacific coast where they are at home, as well as in that part of their range which includes middle eastern México, Yucatán, and interior districts of northeastern Guatemala and northern Honduras. Near San Gerónimo on the Pacific side of the Isthmus of Tehuantepec, I met Citreoline Trogons far from water amid the cacti and low, thorny scrub which cover so much of this dry and excessively hot region. In the vicinity of Matías Romero in the center of the Isthmus, I found them among the taller and more luxuriant trees along a river. Black-headed Citreoline Trogons are indeed resident in some of the rainiest regions of the Caribbean lowlands of Central America, although here they appear never to dwell in the heavy rain-forest itself, but prefer habitats where they receive more sunlight. In the humid lower Motagua Valley of Guatemala, and near Tela on the northern coast of Honduras, I found these trogons fairly common in pastures with scattered trees, in light second-growth woodland, along the edges of banana plantations, and among the fringes of trees bordering rivers flowing through the cleared districts. A heat-loving species, the Citreoline Trogon appears not to range far above sea level; but I am unable to define its upper altitudinal limit in Central America.

Compared with such resplendent creatures as the Quetzal or even the Mexican and Massena trogons, the Citreoline Trogon is a bird of subdued plumage. When viewed perching well above the observer's head, the male appears to be clad largely in dull black, with rich orange-yellow on his belly, fading into yellowish-white where it adjoins the black or slate-color of his chest. One must see him resting low and in the sunshine to appreciate the full loveliness of the iridescent blue-green and golden-green plumage of his back and lesser wing coverts, and the metallic blue and violet-blue of his rump and upper tail coverts. His four middle rectrices are deep green with contrasting tips of black, the three outer pairs basally black with white terminal portions, the amount of white on these feathers varying greatly in the different races. The female is similar in

appearance but lacks most of the rich metallic coloration of the upper parts; yet except with favorable illumination it may be difficult to distinguish the sexes as one sees them among the trees (at least in the Black-headed Citreoline Trogon). In the race *melanocephalus* the whitish, pale yellowish or (according to Van Tyne, Univ. Mich. Mus. Zool. Misc. Publ., 27, 1935:22) "Greenish Glauous" bill of the male is, in some pairs at least, decidedly lighter than that of the female, and the ring of bare whitish skin surrounding each brown eye is more faintly tinged with blue—"Pale Russian Blue" according to Van Tyne. In the forms which inhabit the Pacific lowlands of Oaxaca and Chiapas, the iris is bright yellow and the naked orbital ring blue of so dark a shade that it does not contrast with the blackish feathers of the head and in the field appears to be lacking. These differences in the color of eyes and eyelids, together with the more extensive white on the outer tail feathers of the nominate race, are the best field characters for distinguishing it from *melanocephalus*, which until recently was considered to be a distinct species. A male of the black-headed race collected in El Petén by Van Tyne (*loc. cit.*) weighed 69.5 grams.

#### FOOD

Like other members of the family, Citreoline Trogons have a varied diet, consisting of both fruits and insects, which they pluck or catch while they hover momentarily on fluttering wings at the end of a long upward or outward dart. Among fruits, they are fond of the orange-colored pulp of that of the Central American rubber tree (*Castilla*), the green fruiting catkins of the guarumo (*Cecropia*) and berries of various sorts. Their animal prey includes dragonflies; mantises, grasshoppers and other orthopterans; big caterpillars, both hairy and hairless; and many smaller insects difficult to identify in their bills. Between their swift darts to seize food, the Citreoline Trogons rest motionless for protracted periods, perching very upright with their long tails directed almost vertically downward. Their flight is distinctly undulatory.

#### VOICE

The usual call of the Citreoline Trogon is a low, throaty, unmelodious *cuck cuck cuck cuck*, easily distinguished from the clear, mellow, many-times-repeated *cow cow cow* of the Gartered Trogon (*Trogon violaceus*), another yellow-bellied species of open country with which it mingles over much of its range. During the mating season, which in the Caribbean lowlands of Guatemala is in April and May, several Citreoline Trogons of both sexes perch close together in the scattered trees that remain standing amid the cleared lands, calling at intervals in low, unimpassioned voices. As each calls, it jerks its tail up and down with rapid but mincing strokes and shakes its slightly relaxed wings. Occasionally one trogon darts at another, who usually retreats without any show of resistance. The birds are evidently courting, but the proceedings are so long drawn out that it requires extraordinary patience to follow them to their natural conclusion. Later, while carving out the nest cavity, the trogons give voice to low, whining notes which resemble the grunts of new-born puppies.

#### NEST BUILDING

After my incomplete experience with the nest of the Massena Trogons, I had expected to watch nesting trogons in the deep shadows of the forest; and no greater contrast can be imagined than that between my anticipations and the actuality of my second nest, my first of the Citreoline Trogon. This was situated in a great black termitarium, atop a low wooden post which supported a fence of barbed wire that separated a weed-choked cattle pen from a small marsh on Alsacia Plantation. Of all the trogons' nests I have seen, this had the least attractive site. The bulky termitary measured about two

feet in height by sixteen inches in transverse diameter, and its bottom was only three and a half feet above the ground. When by rare good fortune I found the pair of Citreoline Trogons digging into it, late in the afternoon of April 8, 1932, they had made a cylindrical opening which began near the bottom and struck obliquely upward into the black heart of the termitary. The tunnel was already seven inches long, but too narrow to admit my hand. The termitary was still inhabited by many of the little white termites that had made it.

At dawn on the following morning, April 9, I hid myself in a tangle of vines from which I could see the termitary and waited until eleven o'clock. Although I repeatedly heard the distant notes of the trogons, they did not return to their work during my long vigil. When passing by shortly after noon on April 10, I noticed the female trogon perching on the barbed wire fence near the termitary. Soon the male flew up from the direction of the nest to join her here, and both panted beneath the bright midday sun to which they were exposed. After a minute or two the female flew toward the termitary, which was screened from me by foliage. The birds were evidently at work, and I tried to reach my observation post amid the vines without disturbing them by taking a circuitous course through the dense bushy growth. But I succeeded only in tearing my shirt and driving them away. They went off in different directions, but soon called to each other and reunited, and after about a quarter of an hour they returned to their perches on the wire, about ten feet from the termitary. The male trogon was the first to resume work. I watched them at their task for the next hour and ten minutes and much during the following four days.

Both male and female trogons shared the difficult task of carving out the nest cavity in the hard black substance of the termitary, but the male was clearly the leading spirit in the undertaking. He usually arrived first on the strand of wire where they rested during the operations, called his mate if she delayed in joining him, and when she arrived went first to work in the termitary. He always clung for many seconds or even minutes, back downward, beneath the entrance, and made a most careful survey of the vicinity before he would enter the boring. As he turned his head slowly from side to side, the broad ring of bluish-white bare skin, which separated his dark eye from his black face, gave him an odd, bespectacled aspect. Sometimes after looking around in this manner he would decide not to enter, and, although I could discover no cause for his mistrust, returned to perch on the wire for an interval before at last beginning to work.

Satisfied at length that all was well, the trogon would climb up into the hole until only his deep green, black-tipped tail was visible to me. From my place of concealment in the vine tangle I could hear the crunching of the hard substance of the termitarium and see the black chips falling from the entrance. Whether he worked by hammering with his bill, or by biting and twisting the thin, tough sheets of which the structure was composed, I of course could not see; but from the character of the sounds he made and the form of his bill—not sharp like a chisel, but blunt and thick for crushing and tearing—I think it more likely that he followed the second method. When he dropped out after a period of work, he went to perch close beside his mate on the fence; and she, after delaying beside him for an interval, flew over to take her turn at the task. Before entering, she, too, clung beneath the entrance, peering cautiously around with her oddly bespectacled eyes, often for a period much longer than she afterward worked. So the two shared the labor, turn and turn about; but on my first afternoon of watching their periods of work were very short, ranging from a fraction of a minute at the beginning to about three minutes at the end of the hour. The male usually went to work in silence; but the female often voiced a low, rapid, throaty *cuck cuck cuck* as she clung below the tunnel before climbing into the termitarium. Much of the time as the trogons labored, they

uttered a very low, not unpleasant whine, and called *cuck cuck cuck* in a voice so weak that it was scarcely audible to me at a distance of twenty feet.

In the tropical lowlands, birds and men alike take advantage of the cooler hours of the early morning to perform the greater part of their necessary work. The majority of passerine birds, I think, build most actively early in the day; but this is by no means true of some of the non-passerines. These trogons did not come to begin their task until half-past ten or eleven in the morning, and they worked, with short recesses, through the warmest part of the day, sometimes until four or five o'clock in the afternoon. It must have been frightfully hot inside the black termitarium with the sun beating down upon it, for it was practically unshaded; and when the birds emerged from a spell of work they perched on the barbed wire to pant with open bill. Upon each successive return to the nest after an absence taken to rest or feed, the trogons' periods of continuous labor gradually lengthened as they became more absorbed in the undertaking; but the male always worked longer than his mate. For example, between 12:50 and 2:50 p.m. on April 11 their periods of labor were as follows: The male worked 1 minute, then the female, 1½ minutes; male, 4½, female, 11; male, 20, female, 12; male, 24, female, 5.

That the trogons actually worked while hidden from my view in the termitary I could be sure by the continuous crunching sound which issued from it and the constant falling of chips from the mouth of the boring. During the first of the longer shifts of the female, her mate became impatient of waiting for her on the fence wire and clung for a moment at the entrance while she was within, then flew back and forth in front of it several times. During the twenty-minute turn of the male which followed, the female became even more restless, flew to and fro in front of the termitarium, calling in a low voice, and finally clung in the entrance, whereupon her mate at last emerged.

By the middle of the afternoon of April 11 the tunnel had become twelve inches long and had already begun to widen into the nest chamber at its upper end. On the following day, for the first time, the trogons emerged from the termitary head foremost, which indicated that the nest cavity had already become wide enough to permit them to turn around in it. The male trogon, who from the beginning had toiled the harder, now assumed an increasingly large share in the task. Sometimes he would work a few minutes, drop down below the entrance for a long and careful scrutiny of his surroundings, then enter to bite away more of the substance of the termitary, repeating this several times in succession while his mate waited inactive on the barbed wire. From the first she sometimes clung below the entrance, peering around as though she intended to go in and work, but in the end flew back beside her mate without having entered or accomplished anything. He seemed to consider this as the equivalent of a shift at work, and on her return to the wire flew over to take another spell of honest labor himself. As the task progressed, the female missed her turn with increasing frequency, while the male's periods of toil lengthened, and once he worked for half an hour continuously.

On April 14, the final day of nest building, the female was in the nest for less than two minutes of the five hours that I spent in sight of the termitary. Even then she apparently did no work, for I heard no sound of crunching while she was within. Twice she grew impatient and flew out of sight while her mate was busy in the cavity and could not see what she did. When at length he emerged and found himself alone, he called in a low, calm voice and waited, but received no response. Again and again he called, becoming louder and more insistent, but his recalcitrant partner would not return; so he went off in search of her and his voice became faint in the distance. He would never work unless the female was perched near the termitary, or unless she had been there when he last looked around.

After a quarter of an hour they returned, and again the male entered the chamber for a long spell of work. Again the female went off while he was busy inside. When he came out and found himself alone he called earnestly for fourteen minutes; the female answered from the distance but refused to obey his entreaties to return. So at last he flew away, and during the next two hours no more work was done, although on past days the trogons had labored steadily during this period of the early afternoon. The cavity now appeared to be completed. By far the greater part of the task of excavation had been accomplished in the six days (April 8 to 14) which had passed since I discovered it.

Later, when this nest was no longer in use, I opened it to take some measurements. The chamber was  $7\frac{1}{2}$  inches high by  $5\frac{1}{2}$  in diameter; the obliquely ascending entrance tunnel, which led into the top of this chamber was about 6 inches in length and  $2\frac{1}{2}$  in diameter. The nest contained no soft lining.

A second nest of the Black-headed Citreoline Trogon, found in the same locality on May 6, was in a large termitarium attached to the lower side of a fallen willow tree that leaned against some bushes on the steep bank of a lagoon beside a banana plantation. The doorway of the nest was only about two feet from the edge of the bank. This massive termitary, measuring about two feet nine inches in length by eighteen inches in greatest transverse diameter, was full of termites (*Nasutitermes*), which had sealed off the ends of all the passageways that abutted on the cavity made by the birds. The trogons' entrance-way opened as usual on the lower side and led sharply upward.

After the first pair of trogons lost their nestling, they carved a second nest cavity into a termitary on a neighboring fence post, twenty-five feet distant from their first nest. The doorway of this was five feet above the ground. This termitary was also still occupied by the insects which made it.

In addition to these three nests of the Black-headed Citreoline Trogon, I have seen one belonging to a yellow-eyed form (probably *T. c. sumichrasti*). On July 17, 1934, while visiting Tonalá in the Mexican state of Chiapas, I made an excursion into the hills behind this lowland town to visit some Indian ruins inaccurately called "La Iglesia Vieja." The pathway wound up a mountainside, passing through light woods, and crossing many pretty little streams of clear water that tinkled down the steep slopes. Not far above the plain, I happened to see a termitarium in a small tree growing a little distance from the trail. When I examined it, and before I could come quite beneath it, the sound of my footfalls alarmed a male Citreoline Trogon, who darted out and away, voicing the usual dry *kec kec kec* after he had vanished amidst the trees. Examining the termitary from the ground, I found two round openings, one of which went in only a few inches, while the other penetrated to the heart of the structure. The latter was doubtless that from which the trogon had emerged.

The termitary was far out on a horizontal bough, about eighteen feet above the ground, and difficult to approach. When I finally scrambled out to it, I found, as I had expected, that the aperture was too narrow to admit my hand. Although reluctant to meddle with the birds' habitation, I decided to enlarge the opening just enough to put in my hand and learn what the cavity contained. This was no easy task, for the substance of the termitary was extremely hard—in places too hard to be broken with my naked fingers; and it was difficult to chisel with the blunt point of a machete while stretched prone along the branch. As I worked, bathed in perspiration, the termites swarmed out, covering my hands and forearms, and even reaching to my neck and face, administering bites that were slightly painful where the skin was tender. When finally the aperture had been made just sufficiently wide to squeeze in a hand, I took out two pure white eggs that had been quite recently laid, as I could see through the thin, trans-

parent shell. They rested on some loose debris, apparently fragments of the termitary itself, on the bottom of the cavity.

I replaced the eggs, hoping that the owners would not desert them because of the enlargement of the entrance-way. As we came down the trail in the evening, I found one of the pair of trogons near the nest. Apparently it had flown out upon hearing our footfalls as we came down the steep hillside pathway.

#### THE EGGS

With the completion of the first nest on the fence post beside the weedy cattle pen, I found myself in a quandary. I wanted to learn when the eggs were laid, how long they took to hatch, what the new-born young looked like, and a score of other things which could be determined only by looking frequently into the nest. But the obliquely ascending tunnel entered the top of the ellipsoidal black chamber and afforded no view of what rested on its floor. The entrance was narrower than that of the larger Massena Trogon, and I could not even push my hand inside. I thought first of cutting from the top of the termitary a segment which could be removed and replaced as necessary, but I doubted whether the birds would accept so great an alteration; light would certainly enter through the joints. Worse than that, I feared that ants, a great scourge of nesting birds, might find their way in, for the porous structure would not permit a close joint once it had been cut. Finally, I used a small mirror and illuminated the chamber with a small electric bulb.

In order to avoid too great disturbance of the nest at the critical period of egg laying, I at first made my examinations at intervals of several days. Between April 20 and 23 two eggs were laid, the first apparently on the 21st, a week after I considered the nest to be completed. The third and last appeared on April 25. Hence the interval between laying successive eggs was two days.

The nest beside the lagoon likewise contained three eggs when found on May 6, and this was the number in the replacement nest of the first pair when I discovered it on July 9. In every instance the eggs rested merely on some hard chips of the black substance of the termitary, no softer lining having been taken in. Because of the impossibility of inserting my own hand into the nest cavity, the eggs were not removed for examination while fresh. As seen with artificial light and by reflection, they appeared pure white, as were those of the race *sumichrasti* examined in Chiapas. Later I opened a deserted nest and removed two old, unhatched eggs, which measured 29.8 by 22.6 and 31.0 by 23.0 millimeters.

#### INCUBATION

By means of two long and several short vigils and numerous brief visits, I learned how the trogons divided their time while incubating in the nest on the fence post. As with other species in the family, male and female shared the task of incubation, the latter sitting through the night, the former taking charge of the nest through most of the day. Their hours in the nest were much the same as those of the pair of Massena Trogons that I had studied in Honduras two years earlier. The female, continuing the long session begun the preceding evening, remained in the termitary until about an hour after sunrise. She flew off suddenly, without warning and without a signal from her mate, at about seven o'clock in the morning. Sometimes the male entered within a few minutes of her departure, but on other mornings he delayed more than an hour. Thus on May 7 the female left at 6:59 and he did not enter until 8:15. If undisturbed, he then sat continuously through the day, eight to ten hours in all. I wondered how he could endure the heat within his black nest when the morning sun beat down fiercely upon it. Between three and five o'clock in the afternoon he ended his long shift. His method of emerging was

very different from that of his mate, for he came out quite gradually. First his whitish bill appeared in the entrance and remained there many seconds while he hung looking downward. Next his head and neck emerged, and he peered first to one side and then the other, surveying the world from which he had so long withdrawn himself before launching forth into it. Then with a dart he was off and undulated to a convenient perch, where he stood very upright and called for his mate, who might be long in responding to his summons.

To make quite sure that the male trogon sat all day without intermission, I resolved to keep continuous watch. In order to avoid a vigil which would be too long and tedious, I decided to divide my watch between two consecutive days and started at one o'clock in the afternoon of May 8. The male, who was in the nest when I began, remained continuously until 3:12, when he left spontaneously. I waited until four o'clock, but the female had not yet arrived to take her place on the eggs. The following morning I resumed my vigil before the termitarium at sunrise. At 7:05 the female suddenly darted out and flew to perch near her mate, who was resting in a tree fifty feet away. If he had called to her I failed to hear his voice, although he was nearer to me than to the nest. At 7:11 he silently entered the termitary. It turned out to be a beautiful day, such as one frequently enjoys in the Caribbean lowlands of Central America in the dry season, with a clear sky and a bright sun, but it was not oppressively warm. My visual faculties were riveted on the termitary, which I dared not neglect for a second, lest the trogon dart forth unseen. The morning slipped by without his so much as showing his head in the entrance. I had intended to terminate my watch at the hour when I began on the previous day, but when one o'clock arrived I decided to continue until the bird ended his turn on the eggs. I had not much longer to wait, for in about fifteen minutes some children came noisily down the hillside behind the nest, and at the same time someone pushed a tramcar which rolled with loud rumblings over the tracks a hundred feet away. The combination of sounds brought the trogon to the doorway, where he hung head downward, peering out, undecided whether he had better go or stay. Just then the iron wheels of the car jolted noisily over an uneven joint in the light rails; he darted out and away and called from the distance.

An hour later the female, after perching long on the wire, the very symbol of caution as she turned her head slowly from side to side to make sure that no enemy was in sight, flew directly into the nest, at 2:17. This was the earliest that I saw her enter. On May 7 she did not go in until 5:40 in the evening, although her mate had left at 5:02; and on May 3 she had not entered by 6:00, although the nest had been unattended since the male's exit at 3:58. Once within the termitary, the female normally remained until she relinquished her eggs to the care of her mate next morning.

These trogons, while sitting on the nest, had become indifferent to the loud banging of a heavy wooden gate not far off, and to the uncouth shouts of the plantation laborers who used the path that wound up the hillside behind their termitary. But let someone walk close behind their nest, swishing through the tall grass at the edge of the little marsh, or tap on the fence wire even a good distance away, and they darted out of their chamber in a flash. Fortunately, people seldom visited this neglected corner of the pasture, which had been fenced off so that cattle could not enter.

The nest beside the lagoon faced into a banana plantation which provided me with only imperfect concealment while I watched it. Because I did not wish to arouse the curiosity of the laborers in the plantation, I did not set up a blind and make prolonged observations. Occasional visits to the nest and short vigils showed that the pattern of incubation was essentially the same as at the nest on the fence post, the male sitting

through most of the day, the female by night. On May 11, I began before sunrise to watch the termitary, screening myself as well as I could behind a clump of bananas. When no trogon had come in sight by 8:10, I advanced to the nest and the female flew out, considerably later than I had ever found the female in the first nest. The following morning I arrived at 7:15 and began to watch. The female, as I later learned, had already flown from the nest. At 7:30 the male came and perched on a banana leaf above his termitary; but I believe that he glimpsed me in my imperfect concealment, for he soon flew away again. At 8:34 he called from a West Indian birch (*Bursera Simaruba*) on the bank of the lagoon, then advanced to a banana leaf above the nest and repeated his low throaty note many times over. Then he dropped down among the low weeds in front of the termitary, called a few times more, and rose and straightway entered the unattended nest.

On the afternoon of May 10 the male trogon left this nest spontaneously at 3:59, but the female did not enter until 5:01. She also dropped to the ground in front of the termitary before rising to the doorway only two feet up. On May 13, I found the female in the nest at 4:20 p.m., and on May 19, when the eggs were near the point of hatching, at 3:28 p.m. During the course of incubation the sitting trogons regurgitated the hard seeds of the fruits they had eaten. About a dozen, the size of cherry stones, accumulated on the floor of the chamber in the termitary beside the lagoon.

At the nest on the fence post the last of the three eggs was laid on April 25, and one egg hatched on May 14, after at least nineteen days of incubation. The other two failed to hatch.

#### THE NESTLINGS

The pink skin of the newly hatched Citreoline Trogon was absolutely naked and its eyes were tightly closed. At the age of a week it still had closed eyes, but the pin feathers were beginning to sprout out through the skin. By the time it was eleven days old these pin feathers had become very long. On May 29 I found that the nest on the fence post had been invaded by small brown ants, which swarmed up the post and through the entrance-way in countless numbers. I promptly enlarged this passage in order to reach the nestling within and render it such assistance as I could. But the young trogon was past all helping, for its head was gone and ants covered its body—nor could I find the head. I doubt that the ants had killed the nestling; they could not have carried off its skull. It seemed likely that a weasel or some other small mammal was guilty. The pin feathers of the fifteen-day-old nestling were surprisingly long; those of the primaries reached  $2\frac{1}{4}$  inches, while the rectrices were  $1\frac{1}{8}$  inches in length. Some of these long sheaths were breaking just beyond the middle, to let the enclosed vanes escape. The tips of some of the blackish wing-coverts were already pushing from the ends of their sheaths. While I was examining the ruined nest and its ill-fated occupant, the female arrived bearing an insect. Years later, I saw a male Jalapa Collared Trogon (*Trogon collaris puella*) bring food twice for a nestling which lay dead below the nest, and similar behavior is not uncommon among birds of other families.

With the loss of this nest, the other beside the lagoon acquired greater importance. Here all three eggs had hatched between May 19 and 21. Both parents fed the young, bringing a variety of insects, including small mantises, green caterpillars, dragonflies, and other kinds too small to be identified as they were held in the bill. Rarely they served a berry to the nestlings. Arriving with something in their bills, the parents dropped among the low weeds at the edge of the bank and delayed there a minute or so before rising to the nest, exactly as they had done when they entered to take a turn on the eggs. It was surprising to find a bird so arboreal as a trogon settling on the ground in this



manner; but the entrance to the nest was so low and directed so sharply upward that I suppose, with their peculiar manner of flight, they found it too difficult to enter without first coming to rest below it.

While delivering the food to the nestlings, they clung for several minutes in the entrance tube with a few inches of the tail alone showing; but without being able to see inside I could not determine what occupied them so long. On leaving they dropped out of the nest backward and rose into the air, without touching the ground. They were not very excitable, and when I approached their nest they flew off to a safe distance, if not entirely out of sight. From the age of two or three days the blind nestlings continually uttered a little, far-away peeping, faintly audible a few paces from the nest. Such a tell-tale of their presence might defeat all their parents' exceeding caution in approaching them.

When the young trogons, at the age of eleven days, bristled with long pin feathers and their eyes were open, they were quieter in the nest, only making a sort of hissing cry while their parents clung in the entrance tube to feed them. This was a much shorter process than it had been ten days earlier, which led me to believe that the parent with its head in the entrance had then in some way prepared the big insect it brought for the nestlings and now that they were older this preparation was no longer necessary. Also, now the parents no longer alighted on the ground in front of the termitary, but with practice had learned to fly directly into the entrance tube as they descended from the trees bordering the lagoon. They became somewhat more excited when their nest seemed to be in danger. Although they made no demonstration while I visited it, they might perch above me uttering at intervals a single low *cuck*, at the same time spreading and closing their tail feathers fan-fashion, a movement which revealed, to one standing behind them, momentary flashes of white.

The three nestlings were fed rather infrequently. On May 23, when they were two or three days old, the mother brought food only thrice in the three hours between 5:35 and 8:35 a.m. The father sometimes approached with food and once got as far as the ground in front of the termitary, but he saw me in my imperfect concealment and was too wary to enter the nest in my presence. On May 25 I watched from 9:05 to 10:10. I had improved my screen of dead banana leaves, and now both parents fed apparently without distrust, but each only twice in the 65 minutes. On June 2, in the hour between 9:15 and 10:15, the mother fed the nestlings four times and the father only once. Sometimes, while I was squatting in front of the termitary to examine the interior with light and mirror, a parent arriving with food would dart up quite close before it appeared to become aware of my presence; once the father almost bumped into me. On such occasions I sometimes had a better opportunity to recognize what they brought in their bills than while watching from concealment. I never saw them remove waste material from the nest chamber. This was so humid that the mirror I used for viewing the nestlings would become clouded with condensed moisture even on warm, dry days, thereby making a difficult observation doubly difficult.

When the young trogons were two weeks old, they bristled with amazingly long pin feathers, from which hardly any of the vanes had escaped. In the course of the next two days a marvelous transformation came over them, and they were completely clothed with the feathers which in the interval had shed their long sheaths. Only with anis and antbirds have I seen the feathers burst from their horny envelopes as rapidly. The young trogons were ready to have their portraits taken, so the following day I brought the camera and an Indian boy of ten to act as helper. The lad's hand easily went into the entrance tunnel, which was too narrow to admit mine. He drew forth one of the little

birds and passed it to me. Now for the first time I held in my hand and saw by direct vision a trogon nestling, for hitherto I had viewed them only by reflected light. It was a trogon in miniature, completely feathered but seemingly only about a third the size of the adults. It struggled to escape; but from my experience with kingfishers, motmots, woodpeckers and jacamars, all of which remain flightless for a number of days after they are well clothed with plumage, I did not believe it could yet fly. Holding it low in a clear space amidst the bananas, I opened my hand, ready for at most a short chase if it fluttered over the ground. But no sooner were my fingers opened than its wings began to whirr; in an instant it rose sharply into the air and flew above the tops of the banana plants, twenty or twenty-five feet high. The mother trogon, who had been watching us from a banana leaf with a long-horned grasshopper in her bill, uttering at intervals a staccato call, darted toward it; both vanished among the giant foliage. Her plumage had become worn and frayed, her yellow belly soiled and discolored, in the performance of her parental duties.

"Take out another, Macario," I requested.

The boy felt in the nest and replied that there were no more. Almost incredulous, I looked in myself with the mirror, only to find it was as he said. The bottom of the nest was covered with the accumulated droppings of the nestlings, among which maggots swarmed; but the other two nestlings had gone without doubt at the age of sixteen or seventeen days. Their power of flight had come so rapidly that I had completely missed my opportunity to photograph them. I had not even observed their markings carefully, for the one I held in my hand darted away before there was time to examine it. Its blackish wings were, I remember, unlike those of its parents, prominently marked with white, and its bill was shockingly dirty.

On a brief visit to Alsacia Plantation at the end of the same year, I examined all three of the termitaries in which the trogons had nested. The first, in which the single nestling had been killed, was still open on the side, as I had left it after enlarging the aperture. The termitary beside the lagoon had rolled down the bank when the willow log that had supported it had decayed and crumbled; the trogons' nest chamber had not been closed. But the chamber in the second termitary on the fence post—the replacement nest of the pair of trogons who had lost their first brood—had been quite closed by the termites of the thriving colony which still occupied this structure. The only indication of the birds' nest which remained was a patch of slightly lighter brown on the surface, marking the spot where the doorway had been. A termitary in which a pair of Massena Trogons had nested was similarly repaired by the termites after the birds had forsaken it.

#### SUMMARY

The Citreoline Trogons (*Trogon citreolus*) inhabit more or less arid country in the lowlands of tropical México and Central America as far south as the Gulf of Nicoya in Costa Rica. One race (*T. c. melanocephalus*) dwells in wet districts of the Caribbean lowlands, where it is confined to cleared lands with scattered trees and appears never to live in the heavy rain-forest of these regions.

Their diet consists of both fruits and insects, which they pluck or catch while hovering momentarily on beating wings at the end of a dart that is often long and spectacular.

The usual call is a throaty, unmelodious *cuck cuck cuck*, very different from the clear notes of many other trogons.

Three nests discovered in the Caribbean lowlands of Guatemala from April to July were all in bulky termitaries still inhabited by the termites and were between two and five feet above the ground. A nest found on the Pacific side of Chiapas was in a termitary about eighteen feet up.

The excavation of one nest chamber was watched in detail. Male and female alternated at the difficult task of digging into the hard termitary, but the male usually arrived first and did the greater share of the work. Neither member of the pair would enter the hole to work unless the other were perching near by; but sometimes the female flew away while her mate was toiling inside and could not see her. They began operations late in the morning and continued through much of the afternoon. The greater part of the excavation of this chamber was done in six days.

Each of the three Guatemalan nests contained three white eggs, laid (in one instance) on alternate days on the hard bottom of the unlined chamber in the termitary. First layings were in late April or early May, a replacement laying about the end of June. The Chiapas nest held two fresh eggs in mid-July.

The male trogon incubated through most of the day, from seven or eight o'clock in the morning until from three to five in the afternoon, staying in the nest continuously if undisturbed. The female sat from the middle or late afternoon until early the following morning. Each member of the pair might leave the nest before the other came to replace it.

One egg hatched after about nineteen days of incubation.

At the time of hatching the nestlings had closed eyes and pink skin with no trace of feathers. Soon sprouting, the feathers became very long before the sheaths burst to release the enclosed vanes. This process, which began when the nestlings were about two weeks old, was extremely rapid. A day or two later the young trogons were completely clothed with plumage and could fly.

Both parents fed the nestlings, bringing them a variety of winged insects and caterpillars, rarely a fruit. They failed to keep the nest clean and droppings soon covered the bottom. They made no demonstration when the nest was visited by a man.

The nestlings left the termitary at the age of sixteen or seventeen days, when they could fly well.

One of the nest cavities in a termitary was closed up by the termites after the birds abandoned it.

*Finca "Los Cusingos," San Isidro del General, Costa Rica, January 27, 1948.*