

LIFE HISTORY OF THE RUDDY GROUND DOVE

By ALEXANDER F. SKUTCH

The Ruddy Ground Dove, also called the Talpacoti Ground Dove (*Columbigallina talpacoti*), a species hardly larger than a sparrow, is found from southern México through much of Central and South America to eastern Perú and northern Argentina. The male has a grayish head, cinnamon-brown upper plumage, warm reddish-chestnut wings with two black bars on the coverts, and russet-vinaceous under parts. The female is paler, more grayish and brown, with usually only a faint wash of the male's ruddy color on her breast and wings. The eyes of both sexes, when viewed in a strong light, are red; those of the male are a deeper red than those of the female, but in the shade the irides of both appear black. Their bills are light horn-color with a darker tip; their feet are reddish-pink.

In Central America these doves are found on both coasts and range upward into the foothills to an altitude of about 3500 feet. They thrive best among the vegetation of the cultivated lands in regions of abundant rainfall that were formerly covered by heavy forest. They are numerous throughout the Caribbean lowlands wherever the forest has been destroyed, in the southern and central parts of the Pacific slope and lowlands of Costa Rica, and amid the coffee plantations on the lower Pacific slope of Guatemala. In somewhat more arid regions, as about the head of the Gulf of Nicoya, they mingle with the Common Ground Dove (*Columbigallina passerina*), but they do not follow it into still drier areas where cacti are more numerous, nor do they extend half as far above sea level as this hardier and more adaptable congener. However, in the regions of heavy rain-forest where the Ruddy Ground Dove is most abundant, the Common Ground Dove is absent.

The Ruddy Ground Dove dwells among the cultivated lands and pastures, and it is found in the weedy vegetation on neglected fields until this growth becomes high enough to exclude the sunshine from the ground. I have never seen it in the forest. It likes best to forage on bare and open ground, especially in the vicinity of human dwellings and cowsheds, where ten or twenty may gather in a flock, sometimes in company with Blue Ground Doves (*Claravis pretiosa*). What they so industriously gather from the bare earth is difficult to determine, but probably they pick up small seeds and insects.

The call of the Ruddy Ground Dove is a soft *kitty-woo*, uttered by both sexes. This dove also delivers a simple, low *coo*, and I have heard the male give a phrase which may be written *too-oo-woo*. The voice of the male is slightly deeper and fuller than that of the female. One female while brooding nestlings called *t'cuwu*, *t'cuwu*.

SLEEPING

In the village of Buenos Aires in southern Costa Rica, one December, I found a number of Ruddy Ground Doves roosting amid the bases of the broad, crowded leaves of the arborescent *Dracaena fragrans* that bordered the pathway leading up to a little church. Here they slept in company with many wintering Baltimore Orioles (*Icterus galbula*). The male of a pair, which built a nest in a dense hedge of *Stachytarpheta* behind our house, slept in the hedge not far from the nest where his mate incubated. Another male roosted for several nights amid the dense foliage of a sour orange tree, about 20 feet from his nest which was in a calabash tree. He did not sleep with his head turned back and buried in the plumage of his shoulders, in the manner of many birds, but held it forward and exposed, the bill pointing slightly downward. This is the usual sleeping posture of the ground doves.

ATTACHMENT OF MATES

Mated Ruddy Ground Doves are strongly attached to each other. One May morning in southern Costa Rica, I watched a male and a female that were perched side by side in a small tree growing in a mountain pasture. These birds were pressed so closely together that the female held up her wing on the side next to her mate, as though there was not space for it between them. Presently they began to preen, and the female gently billed the feathers of her partner's neck. After a time they both turned to face in the other direction and pressed as closely together as before, but with different sides in contact. They remained resting side by side in this fashion for nearly an hour.

THE NEST

Nest-site.—In Colombia, the Ruddy Ground Dove begins to build its nest in December for, on January 3, 1941, I found a nest with two eggs near Cali in the Cauca Valley. In southern Costa Rica and in adjacent parts of Panamá, the long breeding season starts off at least as early as January. The nest is usually placed in a tree, shrub, or herb, growing in a low thicket, bushy field, pasture, plantation, dooryard, or hedge-row. In western Panamá I found nests built upon the topmost "hands" of bunches of green bananas hanging in a plantation; here the upturned fruits kept the nests in place. Occasionally the slight structure rests upon the abandoned nest of some other bird. One pair used as their foundation the remains of an old nest of the Blue Tanager (*Thraupis episcopus*) which was in an orange tree; a second pair built upon a nest of the Golden-masked Tanager (*Tangara nigro-cincta*); and a third pair placed their nest on top of the bulky edifice of sticks made by the Slaty Castle-builder (*Synallaxis brachyura*). An exceptional site was a leaf of a pineapple plant, one of a dense cluster growing close beside our house. Here the nest was in an exposed position, with no foliage above to shade it from the morning sun, and little to screen it at the sides. Thirty nests that I have found ranged from one to about 30 feet in height, but nests which are lower than two or higher than 20 feet are exceptional. Two-thirds of the nests were from four to eight feet above the ground. Although the related Common Ground Dove and the Plain-breasted Ground Dove (*Columbigallina minuta*) sometimes build upon the ground, the Ruddy Ground Dove appears never to do so either in the Guianas (Haverschmidt, 1953:22), Panamá, Costa Rica, or Guatemala.

Nest-building.—The shallow, saucer-like nest is built by male and female working in closest coöperation. On January 3, 1941, I discovered a pair building a nest about 20 feet above the ground in a crotch of a jacaranda tree growing in a vacant lot. This tree was near a motion-picture theater on the outskirts of Cali, Colombia, where this dove was exceedingly abundant. The female was sitting in the nest, arranging the materials. Her mate picked up straws from the ground, then flew up to the nest and stood on her back while he laid them beside her. After he had done this three times the female flew away; then the male sat on the nest himself, arranging the sticks and straws with his bill. Presently he, too, left and the pair did not return for some time.

This method of building, with one member of the pair sitting upon the incipient nest and the other bringing material to it, is widespread among pigeons. The Blue Ground Dove, the Red-billed Pigeon (*Columba flavirostris*), the Short-billed Pigeon (*C. nigrirostris*), the White-tipped Dove (*Leptotila verreauxi*) and other species construct their nests in the same fashion. Whenever it is possible to distinguish the sexes, it is the male who brings most or all of the materials while the female sits on the nest and arranges them in the structure.

At about seven o'clock in the morning of June 13, 1943, I discovered a pair of Ruddy Ground Doves building a nest in an annatto tree (*Bixa orellana*) growing close beside

my house in the valley of El General, Costa Rica. The site was six and one-half feet above the ground, on a thick branch of the tree. The nest was just newly begun, with only a small accumulation of straws and the like in a crotch. About two feet away, nearer the center of the tree and slightly higher, was a still smaller collection of straws, evidently another beginning of a nest. The surrounding foliage was open, so that I enjoyed an unusually favorable view.

Although the female dove was absent when I began to watch, the male twice brought material and sat on the nest to arrange it. The female then returned and took her position on the nest. The male came twice more with one straw each time and stood on the female's back while he laid it in front of her; when she was present, he always stood upon her to deposit the material. After he flew off, she put the straws and twiglets in order. However, after receiving the second piece she left, probably frightened by a movement I had made. The male then brought two more straws, one at a time, and arranged them himself. Then his mate returned and sat while he carried seven straws to her; after placing the last of these she flew away, apparently because she was bored.

When next the male returned with a bit of nest material, instead of going to the position where the pair had been building, he went to the other accumulation of material nearer the center of the tree. Here he deposited his burden and settled down to shape the nest. Soon the female, returning with empty bill, saw the male there and went directly to sit on him, until he moved off the incipient nest and left her resting there alone. After a short absence, he again returned with a straw, but he ignored his mate sitting on the second nest and went directly to the first structure where he placed his straw and settled down to shape the nest. Here he remained until the female deserted the inner position and came to him, sitting half upon him until he made way for her. Here she stayed, putting things in order, while he brought her three more straws. Her willingness to go ahead with building in whichever of the two locations her mate fancied, suggested that the choice of the nest-site rested with him. Continued watching made it clear that he took the initiative in nest-building and his mate followed his lead.

Later the female flew away and the male brought two more straws and sat on the nest while he worked them into place. Then, from 8:30 to 8:51 a.m., both members of the pair were absent and no work was done. At the latter hour the male came, followed by his mate. I could not see whether he carried anything in his bill, but she clearly brought nothing. He preceded her to the nest and sat upon it, twitching his wings. Soon she came and stood beside him until he relinquished his position to her. He flew off, but in a few minutes returned with material to lay in front of her. He brought four pieces; and then she, quickly losing interest as usual, walked from the nest and out along the supporting branch, at 9:05. While she rested there, preening, the male came with still another contribution and sat in the nest to work it into place. At 9:10 the female flew from the annatto tree and the male rose from the nest to follow her. Although I watched until ten o'clock, no further work was done; nor did I see the doves at their nest later in the day.

On the following morning, before sunrise, I began to watch the nest from a blind which I had previously set in a favorable position. Neither member of the pair appeared in the annatto tree until well after sunrise, at 6:44, when the male came alone and settled in the nest to arrange its materials, pausing once in his work to call *kitty woo, kitty woo, kitty woo*. Three minutes after his arrival the female appeared, as usual bringing nothing in her bill. She walked over the male on the nest, then stood beside him, reaching over his back to arrange the material on the opposite side. Then she walked over him again, but he would not yield his position on the nest to her, and after a minute she flew away. A few minutes later he also left.

At 7:09 a.m. the pair returned together, both with empty bills. The male went first to sit on the nest, and his mate came and stood upon him; then she stood at his side. After a minute or two he flew off and she settled into his place. During the next 19 minutes the male brought six contributions, including straws and rootlets, which as before were deposited while he stood on his partner's back; these, the female shuffled into place with her bill. The pair made a pretty picture in the old annatto tree, which had been cut back in successive harvests of the fruits until it had a shapely, rounded dome of light green foliage, that at this season was covered over with blossoms of a delicate pink and prickly developing pods of a light shade of red, all aglow in the golden beams of early morning sunlight.

At 7:30 a.m. the male dove vanished and remained away for nearly 40 minutes. During his long absence the female sat constantly on the nest, at first keeping herself well occupied with the task of shuffling its straws into a more compact mass, later merely resting quietly, preening a little or pushing the materials about in a desultory way. When at last her partner returned, his bill was empty, but he stood beside her and went through the motions of placing a straw by her breast. Then he dropped down to the lawn beneath the tree and returned promptly with a contribution. He now began to bring things to his mate in rapid succession, for he had found a liberal supply of straws and grass rootlets, and during the next quarter-hour he took ten pieces to the nest. Among his contributions were fine fibers and one brown, curled annatto leaf, which was accepted and worked into the structure by the female, although it resembled nothing else there. Although on each trip to the nest he carried only his usual single piece, he carefully selected this from the available supply, picking up and dropping again many articles which proved unsatisfactory. Most other birds would have carried more of a "lazy man's load" of several pieces each time and so have economized effort.

After 8:23 a.m., five minutes passed before the male dove made another visit to the nest, this time bringing a fine straw. Then he rested for ten minutes, at the end of which time he embarked upon another period of concentrated activity and brought 11 pieces of material in 16 minutes. At 8:53, while her mate was beside the nest laying before her a straw he had just brought, the female, who had been sitting continuously for 102 minutes, unceremoniously stepped from the nest and walked off toward the end of the supporting branch. The male himself placed this last contribution, then came to stand close beside his companion. After two minutes both flew away; although I continued to watch until 9:30, they did not return. I had planned to resume observations the following morning, but long before sunrise there was an egg in this nest, and incubation had begun. Most of the work of building the structure had been done on two mornings between about seven and nine o'clock, and I had the good fortune to witness most of the construction of this nest.

Another nest near our house was completed in three or four days. In Surinam, Haverschmidt (1953) also watched the construction of a nest of the Ruddy Ground Dove which was finished in two days. Here also the doves carried a single piece of material at a time. Although building passerines often gather a whole sheaf of straws or fibers in their bill, most of the pigeons I have watched carried only a single piece of material on each visit. The only exception to this was a male Blue Ground Dove who seemed at times to hold several pieces, but it might well have been that these were all branches attached together. This restriction to a single article at a time is understandable in the Red-billed Pigeon, Short-billed Pigeon, Scaled Pigeon (*Columba speciosa*) and other species which break twigs or inflorescence branches from high in the trees, often struggling hard to detach them. It would be scarcely possible for them to pull away a stubborn piece while burdened with another item. This objection to carrying

several articles at once does not hold with the Ruddy Ground Dove, the Blue Ground Dove, the White-tipped Dove and others which glean loose bits of vegetation from the ground; it may be that their habit of bringing only a single piece at a time was inherited from ancestors that built their nests with materials gathered in the tree-tops. In any case, the capacity to seize one thing in the bill while holding another object is not so important to pigeons that feed their young by regurgitation as it is to small passerine birds that find this ability exceedingly useful in gathering a generous load of insects or other morsels for their nestlings.

Description of nest.—The nest of the Ruddy Ground Dove is a firm but slight and shallow, saucer-shaped structure, sometimes scarcely more than a platform with a shallow depression at its center. It is composed of straws, fine twigs and weed-stems and is lined with bits of dry grass and rootlets. One nest measured 3 by $2\frac{3}{4}$ inches in outside diameter; another, much bulkier, was $4\frac{1}{2}$ by 4 inches. The nests are about two inches in height, and the hollow that contains the eggs is about two and one-half inches in diameter by one inch deep. Although barely big enough to hold the eggs, the nests of the Ruddy Ground Dove are as a rule substantially made, with thick walls; yet some, especially those which have a broad supporting surface, are flimsily constructed. The nest of this dove is generally to be distinguished from that of the Blue Ground Dove by its more solid construction.

THE EGGS

Time of laying.—The first egg may be laid on the day following the completion of the nest. At two nests, possibly both belonging to the same pair, the female came in the evening to sleep on the empty nest, and when she flew off, in the dim light of dawn next morning, she left the first egg. At four nests, the second egg was laid on the day after the first appeared; at one nest, two days intervened between the laying of the first and second eggs; and at another nest the interval was three or possibly even four days.

Even when the eggs are laid on successive days, the interval between the first and second egg may be greater than 24 hours, for in several instances the second egg was deposited considerably later in the morning than the first. Thus at nest 24, the first egg was laid before 5:30 a.m., but at 6:35 the following morning there was still only the single egg, covered by the male. The female was on the nest at 7:20 and 7:40; but I did not wish to run the risk of disturbing her in the act of laying, so I did not learn when she deposited the second egg. However, it was certainly laid more than 25 hours after the first. Similarly, at nest 27, the first egg was laid before 5:20 a.m.; the second was laid between 6:00 and 8:55 on the next morning. At one of Haverschmidt's nests in Surinam, the first egg was laid before 6:30 a.m. on one day, and the second was laid between 7:00 a.m. and 4:30 p.m. on the following day.

Size of set.—The full set of the Ruddy Ground Dove nearly always consists of two eggs. At times a nest with only a single egg is discovered, but one can seldom be sure in such cases that the other egg has not been lost. Not infrequently an egg is rolled from the shallow nest if the dove is frightened and darts away suddenly. Yet at one nest that I kept under observation during the period of laying, only a single egg was ever found; it was abandoned soon after it was deposited. Haverschmidt (1953) likewise found that only a single egg was laid in a nest that he watched closely. In British Guiana, Beebe, Hartley, and Howes (1917:213) found occasional nests of this species containing one egg and also some nests with three eggs. Sets of three eggs are most unusual among pigeons, and Belcher and Smooker (1936:4) state that they are of rare occurrence in the Common Ground Dove in Trinidad.

Description of eggs.—The eggs of the Ruddy Ground Dove are pure white and ellip-

soidal, with little difference in shape between the two ends. The measurements of 16 eggs average 23.2 by 17.1 millimeters. Those showing the four extremes are 25.4 by 17.5, 24.2 by 17.9, and 21.8 by 15.9 millimeters.

Monthly distribution of sets.—In the basin of El General in Costa Rica, the eggs were laid in 29 nests as follows: January, 1; February, 4; March, 6; April, 8; May, 1; June, 4; July, 2; August, 1; September, 2. The majority of nests were found in the wet season, which extends from March to December or January. It is perhaps significant that three of my four February nests were found in the unusually wet February of 1937. At Palmar Sur, on the Pacific coast of southern Costa Rica, nestlings were found on September 20, 1947, and a pair was building a nest on October 20 of the same year. In Guatemala, a nest with eggs was found near Los Amates in the Motagua Valley on May 10, 1932, and two nests with eggs were found near Colomba, at 3000 feet above sea level on the Pacific slope in the Department of Quezaltenango, in July, 1935.

INCUBATION

Incubation of the first egg.—Incubation begins with or, if a paradox is permissible, even before the laying of the first egg; for we have seen that the female may sleep on the nest before she has laid any eggs, and she may sit quietly for long periods while building is in progress. Haverschmidt (*op. cit.*) also found that the female ground dove sat on the nest the day before she laid the first egg and slept upon it during the night before laying. After the deposition of the first egg, it is kept almost constantly covered until the second egg is laid. This is, in my experience, generally true of pigeons; it is doubtless important that the shining white egg be kept covered, lest it attract the eye of some predator. From the time the eggs are laid until they are hatched, they are rarely left exposed. For this reason, perhaps, selective processes have not been at work (save in a few exceptional genera like *Oreopeleia*) to create a pigmented shell that would be less conspicuous in the slight, open nest.

On the day the first egg is laid, the division of time spent on the nest by the male and female ground dove is wholly different from that followed after the second egg appears. At the nest in the clump of pineapple plants beside my house, the female flew off, leaving the single freshly laid egg, at 5:30 a.m. on April 5, 1943. At 6:05 I found the male covering the egg. The female was sitting at 7:27, 9:18, and 10:55 a.m. The male was again in charge at 12:15 and 3:30 p.m., but the female was back at 5:30 p.m. Next morning at 6:35 a.m., the male again covered the single egg.

Later in the season, at the nest I had watched the doves building in the annatto tree, the treatment of the single egg was somewhat different. This egg had been laid before 5:20 a.m. on the morning of June 15. At 6:00 a.m., I found the male covering it. At 6:24 he called *kitty woo* several times over, and a moment later I noticed his mate approaching. She came to stand above him, and after a brief delay he relinquished the care of the nest to her. At 7:37 a.m. she left spontaneously, after having sat quietly for an hour and 12 minutes. Her absence was short, and at 7:44 she returned to the egg. At 8:16 she cooed, then departed, as her mate approached with a straw in his bill. He laid it on the nest and sat on the egg. While incubating, he devoted considerable time to arranging the materials of the nest. Meanwhile, a Bananaquit (*Coereba flaveola*) was carrying off the straws from the unfinished nest two feet away. The male dove sat until after 9:00 a.m., when I ended my three-hour vigil. Returning at 1:35 p.m., I found the female on the nest. She was still there at 2:05, but at 3:20 the male was again sitting.

Hence at the nest on the pineapple plant, the male dove took at least two turns at covering the egg in a single day, and at the nest in the annatto the male took three turns, in each case with intervening sessions by the female. This is, of course, in marked con-

trast to the single long daily session that the male takes after the set of two eggs is complete. After incubation has continued for a few days, one never finds the male sitting as early as six o'clock in the morning, nor with rare exceptions does one find the female on the nest during the early afternoon.

Incubation of the full set.—The pattern of incubation of the Ruddy Ground Dove is similar to that of other members of the pigeon family. The male and female replace each other on the nest only twice each day. The female sits on the eggs in the afternoon and remains until her mate relieves her the next morning. He is then in sole charge through the middle of the day, until the female returns in the afternoon. Each member of the pair sits continuously until replaced by the other; if one should interrupt its long session, whether spontaneously or because disturbed, it normally returns to the nest in a few minutes. Thus the eggs are rarely left uncovered unless the doves are subjected to much interference from humans or animals. The hour when change of occupancy takes place varies somewhat from nest to nest, and even at the same nest from day to day; but as a rule the male is to be found covering the eggs from somewhat before mid-morning until about mid-afternoon whereas the female incubates from the late afternoon through the night, and into the early forenoon.

In the course of incubation, I maintained no continuous watch of the nest in the pineapple plant beside the house, but I looked at it frequently to learn which sex was in charge of the eggs. The latest hour of the morning at which I found the female on the nest was 7:55 a.m.; the earliest at which I saw the male there was 8:05 a.m. In the afternoon, the latest record of the presence of the male was 3:00 p.m.; the earliest record for the return of his mate was 2:50 p.m. Hence the male covered the eggs approximately from 8:00 a.m. to 3:00 p.m., or a period of about seven hours each day, during which time I never failed to find him at his post.

For the nest in the annatto tree, which presumably belonged to the same pair of doves, I have a large number of observations, because this nest could be watched from the porch, where the birds seemed indifferent to my presence. Here the latest hour at which I found the female incubating the two eggs in the morning was 8:40 a.m.; the earliest time at which the male was present was 8:27 a.m. The shift of occupancy occurred with fair regularity some time between 8:15 and 8:45 a.m.; one morning I witnessed this change at 8:34. In the afternoon, the earliest record for the return of the female was 2:45 p.m., but this occurred on the day when the second egg was laid. Thereafter, I did not see the female on the nest before 3:15 p.m.; on an afternoon with no heavy showers, she was usually to be found covering the eggs by 3:30 p.m. One afternoon toward the end of the period of incubation, I watched the female relieve her mate at 3:22 p.m. However, on afternoons of hard, long-continued rains, which were frequent at this season, she would sometimes come very late. Once she did not return until 4:13, and on another wet afternoon not until 5:01. In each instance the male sat faithfully, if impatiently toward the end, until relieved of duty. At most he would absent himself for a minute or two, probably to avoid soiling the nest, and from time to time while sitting he would call his tardy partner with soft *coo's*. At this nest, too, the male incubated normally for about seven hours a day, but on wet afternoons his period of duty might be prolonged to eight or even nine hours. Less methodical observations at other nests of Ruddy Ground Doves in southern Costa Rica have shown that this pair was fairly typical in the division of time on the nest during incubation. In only one instance, after the set of eggs was complete, have I found a female on the nest as late as 9:35 a.m.

But on July 21, 1935, at Colomba, Guatemala, I spent an entire day watching, from a blind, a nest where incubation had been in progress for at least six days. There I found a very different schedule. The female spent the night on the nest and sat continuously

through the morning, except for one brief, spontaneous absence of two minutes' duration, from 11:03 to 11:05 a.m., when possibly she went to drink. She did not leave until she heard her mate approaching at 12:38 p.m. As the morning wore on, and the male did not come to relieve her at the conventional hour, she called softly over and over, *kitty woo, kitty woo*, and once received an answer from the distance; but this exchange of greetings did not lead to her prompt release from incubation. The male went on the nest at 12:43 p.m. and sat continuously for two minutes less than five hours. Like his mate, he frequently closed his eyes for a moment while sitting. Silent at first, at half-past five he grew impatient over his mate's continued absence and began to coo in a voice somewhat fuller than hers. At 5:41 p.m. the female came back for the night, and the male flew off. In this instance, the female's arrival was not delayed by inclement weather, for the afternoon was fair; apparently she returned late merely because she had left late.

On subsequent days, I found the male dove on this nest earlier in the morning, at 11:00 a.m. on July 22 and 9:10 on July 23; but on July 24 the female was still on the nest at 9:10, although the male did come by 10:00. Apparently between 9:00 and 9:30 was his usual time for coming to the nest during the last few days of incubation. The female, having been relieved late in the morning, commonly kept her mate sitting far into the afternoon; 4:35 p.m. was the earliest hour at which I found her present; and twice more I found the male covering the eggs as late as 5:15 p.m. His daily session, roughly from 9:00 a.m. to 5:00 p.m. during the final days of incubation, lasted about eight hours.

In Surinam, Haverschmidt (1953) found that the male Ruddy Ground Dove almost invariably came to the eggs between 10:00 and 11:00 a.m. and sat until the female returned between 3:00 and 4:00 p.m. Sometimes the incubating bird was so reluctant to leave that the incoming partner had to push it from the eggs.

When approaching or leaving the nest, Ruddy Ground Doves do not fly directly to or from it, in the manner of hummingbirds and other very small birds with well-made nests and minute control of their flight. On the contrary, when coming to the nest they usually alight on a branch a foot or more away and walk to it. Similarly, when leaving they carefully step from the nest and walk out along the supporting limb before taking wing. In this fashion they are less likely to knock or shake the eggs from the shallow nest. It is only when suddenly alarmed that they fly directly from the eggs.

Far less careful of the sanitation of the nest than most birds, the doves sometimes soil the structure with their own excrements while they incubate, a not unnatural result of their very long periods of uninterrupted sitting. However, at times they appear to leave the nest for the purpose of voiding their droppings at a distance; their absence of a minute or two is hardly long enough to allow them to forage for food, although there might be sufficient time for them to drink water.

Adding to the nest.—On rare occasions I have seen doves make small additions to their nests after they had incubated for a number of days. At a nest built in my garden in 1942, I found the female bringing material to it only three days before the eggs hatched. Between 9:30 and 10:00 a.m., while her mate incubated, she brought at least seven pieces and placed them on the rim beside him. She walked over the lawn, bobbing her head in typical columbine fashion, and plucked at dry straws and fallen twigs until she found one loose and light enough to be moved. This she picked up and carried to the nest. She also brought the fibrous remains of a half-decayed leaf. Similarly, I once watched a female Blue Ground Dove take a number of twigs to the nest, between 9:00 and 9:15 in the morning, while her mate incubated the two eggs. This activity of the females in carrying material to the nest during the course of incubation is the more sur-

prising in view of the fact that when the nest was originally built I noted only the male of these two species taking material to it, while the female sat on the growing structure to receive and arrange the contributions. In the Ruddy Quail-Dove (*Oreopeleia montana*) both sexes often bring a leaf or twig when returning to the nest to incubate, but I have not seen them make special trips to add to their slight nests after the eggs are laid (Skutch, 1949:6).

Distraction display.—While incubating, the male Ruddy Ground Dove is as a rule more steadfast than his mate and will at times remain at his post in the face of an approaching man and suffer himself to be all but touched. At times, however, the female is almost equally staunch. The female studied by Haverschmidt (1953) in Surinam stayed on her nest while he removed the nestlings from beneath her for weighing, but none in my experience has been so brave.

I have rarely seen the Ruddy Ground Dove give a distraction display, probably because in the low thickets where they so often build their nests the vegetation is too dense to permit "injury-feigning." Even on plantations the ground is covered in most places with weeds too tall to allow the doves to perform in a convincing manner. At times, when disturbed, the dove will leave the eggs and drop toward the ground as though to alight, but on seeing the dense herbage it decides otherwise and skims off over the tops of the grasses and weeds. But one time in January, while I stood in a scrubby pasture near Cali, Colombia, a little before midday, a ground dove suddenly burst from a compact, spiny *Xanthoxylum* bush about twelve feet from me. He dropped to the ground and walked slowly away in a halting, wavering fashion, with raised, quivering wings that appeared to be painful and useless. I followed deliberately, and he continued to drag himself away in an unsteady course until out of sight among the bushes. Returning then to the thorny shrub, I found his nest with two eggs.

One morning in Costa Rica I found a male Ruddy Ground Dove brooding two newly hatched nestlings in a nest situated in a thicket ten feet above the ground. He sat most steadfastly, but when I raised my mirror to the level of the nest he jumped off and dropped to the ground in the midst of the thicket. Here he stayed for about a minute, flapping his wings violently and making loud sounds as they struck against the surrounding vegetation. The foliage between us was so dense that I could see little of him, but the noise he made was sufficient evidence of what he was doing. It was the best demonstration that he could make amid such tangled vegetation, and considering his handicaps he did very well.

Incubation period.—I have determined the length of incubation at four nests. At two nests, each containing two eggs, the incubation period was 12 days or a little less, counting from the laying to the hatching of the last egg. At two other nests it was 13 days. In four of my nests, both eggs hatched on the same day; in two, on consecutive days. In Surinam, Haverschmidt (1953) found the incubation period of this dove to be 12 days at one nest and 13 days at two other nests. He determined the incubation period of the related *Columbigallina minuta* to be 13 days in one instance. The eggs of these small doves of open country and secondary vegetation require a day or two more of incubation than those of the larger Ruddy Quail-Dove of the heavy forest. However, they hatch in considerably less time than those of many of the pigeons of northern lands (Skutch, 1949:7).

CARE OF THE NESTLINGS

The newly hatched Ruddy Ground Doves have pink skins with a sparse, buffy, hair-like down, and their eyes are tightly closed. The shells from which they escape promptly disappear from the nest, but whether eaten by the parents or carried off I have not learned.

It is not easy to find a nest conveniently situated for a study of the mode of feeding the young. Of those I have noted in recent years, the most favorable was the one found among the pineapple plants beside our house. By placing a stool atop a box inside the blind, I could look down on this nest from close at hand. But even with this advantage my post was not wholly satisfactory, for much of the time the parents sat with their tails toward me and I could not see plainly when they fed the nestlings. I devoted a total of about 29 hours to watching this nest from the blind, but my study was prematurely terminated by the disappearance of the nestlings when they were eight days old. In most small birds, a fairly satisfactory picture of the way the young are attended can be obtained by watching the nest for sample periods of a few hours' duration. But because of the peculiar manner of feeding the nestlings in the pigeon family, one may watch for hours without witnessing the transfer of food. No trustworthy deductions as to the times of feeding can be drawn from observing the times of the parents' return to the nest; this is especially true when the young are only a few days old. To learn in detail how the nestlings are fed, continuous all-day vigils are necessary. Thus it would be desirable to have two observers who could replace each other at intervals. A thorough study of the nest life of a wild pigeon would demand many hours of patient watching, but it should yield information of great interest.

One day old.—At daybreak on April 19, 1943, the day after the two nestlings hatched, I began to watch the doves' nest among the pineapple plants and continued until 3:40 p.m. I was seated in the blind continuously except for brief interludes at meal-times, when I watched from the window of the dining-room. From the latter viewpoint, I could not actually see the nest, which was screened from my view by the foliage, but I could see whether a parent came to it or left. The female dove was covering the nestlings at dawn and continued to sit quietly through the early hours of the morning. Once a nestling pushed its head from beneath her breast. At 7:31 a.m. the male flew down into the clump of pineapples near the nest. The female rose, cooed softly, and lifted and vibrated her wings. As the male approached the nest walking down the long pineapple leaf on whose base the nest rested, the female backed to the farther rim of the structure. There she had difficulty in taking off, for the spiny pineapple leaves clustering around did not leave space for her to spread her wings. Finally she hopped upon a fallen stick which gave her a slight elevation and thence gained the air. The male per-versely settled on the nest with his tail toward me.

Ten minutes after his return to the nest, the male dove bent down and appeared to feed the nestlings, but since his head was concealed from me by his body, I could not be sure of this. Three minutes later he appeared to feed again. He was continually trembling and panting as he sat on the nest, although the sun was still low in the east and the air cool. Between 8:00 and 8:33 a.m. he fed the nestlings three times—I could see this action more clearly. Then followed an hour and a half of quiescent brooding. At 10:04 and 10:14 he seemed to deliver more food, but again his head was invisible to me. But at 10:28 he turned sideways, and I saw him feed both nestlings several times, alternately, in brief installments spread over a period of four minutes. Taking the nestlings' bills into his own mouth, one at a time, he regurgitated the "pigeon's milk" from his crop, a process which appeared to require considerable muscular effort and was accompanied by jerky movements of his body which gave the little ones' heads a good shaking. Other brief feedings followed at 10:35 and 10:54, and again between 11:07 and 11:19 he spent much time giving food to the nestlings, devoting five minutes to intermittent regurgitation for the benefit of a single one. From 12:20 p.m. to 12:56 p.m. there were many more feedings, one nestling receiving nourishment intermittently over a period of ten minutes.

At 1:00 p.m. the male dove left the nest for the first time since his arrival five and one-half hours earlier. He flew toward the neighboring creek and returned from the same direction only four minutes later. Doubtless he had gone to drink, for through much of the morning he had been sitting in the hot sunshine and had panted a great deal, and also he had given much liquid nourishment to the nestlings. Although he had scarcely been gone from the nest long enough to find food, eight minutes after his return he rose up and gently seized the tips of the nestlings' bills, alternately. Finally he induced one to stretch up its head and take a little food; but the young seemed not to be hungry now and lay quietly in the nest. At 1:42 p.m. he started to call *kitty woo* in a low voice, and during the next three-quarters of an hour he cooed many times over. He was becoming restless now and often shifted his position in the nest. From time to time he gave still more food to the nestlings, once billing one of them until it responded by rising up to take nourishment. Then at 2:26 he walked out along the pineapple leaf and flew away, but after 20 minutes he returned and resumed brooding, calling again and again while he sat. Finally, at 3:15, the female arrived and he went off. She dropped down among the spiny leaves at a point about a foot from the nest and seemed to have difficulty in passing through them to reach the nestlings. It was 3:33 before she got to the young and began to brood. She had not offered them food by 3:40, when I was obliged to terminate my long vigil.

Thus on the nestlings' second day of life outside the shell they were constantly attended save for two short absences of the male, totalling only 24 minutes, and the interval between the female's return to the pineapple patch and her delayed arrival at the nest. The parents divided the care of the nest between them much as in the days when they were incubating, except that now the male arrived about half an hour earlier in the morning than I had ever seen him at the nest during incubation, and, in the afternoon, the female came somewhat later than had been her custom. The male dove appeared to be chiefly responsible for feeding the nestlings. He seemed to have an inexhaustible supply of nourishment in his crop, and he continued to pass it to the nestlings at intervals through most of his long stay of nearly eight hours on the nest. He last regurgitated food to them at 2:10 p.m.

Two days old.—The following day, April 20, I watched from the blind so as to record events at the nest during those hours I had missed on the preceding day, including the brief interval when I had watched through the window as I sat at breakfast and could not see in detail what had happened. The female was brooding the nestlings at daybreak. At 5:39 a.m. one of them pushed out from beneath her breast and stretched up in front of her. She fed it for four minutes, then dropped its bill and grasped that of the other, which meanwhile had emerged from the other side of her breast. She regurgitated to this second nestling for only two minutes, then both retired beneath their mother's warm feathers. Thus, unlike the great majority of birds, she was able to feed her nestlings in the morning before she herself had eaten. During the remainder of the morning and the early afternoon I made only occasional visits to the nest, finding the male present at 9:00 a.m., noon, and 1:30 p.m., but the young were unattended from 1:45 to 2:30 p.m. At the latter hour, when a storm was threatening, I entered the blind. At 2:45 the female flew twice by the nest, alighting each time in another part of the clump of pineapple plants. I cannot explain why she did not go directly to the nest. At 2:55 a light shower fell. At 3:10 the male returned to the nest, walking down the pineapple leaf as usual. He stood above the nestlings, twitching up his left wing, and while he delayed in this position his mate arrived. For about two minutes the pair faced each other across the nest, bobbing their heads and twitching their wings, which I later learned was their usual practice when they met at or close to the nest. Then the female

pushed herself over the nestlings and the male flew away. While she brooded, a small brown grasshopper walked over the nest's rim. She paid no attention until it crept up on her breast, when she gave it a sharp peck that made it hop away. I continued to watch until it grew so dark that I could hardly distinguish the dove on her nest, but I did not see her feed the nestlings once after her return.

Four days old.—Each day the male dove came to the nest a little earlier in the morning. On April 19, the day after the nestlings hatched, he arrived at 7:31 a.m.; on April 21, he came at 7:03; on April 22, at 6:50. On this last date the female had departed from her earlier practice of remaining on the nest until he replaced her and was absent when I entered the blind at 6:35 a.m. Arriving at 6:50, the male alighted far out on the pineapple leaf and walked slowly along it to the rim of the nest, where he stopped and cooed softly. The nestlings now had open eyes and reached up for food almost as soon as their father reached them. Formerly the young doves had been fed one at a time; but now that they could see, both tried to put their bills into their parent's mouth at once, one on each side, and they were sometimes successful in this endeavor. The process of regurgitating food to the nestlings continued intermittently for about 12 minutes and was accompanied by fairly violent jerking movements of the parent's body. Then, after a ten minutes' rest, he resumed feeding, this time taking the nestlings' mouths alternately into his own and continuing feeding in this way for five minutes. Then there was an eight minutes' rest followed by five minutes more of regurgitation. The male dove did not tremble as he had done on previous mornings. Next followed a long rest, from 7:30 to 8:56 a.m., at the end of which time he fed the young intermittently for 17 minutes. At 10:08 he again gave food to a nestling, but for only a few seconds. Although I continued to watch until 11:30, the youngsters received no more nourishment. From time to time they would rise up in front of the male, silently importuning to be fed; then he would sometimes take the bill of one into his own, only to drop it at once, without giving anything. Three mornings earlier, the male dove had regurgitated food to the nestlings whenever one of them had lifted its sightless black head and bobbed about, and he had even coaxed them to eat when they showed no inclination to do so, continuing his feedings until 2:10 p.m. The preceding day he had fed freely until at least 11:14 a.m. But now he had practically exhausted the contents of his crop by 9:13 a.m., after which he delivered only one very skimpy meal at 10:08. As the nestlings grew older, they evidently drained the "cup" more quickly.

The male dove sat continuously from 6:50 to 11:30 a.m., except for a nine minutes' absence from 11:09 to 11:18, when he had flown off toward the creek, evidently for water. While this male covered the nestlings, another male Ruddy Ground Dove cooed persistently in a guava tree about a hundred feet away and was repeatedly answered by the one on the nest. When the sun shone brightly, the parent stood over the nestlings to shade them rather than brood. Although the parents devoted much time to their family, they were somewhat inconsistent in the care of the young. When only three days old, the young doves, practically naked, were left uncovered in a hard shower which began soon after midday. Also the parents at times carelessly stepped on the young when going on or off the nest, but this apparently caused the little ones no harm.

Seven days old.—At 12:30 p.m. on April 25, I began my last long vigil at this doves' nest. The nestlings, now a week old, were alert and active, and their feathers were beginning to break from the sheaths on the back and wings. The young were alone when I arrived at 12:30 p.m. and continued so for the next hour, despite a sprinkling of rain. At 1:25 p.m. the male returned, cooed in a low voice while perching at the top of an arching pineapple leaf, then approached the nest by walking down the leaf that supported it. The youngsters appeared to take no notice of him until he stepped on them,

when they rose up and placed their bills in his mouth for a feeding. For about five minutes he continued to regurgitate food, at times to one alone, at times to both together. The meal over, he crossed to the other side of the nest and faced east, stepping many times on the nestlings, who appeared not to mind this rough treatment. He stood on the edge of the nest, facing me, one of the young doves mostly beneath him, the other mostly outside him, with only its head beneath the paternal breast. After a while the youngsters stretched their wings and preened. Then one took exercise, beating its wings.

At 2:03 p.m. the female replaced her mate on the nest. This was, with a single exception, the earliest hour of the afternoon at which I had seen her there. On April 19 she had returned at 3:15; on April 20, at 3:10; on April 21, at about 2:25; on April 22 she had returned by 1:23; on April 24 she was present at 2:15. She had been coming back to the nest a little earlier each afternoon, if we omit her exceptionally early return on April 22. Now, on April 25, she came at 2:03 and soon after her arrival fed the nestlings, first one alone, then both together, on opposite sides of her mouth, then one alone. The transfer of food lasted four minutes, and when it was over she cooed softly. The youngsters continued to be active, preening and stretching their wings, and from time to time the female gave them gentle pecks. She stayed at the nest only 41 minutes. When the nestlings were two days old, it will be recalled, she covered them continuously from her return in mid-afternoon until nightfall; but when they were four days old she had gone off after a spell of brooding in the early afternoon.

After the female's departure at 2:44 p.m. on April 25, the week-old doves remained unattended until their father returned to the pineapple clump at 3:12. At that time he lingered on the leaf a yard from the nest, not going to feed the nestlings until 3:25. The afternoon then became darkly clouded and cooler, and after a meal which lasted four minutes the male settled down to brood. The female returned at 3:50 and rested on a pineapple leaf near the nest, but her mate made no move to relinquish the young to her care, and after a minute or two she went off. Soon a light rain began to fall. After an absence of a half-hour, the female reappeared, perched in a neighboring annatto tree, and exchanged soft coos with her mate on the nest. After a quarter of an hour more, she proceeded to the pineapple clump. The male seemed reluctant to go, but finally made way for her, and they passed each other on the leaf that formed the pathway to the nest. At 4:37 p.m. she settled down to brood without giving another meal to the youngsters, who seemed not to be hungry. As darkness fell I stole away, leaving her quietly covering her nestlings. At daybreak I returned to the blind, but the slowly growing light revealed that the nest was empty! The female had escaped, for later in the morning I saw her with her mate near the empty nest.

Resumé of observations at the nest on the pineapple plant.—When the nestlings were a day or two old they were brooded almost constantly, the parents occupying the nest according to much the same schedule they had followed during the period of incubation. The male covered the nest most of the day and was the chief provider of nourishment. When he arrived at about 7:30 in the morning he brought a seemingly inexhaustible supply of "pigeons' milk," which he regurgitated into the mouths of the nestlings at short intervals through the morning and early afternoon. He was not obliged to go off and hunt food in order to replenish his supply, and his short absences from the nest, lasting only a few minutes, were apparently for the purpose of quenching his thirst. After her return in the middle of the afternoon, the female did not feed the nestlings; but next morning, before taking food herself, she was able to regurgitate a small amount of food to the young.

As the nestlings grew older, the male came to the nest earlier in the morning. He appeared to give the young doves a greater amount of food at one time, and he exhausted

the contents of his crop earlier each succeeding day, so that he was no longer able to respond to their subsequent requests for nourishment. While the youngsters were still blind he fed them singly; but after their eyes opened, when they were three or four days old, they could see to place their bills in the parent's mouth and were often fed simultaneously. Each day the male would remain away from the nest for a longer period in the early afternoon. Even on their third day the naked nestlings were left exposed to a shower that began soon after noon. The female dove returned to the nest progressively earlier each afternoon, and when the nestlings were a week old fed them at this time. When the nestlings were four days old, the male began the habit of returning to replace his mate about the middle of the afternoon, now taking two turns on the nest each day, whereas formerly he had not returned after his mate had once replaced him in the afternoon. He now fed the nestlings, brooded them for an hour more or less, then was relieved by the female, who without again feeding the nestlings stayed with them until nightfall. When the young were a week old, the parents came to the nest twice as often as when the young were newly hatched, yet at the same time they gave them far fewer meals, apparently because each meal was more liberal and the contents of the crop more quickly exhausted.

In Surinam, Haverschmidt found young Ruddy Ground Doves invariably attended by one of the parents during the daytime until a day or two before they were ready to fly. In contrast to this more constant brooding or guarding, his observations showed less frequent feeding than at my nests in Costa Rica. In reducing the number of feedings as the nestlings grew older, my Ruddy Ground Doves resembled the Blue Ground Dove and the Ruddy Quail-Dove (see Skutch, 1949:14-15).

DEVELOPMENT AND DEPARTURE OF THE NESTLINGS

From nests that were successful, we are able to trace the development of the young Ruddy Ground Doves from hatching until their departure. Upon hatching the young are, as we have seen, pink, blind, and thinly covered with buff-colored, hair-like down, which does not cover their nakedness. The skin rapidly darkens, and when two or three days old they are nearly black. At the age of three or four days their eyes are open. The pin-feathers now grow out rapidly and are long and conspicuous on the five-day-old nestlings. The little doves now peep softly. At the age of eight days they are nearly clothed with feathers which have meanwhile shed their sheaths. A day later, the nestlings' bodies are well covered, although their heads are still bristly with unopened pin-feathers, each terminated by a little tuft of buffy bristles. The young birds can now fly a little and will leave the nest if frightened, although if undisturbed they linger from three to five days longer. A dove, which fluttered prematurely from the nest, held its wings raised above its back in a defensive attitude when I attempted to pick it from the ground.

The nest, which is sometimes lightly soiled by the parent doves during incubation, becomes increasingly dirty after the eggs hatch, for the parents make no effort to preserve the structure in a sanitary condition. Before the nestlings take wing, the nest is heavily laden with their dried droppings. In the matter of the sanitation of the nest, there are great differences among the species of pigeons. Although the Ruddy Ground Dove and the Blue Ground Dove permit their nests to become filthy, the White-tipped Dove and the Ruddy Quail-Dove keep their nests scrupulously clean until the nestlings depart. The Scaled Pigeon and the Red-billed Pigeon do so at least until the young are feathered.

The parent Ruddy Ground Doves spend considerable time on the nest with the young even when these are 12 days old and have for several days been well covered with feath-

ers. But, as when the nestlings are younger, they are not consistent in their attention. Although they often cover the youngsters in fair weather when this seems superfluous, they may leave them exposed to heavy rain. The female broods the young through the night until they are 12 or 13 days of age. When sleeping on the nest, she does not turn her head back and bury it in the plumage of a shoulder but lets it droop forward until her bill touches the fluffed out feathers of her breast; this I noted repeatedly on my nocturnal visits. When 11 days old, the young dove may hop from the nest and perch a few inches away from it, returning later to be brooded.

On visiting a nest in an orange tree early one morning, I found the male dove brooding two fledglings 12 days old. As he flew off, one of the youngsters followed, flying easily to a tree about 25 feet distant. When I lifted up a mirror to see whether the other young dove remained on the nest, it flew to perch on a neighboring thorn, then back to the rim of the nest. At noon this nest was empty. The fledglings were in neighboring trees, and although able to fly well, they found difficulty in alighting, sometimes missing the intended perch and fluttering down to the grass. That evening both returned to their heavily soiled nest to be brooded by their mother. When I visited the orange tree on the following evening, both young doves flew out. Apparently they were returning, after two days of activity among the surrounding trees, to sleep once more upon the nest. So far as I could learn, without making another disturbing visit to this nest, they did not again return that evening; but their mother flew from the nest when I visited it before sunrise next morning. At another nest, a single nestling, which likewise had left the nest at the age of 12 days, failed to return for an additional night's brooding. From a third nest, two young doves departed at the age of 14 days. Haverschmidt found the nestling period of this species to be 11 to 12 days in Surinam. Although the nestling period of the Ruddy Ground Dove is substantially longer than the eight or ten days of the Ruddy Quail-Dove, it is very much less than the three or four weeks or even more of some northern species of *Columba*.

Doves are sometimes reported to be less flexible and adaptable than songbirds, but this is not always true. One day, during the course of pruning a banana plantation in Panamá, a plant bearing a bunch of green fruit was cut down before it was discovered that it supported a Ruddy Ground Dove's nest with two small nestlings. Fortunately, in the fall of the stem, the nest was not thrown from the fruit nor the youngsters from the nest. I placed nest and nestlings in a corresponding position on a younger bunch of bananas in the same cluster of stems. Two hours later I had the satisfaction of seeing the female dove brooding her offspring in the new location. I have known songbirds of several species to feed but fail to brood callow nestlings when their situation was changed in a corresponding fashion.

NUMBER OF BROODS

A second brood often follows swiftly after the first. A pair of doves, whose single nestling departed successfully on April 1, had, by April 8, already covered over the old nest with fresh straws, and next day the first egg of a new set had been laid. Another pair, whose two fledglings flew from the nest on March 14, had relined the old structure by April 3, and the following day they had an egg. A pair, whose two nestlings took wing on August 31, were, on September 17, building a new nest a yard distant from the first. However, this nest was never finished, probably because of the lateness of the season. In the nest which Haverschmidt (1953) studied in Surinam, three broods were reared between October 25 and the following February 24.

The breeding season of the Ruddy Ground Dove in Central America covers most of the year. Since the whole breeding cycle is completed in about five weeks, in this long nesting season of eight to ten months there would be time for a single pair to rear six

or seven broods. Nevertheless, I greatly doubt whether any pair actually produces, or even attempts to produce, so many broods in the course of a year. I, personally, have no evidence for more than two broods in the same breeding season. Belcher and Smooker (1936:5) state that in Trinidad this species breeds throughout the year, but most of their nests were found in May and June, and again in December.

SUCCESS IN NESTING

Of the 34 nests that appear in my records, I know the outcome of 21 that were found before the eggs hatched. Nineteen of these were in El General, Costa Rica, and two near Colomba, Guatemala. These 21 nests contained 40 eggs, of which 20 hatched. Of these 20 nestlings, eight young fledged from five nests. Calculated on the basis of eggs, the nesting success was 20 per cent; while on the basis of nests it was 24 per cent. Approximately one-quarter of the nests produced at least one living fledgling. In an area of three and three-quarters acres of shady pasture and lawn surrounding my house, I found, in 1943, seven nests belonging to three or four pairs of doves. In 1949, there were only two nests belonging to two pairs of doves. Of these nine nests, two are known to have been successful, producing at least one fledgling each, and five are known to have failed. In this smaller sample, the nesting success was slightly higher than in the whole number of nests, in which this group is included. Beebe, Hartley and Howes (1917:213) said of the Ruddy Ground Dove in British Guiana that "not more than half the young ever reached maturity."

The only predator I have caught in the act of pillaging a Ruddy Ground Dove's nest is the Fiery-billed Araçari (*Pteroglossus frantzii*), which, late in the afternoon of September 8, 1948, ate the two eggs from a nest in front of our house. The other known causes of loss are: one nestling died in the nest; one egg fell from the nest; and one nest with a single egg was abandoned.

In the area near our dwelling where there were seven nests in 1943 and two nests in 1944, I found only two in the next 11 years, both in 1948. While there is somewhat more shrubbery and shade, and slightly less bare ground, conditions in this area seem much the same as they were in 1943. I cannot explain the decrease in the number of Ruddy Ground Doves in this area, while in other parts of the valley they are still numerous.

SUMMARY

The Ruddy Ground Dove (*Columbigallina talpacoti*) inhabits plantations, pastures, and low second-growth vegetation in the more humid parts of the Central American lowlands, from sea level up to about 3500 feet altitude. This dove forages on the ground, often in small flocks.

Mated birds perch in close contact and bill each other's feathers.

Nesting begins no later than December in Colombia and it starts in January in southern Central America. The shallow but usually compact, open, cup-like nest is placed in bushes and trees from one to 30 feet high, but most often it is from four to eight feet high. Sometimes the old nest of some other bird serves as a foundation. Nests on the ground are not known.

The male takes the initiative in building and the female seems willing to use whatever site he prefers. Following his lead, she sits in the nest site and he brings material, which he lays beside her while standing on her back. She then shuffles the straws into place. When the female is absent, the male himself places and arranges the material he has brought. He gathers this material from the ground and carries only one piece at a time. The nest is finished in two to four days.

The female spends long periods on the nest the day before she begins to lay and

sleeps there through the night preceding the appearance of the first egg, which is laid before sunrise. The second egg is often laid the day after the first but at a later hour, so that the minimum interval between the laying of the two eggs is 25 hours or more. Sometimes two or even more days elapse between the laying of the first and second eggs.

The set nearly always consists of two eggs. Sometimes, however, only one egg is laid, and sets of three eggs have been reported.

In Costa Rica, nests were found in every month of the year except November and December, but eggs are found mostly in March and April. Breeding is chiefly in the wet season.

The first egg is kept almost constantly covered by the doves; at this stage the parents change places on the nest more frequently than they do after the set is complete. Instead of a single daily period of occupancy, the male may take two, three, or possibly more turns at incubating the egg, with intervening sessions by the female.

After the set of eggs is complete, the male normally incubates for one long period lasting about seven hours each day. This extends from somewhat before the middle of the morning to about the middle of the afternoon. The female incubates from mid-afternoon through the night until her mate returns on the following morning. On afternoons of long-continued, heavy rain, one female left her mate sitting until about five o'clock. At a nest in Guatemala, the male sometimes left his mate in charge until past noon, then replaced her and sat until evening. Usually each partner sits continuously until relieved by the other. If the one that is incubating has occasion to leave the nest, it usually returns in a few minutes. The doves sometimes soil their nest while incubating.

Three days before the eggs hatched, one female brought a number of straws to the nest while her mate incubated. Similar behavior has been observed in the Blue Ground Dove.

Incubating or brooding parents sometimes give a distraction display.

The incubation period is from somewhat less than 12 days to about 13 days.

When nestlings are one or two days old, the parents occupy the nest, using much the same schedule as they follow during incubation, except that the male now comes slightly earlier in the morning. He regurgitates food to the young many times over a period of more than six hours, often coaxing them when they are sluggish in responding. The female does not feed the young after her return in the middle of the afternoon, but is able to regurgitate to them the following morning before she leaves the nest. Until their eyes are open, the young are fed singly, but after they can see they often take food simultaneously.

As the days pass, the male parent comes to the nest at an earlier hour in the morning and the female returns earlier in the afternoon. On the seventh day at one nest she came at two o'clock, fed the nestlings, and brooded for only 41 minutes. The male returned in the middle of the afternoon, fed again, and stayed until the female came back for the night. Thus the female intercalated a period on the nest between sessions of the male, an arrangement never observed during incubation of these doves. Although the parents now came to the nest more often than when the young were newly hatched, they fed the young far less often, but seemed to regurgitate more food at each meal.

Although the parents sometimes brood well-feathered young ready to fly, they are most inconsistent and may leave smaller, naked nestlings exposed to rain. The female broods the young at night as long as they stay in the nest.

Unlike some other pigeons, the Ruddy Ground Doves do not clean the nest, which becomes heavily soiled with droppings.

The young are well feathered and can fly a little at the age of nine days, but unless disturbed they stay in the nest until 12 to 14 days of age, when they fly strongly but

have difficulty in alighting. The young may return to the soiled nest to be brooded by their mother for one or two additional nights after they leave the nest.

The old nest is sometimes renovated for a second brood, which follows from 8 to 21 days after the departure of the first brood. It is doubtful whether any single pair breeds throughout the long nesting season of eight to ten months.

Twenty-one nests contained 40 eggs, of which 20 hatched; but of these 20 nestlings only 8 fledged from 5 nests. The toucan *Pteroglossus frantzii* was the only predator seen to rob a nest.

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