

THE AUK

A QUARTERLY JOURNAL OF ORNITHOLOGY

VOL. 71

APRIL, 1954

No. 2

LIFE HISTORY OF THE WHITE-WINGED BECARD

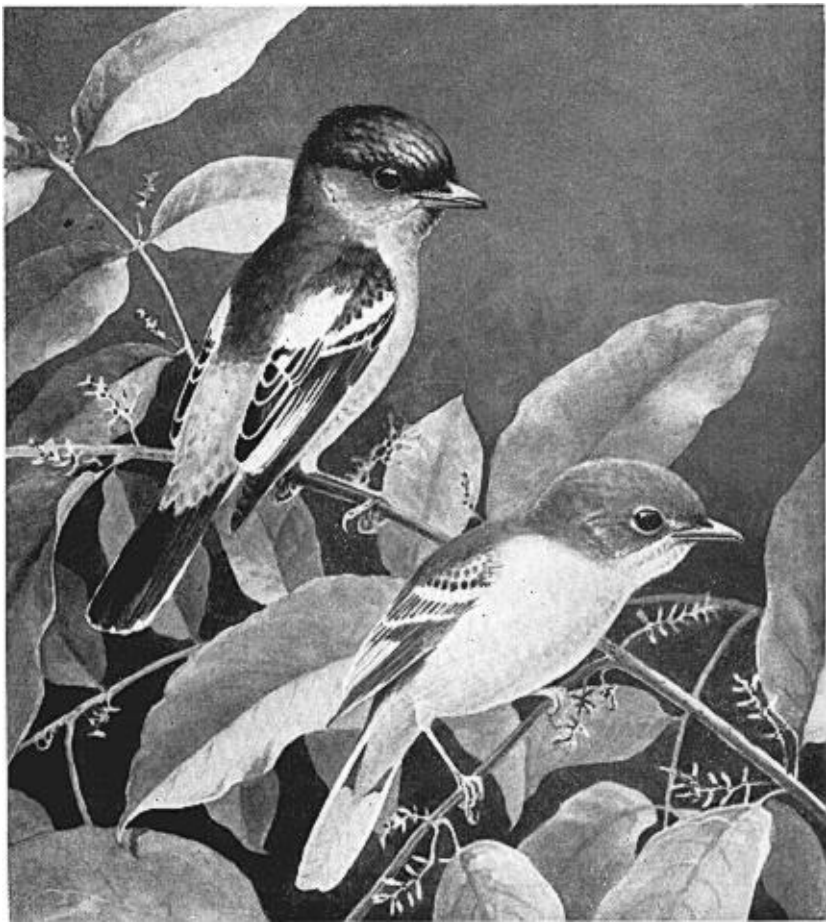
BY ALEXANDER F. SKUTCH

THE White-winged Becard (*Pachyramphus polychopterus*) is one of the smaller and more plainly attired members of the great cotinga family, a most heterogeneous group of passeriform birds related to the American flycatchers and confined to the warmer parts of the Western Hemisphere. Although the cotingas are so characteristic of the bird life of tropical America, very little is known of their nesting. In an earlier paper (Skutch, 1946), I gave an account of the life history of the Costa Rican Tityra (*Tityra semifasciata*), at the same time referring briefly to other studies of the nesting of members of this family. The present paper deals with a cotinga of quite different habits.

APPEARANCE AND HABITS

The White-winged Becard is a small bird hardly larger than a wood warbler, but with a thick-set body and relatively large head. As with many of the cotingas, male and female differ so greatly in appearance that it is not at once evident that they belong to the same species. The male has black upper plumage with gray rump and upper tail-coverts. The top of his head is glossy blue-black. His black wings bear two conspicuous white bands, and many of the remiges have white margins. Along each side of his back there is a prominent white stripe, formed by the outer webs of the scapular feathers. These white markings on the black upper plumage are visible from afar and aid in the recognition of the bird. His tail feathers are black with white tips. The sides of his head and under plumage are dark gray, becoming paler on the abdomen. His bill is blue-gray, tipped with black.

The female, about the same size as the male, is greenish-olive above, sometimes tinged with cinnamon on the back and rump. The feathers of her dusky wings are margined and tipped with yel-



MALE (left) AND FEMALE WHITE-WINGED BECARD (*Pachyramphus polychopterus*) ON A STRUTHANTHUS VINE, FROM A WASH DRAWING BY GEORGE MIKSCH SUTTON.

lowish-buff and dull white. Her rectrices are dusky, tipped with buff. Her under plumage is light olive and pale yellow, her under wing-coverts, pale yellow. Although the colors of her plumage lack brilliance and are difficult to describe, the shades are so delicately blended that she is a very pretty bird.

The species ranges across the tropical American mainland from Guatemala to northern Argentina. There has been some difference of opinion as to how many forms inhabit Central America; but recent authors incline to the view that geographical variation within this area is so slight and inconstant that it is best to recognize only a single race, *P. polychopterus cinereiventris*, the subject of the present study. In Guatemala, where the White-winged Becard is rare, it appears to be confined to the humid lowlands and foothills on the Caribbean side. In Costa Rica it is found on both coasts, although perhaps in greater abundance on the Pacific side, where in the Térraba Valley it is fairly common. Both here and on the Caribbean slope I have found it nesting up to 3000 feet above sea-level but have not at any time met it at higher altitudes. Bangs (1902:40), however, reported it at 4000 feet in the Boquete district of western Panamá.

Like most cotingas, the White-winged Becard lives well up in the trees. I have found it chiefly among scattered trees growing in pastures or rising above low thickets, in the shade trees of coffee plantations, in light and open woodland, and at the edge of the primary forest. Contrary to the experience of Carriker (1910:668), I have never met these becards in small flocks, but always singly or in pairs, sometimes associating loosely with mixed companies of other small birds. I have not been able to assure myself that male and female stay together during the seasons when they do not nest; during these months I have seen the birds singly more often than in pairs. They subsist chiefly upon insects which they capture among the foliage, usually flying up to their prey and, while hovering, snatching it from the leaves—the usual way of cotingas. At a nest which I watched with care, I saw the parents bring only winged insects and larvae, never fruit. But Cherrie (1916:252) reported that in the Orinoco region the food of the White-winged Becard “consists apparently of about equal parts of insects and small fruits.”

For several years a lone male becard roosted in a burío (*Heliocarpus*) tree close beside my house in the valley of El General, Costa Rica. His nightly perch was a slender twig at the very top of the tree, 35 or 40 feet above the ground, where he was screened above by the large, cordate leaves but was often readily visible from below.

VOICE

The White-winged Becard has a variety of utterances, among which are the softest and sweetest notes that I have heard from any bird, although others may surpass it in richness and fullness of tone. One of the most common calls of the male is a rapid sequence of about six soft, dulcet notes, each higher in pitch and weaker than its predecessor. On other occasions, he repeats six or seven times over, more deliberately, and with slight change in pitch, a full, melodious note like that which introduces the ascending series. The female voices similar but weaker notes and, while attending her nest, warbles a soft, liquid, long-drawn murmur.

During the nesting season, the male becard delivers at daybreak a beautiful song which is seldom heard after sunrise. In form this dawn-song resembles the more common song, but it differs subtly in tone-quality. It is composed of an emphasized first syllable followed by a descending series of sweet notes. I fear that I can come no nearer to describing in words this weirdly beautiful utterance. It is a true dawn-song, repeated tirelessly over and over for many minutes at daybreak, but seldom uttered later in the day except in moments of great excitement. Although a great many flycatchers sing dawn-songs, the White-winged Becard is the only member of the cotinga family from which I have heard such a performance.

I heard this dawn-song during many months of each year from 1946 to 1949, when a male becard roosted in the trees near my house. In 1946, I first recorded the dawn-song on April 26 and heard it almost daily until July 4, after which I was absent from the farm for several months. In 1947, he was first heard singing on March 21 and continued his matutinal caroling until September 2—a period of nearly six months. In 1948, he began on March 1 and the following morning sang for many minutes—until after sunrise. That year his period of dawn-singing lasted until the first week in September, slightly more than six months. Although silent on most subsequent mornings, he sang freely at daybreak on several days in late September, on October 8, and on November 1 and 10. In 1945, I had heard a becard sing at daybreak on several mornings in mid-October and on November 11 and 12. In 1949, the regular dawn-singing of the bird by my house again continued until the beginning of September.

In delivering his dawn-song, the becard won my admiration by his endurance no less than by the sweetness of his voice. On the morning of May 24, 1946, he began to sing by moonlight in the top of the burío tree where he slept. From 4:54 to 5:25 he performed on or

near his roost. Then he flew to the edge of the neighboring woods and continued until 5:46. Thus, he sang for 52 minutes. In the ten-minute interval from 5:15 to 5:25, he uttered his verse 83 times. If he sang uniformly at the same rate throughout the 52 minutes, he delivered 432 songs before seeking his breakfast.

On May 27, the becard first sang at 5:03, in the trees beside the house, where he continued until 5:20, when he flew to the edge of the woods. There he sang uninterruptedly until 5:39, when he paused for a minute or two, after which he resumed his dawn-song and carried on until 5:51. Ceasing then the dawn-song, he delivered the day song a few times. From 5:03 to 5:39 he gave 307 songs.

Although as a rule the becard ceases his dawn-singing at about sunrise and through the rest of the day delivers only notes of a somewhat different character, I have through the years accumulated a number of records of "dawn-singing" later in the day. On darkly cloudy or drizzly mornings, the male becard may continue, or resume, the dawn-song after the unseen sun is well above the horizon. On September 27, 1948, a becard sang his dawn-song in bright sunshine—a song most unusual for the hour as well as for the date; probably it was caused by some excitement which escaped me. In early July, 1946, the bird that slept near my house sang the dawn-song as he went to roost on a rainy evening.

In the middle of the afternoon of June 22, 1942, a becard delivered this song at intervals for well over an hour. When after a good deal of searching I caught a glimpse of the songster, I was surprised to find that it wore the pale colors of the female, although possibly it was a young male which had not yet begun to put on adult plumage. At about four o'clock in the afternoon of September 19 of the same year, I heard a becard's song, which continued almost without intermission for the next hour. Going out to investigate, I found a female, or young male, singing tirelessly in an African flame-of-the-forest tree (*Spathodea*) in front of the house. Another song came from the distance, and presently two or possibly three becards appeared in a neighboring *Inga* tree. They chased each other with spirit, singing the dawn-song intermittently; but I saw no actual fighting. In this instance, the delivery of the dawn-song late in the day was definitely associated with emotional stress, apparently resulting either from a territorial dispute or pair-formation. One dark and rainy afternoon in November, I heard a becard in female plumage repeat over and over a shortened version of the dawn-song.

NEST-BUILDING

In the valley of El General, January and February are usually the driest months; showers return in March; then the rainy season continues until the end of the year, abating somewhat in December. In this region, the White-winged Becard may begin to build as early as March 25; but usually it is April before the nest is started. Thus the becard, like the majority of the passerine birds of the valley, breeds in the wet season. The bulky, covered nest with the doorway in the side is placed in the top of a tree standing somewhat apart from others in a pasture or coffee plantation, or rising above lower thickets. Twenty-two nests of which I have records were from 14 to about 60 feet (4.3 to 18 meters) above the ground. Thirteen of these nests were at heights of 25 feet or more; the lowest, only 14 or 15 feet up, were in the rounded, spreading crowns of trees of *Cassia spectabilis* with very dense foliage, or in a heavy tangle of the parasitic vine *Struthanthus*. Because the nests are nearly always situated near the ends of long, slender branches far too weak to support a man's weight, I could reach only two of them. Three of the nests were close to large wasps' nests, possibly chosen for the protection from predatory animals which the insects afforded. Many tropical birds build close to hives of fiercely stinging wasps.

I watched the construction of one nest in the Motagua Valley in Guatemala and about 13 in Costa Rica. The female in each instance built with no help from the male, who, however, attended her as she worked. When beginning her nest, she usually brought long strands of inner bark or other fibrous material and gave each a complete turn around one of the arms of the supporting crotch, thereby assuring a firm attachment. After a good foundation had been accumulated, she built the walls upward and then inward, until the cavity of the nest was completely roofed over. Then she alternately took material inside for the lining and added material to the top to make the roof thicker. Usually females work at a leisurely pace, bringing only 8 to 12 billfuls in an hour; but one becard, building a late nest at the end of June, brought 17 loads of material during the course of an hour, and another came 10 times in half an hour in the early morning. While the female worked, her mate as a rule perched close to the nest, sang from time to time, and did not follow the female on her excursions to gather material, as does the male tityra. He drove away intruders with a loud clacking of his short, thick bill.

A nest found shortly after construction had begun on June 20, 1945, was still not completely roofed over on July 1, for the builder

entered and left from either side. But by July 6 it appeared to be completed, after a little more than two weeks of work.

My first accessible nest was a roughly spherical structure measuring 6 inches in height by 7 inches from front to back (15 by 18 cm.). The round entrance, in the side facing outward from the tree, was 1.5 inches (3.8 cm.) in diameter. This nest was composed chiefly of coarse bast fibers and lined with fibers and narrow strips of monocotyledonous leaves. I was unable to make a more detailed study of the composition of this nest, because it was still occupied by nestlings when I left the vicinity. Ten years later I took down a second accessible nest after the young had flown and I made a more careful analysis of its structure. A top-shaped mass, broadest above and tapering to a rounded bottom, it measured 7 inches in height by 7 to 7.5 inches in diameter (18 by 18 to 19 cm.). The chamber was 3 inches high, 2.5 inches from side to side, 3 inches from front to back (7.6 by 6.4 by 7.6 cm.). The doorway in the side, overhung by the projecting roof, was 1.5 inches high by 1.75 inches wide (3.8 by 4.5 cm.). This nest was composed chiefly of long, more or less shredded skeins of bast fibers, apparently mostly of the burío, a rapidly growing tree with very light wood, abundant on abandoned fields. Some of the pieces of bast fiber had a little outer bark attached to them. Only in the innermost layers of the nest-wall, surrounding the chamber, was other material of importance. Here there were many dead leaves, chiefly monocotyledonous, including bamboo leaves, strips of banana or plantain leaf that were often quite broad, fragments of palm fronds, and grass blades up to 13 inches in length. The very top of the nest was a loose, spreading mass of bast fibers, but beneath this, the body was strongly and compactly built of fibers and dry leaves. On top of all the becard had placed a number of large wing and tail feathers of domestic chickens. Other materials that I have found in fallen, partly destroyed nests or seen in the bills of building females were fibers from the leaf-sheaths of the banana; long, thread-like, dry, pistillate inflorescences of the small tree, *Myriocarpa*; and, in regions where it grows, much "Spanish moss" (*Tillandsia usneoides*).

Two nests of this same race (*P. p. cinereiventris*) are described by Allen (Todd and Carriker, 1922: 327) as very deep, open at the top, 9 to 10 inches in vertical length by 5 and 7 inches, respectively, in diameter. Since the describer did not see these nests in their natural position, I suspect that he mistook the horizontal for the vertical axis and that the doorway faced sideways as in Central American nests of the species. Still, the proportions of these nests from the Santa Marta region of Colombia are quite different from those of Costa

Rican nests. Nests of a related race (*P. p. tristis*) found in Trinidad are described by Belcher and Smooker (1936:811) as vertical and oval; one measured 600 by 280 millimeters.

THE EGGS

In my first accessible nest, the first egg was laid on May 24, 1939, the second on May 26, the third on May 27, and the fourth and last either after 9:30 a. m. on May 28 or on the following day. Hence, the interval between the deposition of successive eggs of the same set may be either one or two days. My second accessible nest contained two eggs when examined on June 11, 1949, and the last of the set of three was laid on the following day. Both of these nests were in the valley of El General, Costa Rica. Richmond (1893:508) found a nest on the Río Escondido in eastern Nicaragua, which on April 14 contained 3 eggs. Jewel (Stone, 1918:269) discovered in the Canal Zone, on June 18, a nest with 3 eggs, 2 of which hatched the same day. In Trinidad, sets of 3 were found by Belcher and Smooker (*loc. cit.*). Todd and Carriker (1922:328) reported a set of 3 from the Santa Marta region on Colombia. Thus in the countries bordering the Caribbean, the set of the White-winged Becard may consist of either 3 or 4 eggs, apparently more often the smaller number.

Only at my first low nest did I risk removing eggs for examination. Extracting them through the narrow doorway of the nest in the tree-top, while I hung precariously supported by one hand, was so delicate an operation that I took out only two for description and measurement. They were pale gray, mottled all over with brown, most heavily in a wreath about the larger end. They measured 20.2 by 15.1 and 19.8 by 14.3 millimeters.

INCUBATION

The eggs are incubated by the female alone. On June 4 and 5, 1937, I devoted a total of nine hours to watching an inaccessible nest in the top of a tall avocado tree. On the afternoon of the first day the female brought fibrous material and a tuft of spider cocoon to the outside of the nest, but the following morning she was taking inside small particles of food. It was evident that the eggs had hatched. During the 9 hours, I timed 20 sessions in the nest; these ranged from 3 to more than 38 minutes. The longest session had been started before I began to watch at 2:30 in the afternoon and was exceptional; the next longest session lasted only 18 minutes. Twenty absences varied from 2 to 36 minutes in length, but both extremes were recorded on June 5 after the eggs hatched. Before the female began to bring

food to the nestlings, the shortest recess that I timed was 11 minutes, the longest 29 minutes. Excluding parts of night sessions contained in my record, the female becard spent a total of 223 minutes in the nest and was away 291 minutes.

Approaching the nest in the tree-top, the female becard would alight upon a bough close by it and turn her big head from side to side, looking carefully about her. Often she flitted from branch to branch while continuing to scrutinize her surroundings. Then she advanced to a twig that passed close in front of her doorway, and from this hopped into the nest. When leaving, she darted through the narrow orifice head first and winged away without pausing in the avocado tree. As she flew overhead, it was easy to see that her tail feathers were all bent to the left from long sitting in the confined space of the nest. This was a permanent curvature, equally prominent when she returned at the end of her outing.

Like the Rose-throated Becard (*Platypsaris aglaiae*) and many other birds which build large or elaborate structures, this female White-winged Becard continued to add material to her nest to the very end of the period of incubation. But her mate, unlike the male Rose-throated Becard, did not share this occupation. This was in keeping with his failure to help his mate during the early period of concentrated building before the eggs were laid.

During the early morning, the male becard was most attentive to his partner. Frequently he perched near the nest while she was within and sang in his dulcet voice or merely preened. At other times he sang in the tops of neighboring trees. At times he seemed to call her forth, then followed as she winged away to search for food. Upon her return he escorted her to the nest. But later in the day he remained for long periods out of sight and hearing. During these long absences, sometimes lasting more than an hour, the female left and returned quite alone.

When her mate's song reached her within the nest, the female becard often replied with a similar song which, however, was much fainter, because her voice, ordinarily weaker than his, was muffled by the thick walls that surrounded her. At other times when she heard him while sitting in the nest, she warbled low, sweet notes. At times, she voiced these soft twitters while perching in front of the doorway, on the point of entering.

The most favorable for study of all my becards' nests was situated near the brow of the high hill behind my house in the valley of El General. Here in the open pasture stood a small tree of the anona family, its crown smothered beneath a great mass of the wiry green

stems of the parasitic *Struthanthus*. The becard had built amid the tangles of this vine, well out from the trunk of the tree, at a height of 14 feet above the steep slope. The nest seemed inaccessible; but the problem of reaching it was finally solved by planting a stout, twelve-foot post, which reached to within two feet of its bottom. When I wished to look into the nest, I set a ladder against the post, to be removed at the termination of the visit. I never drew out the eggs or nestlings but viewed them by inserting a small mirror into the chamber, while it was illuminated by a tiny bulb joined by a wire to an electric torch. While watching the becards, I sat beneath a guava tree on the crest of the ridge, where I had the nest somewhat below eye level, and the green valley of the Río Peña Blanca spread out before me, with the long, forested slopes and craggy summits of the Cordillera de Talamanca rising in the background.

As I passed beneath this nest on the evening of June 9, 1949, the female becard flew out; and the same thing happened the following evening. But the set of three eggs was not completed until June 12. Apparently she slept in the nest during the period of egg-laying. By June 13, if not earlier, diurnal incubation had begun. To study the birds' behavior during the incubation period, I watched from the crest of the hill from 5:30 to 11:24 on the morning of June 20. Since at this season rain falls almost every afternoon, I made my afternoon observations as the weather permitted: from 11:33 to 2:13 on June 21; from 12:53 to 3:44 on June 23; and from 4:12 to 5:40 on June 24. Each of these vigils was terminated by showers which I could see approaching across the valley.

During more than 10 hours of watching, I timed 17 sessions in the nest, ranging from 6 to 38 minutes and averaging 15.2 minutes, and 16 recesses ranging from 8 to 35 minutes and averaging 18.9 minutes. The female was in the nest only 45 per cent of the time. Like other becards she was a poor sitter, apparently depending upon the thick, enclosing walls to retain the heat of the eggs, which sometimes I found partially covered by loose material in her absence. Both her sessions and recesses were longest in the afternoon, and the longest period in the nest of all that I timed came late in the afternoon. Between 8:56 and 11:08 a. m. on June 20, she brought material for the nest on each of her seven returns to resume incubation. Usually she came with a blade of grass or the like, but once it was a feather. One load was deposited on top of the nest, but all the rest were taken inside as she entered to attend her eggs. These additions to the nest involved no special trips, but once she came to lay a chicken feather on the roof, then flew off to continue her recess. In the afternoons I did not see her add anything to her bulky structure.

Upon leaving her eggs, the becard darted swiftly out and away, rarely pausing among the vines that draped in front of her doorway. Only once did she vary this procedure, hopping first to the vines before taking wing. On her return, however, she always alighted in the maze of wiry stems some feet from the nest, paused to look around, then hopped through the tangle to a point nearer her doorway and stopped to look again, and so by degrees advanced until finally she darted up into the round entrance, audibly striking the leaves in front of it.

Although I did not see the male becard go near the nest, he was not inattentive to his mate, at least during the early morning. Often I heard his voice at the time of her return. Once when he sang at the edge of the neighboring high forest, the female, about to enter her nest, sang in response. Once while sitting in the nest, she twittered upon hearing her partner's song float in from the distance. As the morning grew older, he paid less attention to his mate and nest; and in the afternoons, I neither saw nor heard him. In this respect he resembled the male of the pair I had studied twelve years earlier, at a point about ten miles away.

In my first low nest, the last of the 4 eggs was laid between 9:30 a. m. on May 28 and 5 p. m. on May 29. Two nestlings hatched on June 15, and the following day there were 3. One of the eggs failed to hatch. The period of incubation was, then, 18 or 19 days. In the nest in the *Struthanthus*, the last of the 3 eggs was laid between noon on June 11 and 5 p. m. on June 12; and all hatched between the afternoon of June 29 and 3 p. m. on June 30. The period of incubation was about 18 days.

THE NESTLINGS

At the nest in the *Struthanthus*, all the shells had been removed before I saw the nestlings. The newly hatched becards have pink skin quite devoid of the natal down usual on passerine nestlings, and their eyes are tightly closed. When they are a week old, their pin feathers begin to push through the skin and their eyelids start to open. The feathers do not begin to unsheathe until the nestlings are 11 days old, but at 15 days they are fairly well clothed with plumage. They linger in the nest for another week.

On July 2, when the three nestlings in the vine tangle were two days old, I watched their nest for two hours, from 7:08 to 9:08 a. m. The female was brooding when I took my post on the hilltop overlooking the nest, but flew away seven minutes later. At 7:26 the male arrived in the vine tangle with food in his bill, but delayed there while his

mate twice passed him taking food to the nestlings, each time brooding for two or three minutes before going off to hunt again. After 12 minutes, the male had advanced to a point among the vines in front of the doorway, where he delayed half a minute more, then suddenly darted away without having delivered what he had brought. But at 7:41 he returned, clung in the doorway apparently feeding the nestlings, then left. On his third visit with food, the male delayed by the nest for four minutes before taking it to the doorway; and on the fourth visit he procrastinated 11 minutes, while his mate fed and brooded the nestlings. Then on his fifth visit he fed fairly promptly, but when he came the sixth time with food he waited in the vines for nine minutes before taking it to the nestlings. Thus the male becard had started to feed the young not over $2\frac{1}{2}$ days, and possibly no more than $1\frac{1}{2}$ days, after they hatched; but his great hesitancy in going to the doorway suggested that he was just beginning on the morning of July 2 and that this activity was still strange to him. So far as I had seen, he was not, like many male birds, in the habit of making visits of inspection to the well-closed nest during the period of incubation; whence I surmise that he learned of the arrival of the nestlings by seeing his mate carry food.

During the two hours, the male had gone to the doorway and apparently fed the nestlings 5 times; the female, 8 times. After each feeding, she brooded for periods ranging from 2 to 11 minutes—a total of 47 minutes in 2 hours.

On July 8, when the eight-day-old nestlings were in newly sprouting pin-feathers, I watched from 5:30 to 11:00 a. m. When I reached my observation post in the half light, the male was singing below me in the trees by the house. He continued his dawn-song until 5:52, then after an interval of silence sang a little more between 6:05 and 6:07. I did not see the female leave the nest, although without much doubt she had brooded the nearly naked nestlings through the night. She brought the first meal at 6:00, but did not stay to brood either then or at any time during the morning. The male first brought food at 6:20. Now the two parents were taking nearly equal shares in feeding the nestlings, together bringing food 34 times in the 5 hours from 6:00 to 11:00, or at the rate of 2.3 times per nestling per hour. So far as I could distinguish, the nestlings' diet consisted wholly of winged insects and larvae, usually green but sometimes brown in color, and nearly always of substantial size. Once the female brought a big, green, grasshopper-like insect, and I noticed several smaller creatures of the same type. The male now approached the nest with scarcely more hesitation than his mate; but each upon arriving alighted in the

tangle of vines some feet away from it and paused there to look around before advancing to the doorway. To deliver the food, they both clung in the orifice with back outward and somewhat downward, never entering. This position was apparently not easy for them to maintain; for if the food was not promptly taken by the nestlings, the adults dropped down to the vines below the doorway, after a

TABLE 1
RATES OF FEEDING THREE NESTLING WHITE-WINGED BECARDS

Hour <i>a. m.</i>	Eight days old Number of feedings			Sixteen days old Number of feedings		
	By Male	By Female	Total	By Male	By Female	Total
6:00- 7:00	2	2	4	2	3	5
7:00- 8:00	4	5	9	2	4	6
8:00- 9:00	4	2	6	2	1	3
9:00-10:00	1	6	7	1	5	6
10:00-11:00	5	3	8	6	6	12
Totals	16	18	34	13	19	32

pause returned to the entrance, then perhaps after a few seconds there dropped down a second time with food still held in the bill, if necessary repeating this three or four times until the insect vanished. Then they darted rapidly away, sometimes flying only a few feet above the grass as they winged over the crest of the hill, which was above the level of their nest. The female carried off droppings several times and once swallowed one. As I passed below the nest at the conclusion of my watch, I heard a little song coming from the featherless nestlings.

On July 16, when the three nestlings were 16 days old and well feathered, I again watched their nest through the morning. This time the male, after singing his long dawn-song, brought the first morsel at 6:23; the female first brought food a minute later. The number of feedings and the relative parts taken by the two parents were very much the same as eight days earlier, and the nestlings were fed at the rate of 2.1 times per hour for each one. (See table 1.) The greatly accelerated rate after ten o'clock was apparently caused by a change in the weather. The early morning was foggy and almost uncomfortably cool, and I noticed few insects flying. At about ten o'clock the sun began to beat hotly through the clouds; little black, biting flies and sweat bees became troublesomely abundant; and the parent becards brought food much more often. The nestlings soon became full. At 10:34, when their mother came with an insect of only moderate size, she took it to the doorway three times before it

was accepted by a nestling. At all other feedings a single visit to the doorway sufficed to deliver the food, the parent clinging upright at the entrance for a few seconds while passing the object to the nestlings. Again the food consisted largely of green insects, some of them of good size. Almost all the meals were substantial. I noticed no fruit. Twice I saw the female carry off a dropping, and once she swallowed one in the nest-tree. But I did not see the male take a share in cleaning the nest, which he never at any time entered while I was present. The insufficient attention to sanitation explained why the doorway and the ground below were well splashed with white droppings—a usual feature of becard nests at this stage. Once I saw the female drive a little gray Bellicose Elaenia (*Elaenia chiriquensis*) from the nest tree.

From time to time the sixteen-day-old nestlings gave a fair imitation of the day song of their parents, sometimes answering the male, who sang in the distance. When a parent coming with food shook the vine that supported the nest, they set up a chorus of high-pitched notes of a different character. Among non-oscine birds, it is not unusual for the nestlings to give fair, if weak-voiced, imitations of the calls and songs of their elders. Among the true song-birds, with their often more complex songs and generally shorter nestling period, such singing in the nest is very rare.

All three becard nestlings left the nest in the vine tangle between 5 p. m. on July 20 and noon on July 21, at the age of approximately 21 days. All wore at this time a plumage much resembling that of their mother. As they roamed with their parents through the tree-tops, the fledglings repeated constantly, through much of the day, sweet notes and little songs, which often resembled the male's dawn-song and sometimes the day song. These melodious, but somewhat plaintive, sounds floated down from the trees for many minutes together. But the young becards kept themselves so well concealed amidst the foliage and moved so seldom, that I found it most difficult to catch sight of them. After a great deal of scanning of tree-tops, directed by the oft-repeated songs, I finally glimpsed one in the top of a guava tree in front of my house. I last saw the family together on August 5, when they passed through the trees by the house at the day's end. After their first flight, they never returned to sleep in their nest, but roosted amidst the foliage, exposed to the heavy rains of this season.

At several other nests, I saw the male becard help to feed the nestlings, which seems to be his regular practice, although he may be slow in beginning to attend them. Older nestlings may on occasion be

left unfed by both parents for surprisingly long periods. At the end of August, 1944, I devoted two hours of the morning to watching a high, inaccessible nest. The little birds within called much, with soft voices a good deal like those of the parents. From time to time, especially when the wind swayed the tree-top, or some bird alighted near the nest and shook it, they uttered a loud chorus of *cheeps* very different from their other calls. But neither parent came within sight during the two hours. The following day I spent $1\frac{3}{4}$ hours watching this nest, not all in one continuous period, and again failed to see a parent come with food. I thought that the nestlings would surely starve; but next morning their mother brought food to them twice in 45 minutes, and they called less.

These young becards left the nest about September 5. During their last days within they, too, uttered a subdued version of the male's dawn-song. For several days after their departure, I continued to hear this "song" from the trees at the edge of the woodland beside the pasture where the nest was situated. It was difficult to see the fledglings amidst the heavy foliage; but at last I glimpsed one of them, accompanied by both parents. It resembled its mother, except that its yellow bill was far brighter than hers.

LENGTH OF THE NESTING SEASON

This nest, from which the nestlings flew about September 5, is one of the latest included in my records; but two others, built in the same tree in other years, held nestlings during August, one of them as late as August 14. In 1949, I found a nest occupied by well-grown nestlings on September 7. These nests were all in El General in the upper Térraba Valley of Costa Rica, at an elevation of about 2500 feet. The nest which I watched the becard build in the Motagua Valley of Guatemala on July 11, 1932, if successful, would also have sheltered nestlings until about the end of August. Hence the becards' breeding season covers about five months, from April to early September. I do not know how many broods may be reared. Losses of nests are high, and very late ones probably belong to birds which have lost earlier ones.

ENEMIES

The big nests of the White-winged Becard, conspicuously placed in the tree-tops, fall prey to numerous enemies, although doubtless they are above the reach, and escape the notice, of many of the more terrestrial nest-robbers. One of the chief enemies of the becard, at least in southern Costa Rica, is the Parasitic Flycatcher (*Legatus*

leucophaeus), which occupies the nests for its own brood, doubtless capturing them by the same strategy which I have seen it use to dispossess flycatchers of the genus *Myiozetetes* of their bulky, roofed nests; that is, by throwing out the eggs of the builder and rightful owner. I have twice found Parasitic Flycatchers rearing their families in nests built by White-winged Becards, and in other instances have seen the robbers hovering close by with their usual insolence while the becards were building. One nest, about which a pair of the flycatchers loitered as though only waiting for the becard to complete it before claiming it as their own, was occupied by a swarm of small, black melipone bees, which put an end to the dispute between the two kinds of birds. The insects proceeded to close up the nest's doorway with wax or some kindred substance, leaving only a small, spout-like opening for their passage in and out.

I have often found nests of the becard torn apart in the tree-tops where they had been built. This was apparently the work of toucans, probably the big *Ramphastos swainsonii*, an insatiable nest-robber. From its habit of hunting, especially during the nesting season, through the tops of the trees in the clearings not far from the forest, this bird would be more likely than any other predator to destroy the becards' nests. But, although I have watched them despoil nests of other birds, I have never actually seen them pillage one of the becards'.

Like the Rose-throated Becard, the White-winged Becard shows an amazingly strong attachment to its chosen nest-site. Toward the end of March, 1937, a becard began to build in the top of an avocado tree growing in a small coffee plantation. On April 5, I found the nest, still unfinished, lying on the ground. Two days later I noticed another nest, well begun, in the top of a neighboring avocado tree; but the following day this was also pulled out of the tree, by a toucan, I suspect. By May 10, this becard was completing a third nest in the top of still another avocado tree. The two most widely separated of her three nest-sites were only 40 feet apart. For a wide-ranging bird of the tree-tops, not confined by competition for territories to a narrow breeding area, this was unexpected loyalty to a chosen spot. In the third nest she at last hatched her eggs, only to lose her nestlings a few days later.

In four consecutive years there were White-winged Becard's nests in the top of the same tall targuá tree (*Croton draco*) in the pasture in front of my house. The targuá is common in the vicinity, yet this one had a peculiar attraction for the becard, even though most of the nests she started there were unsuccessful. In 1945, she was build-

ing at the beginning of May. During the following days this nest grew smaller instead of larger; and on May 10 the becard started a second nest in a neighboring fork of the same tree-top. By May 14 both nests had quite vanished. Yet a few days later a third structure was begun near the site of the first, but apparently never used for eggs. On July 12, I found the becard working at still another nest in this same tree-top. In this fourth nest she at last succeeded in rearing nestlings, which took wing in early September.

ACKNOWLEDGEMENT

This paper was prepared for publication while the writer held a Fellowship of the John Simon Guggenheim Memorial Foundation of New York.

SUMMARY

The White-winged Becard frequents scattered trees and open woodlands rather than heavy primary forest. It usually remains well above the ground. A lowland bird, it ranges upward to 3000, or in western Panamá 4000, feet above sea-level.

If catches insects by flying up to the foliage and snatching them off without alighting.

Both sexes utter soft notes of great beauty, but the male's voice is stronger. From March to early September, he delivers at daybreak a special dawn-song, repeating a melodious verse hundreds of times with scarcely a break for nearly an hour. Seldom heard after sunrise, this song may be given later in the day if the bird is greatly excited.

In Costa Rica, where most of these observations were made, nesting begins in late March or more commonly in April after the return of the rainy season. The very bulky nest with the doorway in the side is placed in tree-tops from 14 to 60 feet above the ground, nearly always in a position inaccessible to man.

The female builds alone while her mate perches near by, often singing.

The three or sometimes four eggs are incubated by the female alone. She is a restless sitter, apparently depending upon the nest's thick walls to keep the eggs warm. One female, watched for ten hours, was in the nest only 45 per cent of the time. Until the eggs hatch, the female brings much additional material to her bulky nest.

The incubation period at two nests was 18 or 19 days.

The newly hatched nestlings have closed eyes and pink skin quite devoid of down. Pin feathers sprout through the naked skin at the

age of a week; the feathers unsheathe at about 11 days; and the young are covered with plumage at 15 days. Before they can fly they utter good, but weak-voiced, imitations of their parents' songs. They leave the nest at the age of 21 days.

The female alone broods young nestlings; but when they were eight days old no diurnal brooding was observed. Both parents feed the nestlings, the male sometimes beginning a day or two after their hatching, sometimes taking longer to discover them, and eventually sharing the work about equally with his mate. The nestlings are fed winged insects and larvae, but apparently no fruit. When older they are fed at the rate of about 2.2 times per nestling per hour. Some of the droppings are carried off or eaten by the female; but the doorway of the nest, as well as the foliage beneath it, becomes soiled.

Fledglings do not return to sleep in the nest, which is apparently never used as a dormitory.

The nesting season in Costa Rica extends from late March or April to early September, but the number of broods is not known.

Becards' nests are captured and used for breeding by the Parasitic Flycatcher (*Legatus leucophaeus*) and sometimes by melipone bees. Many nests are destroyed, apparently by toucans.

These becards show great attachment to the chosen nest-site, building three or four times in the same tree in one season if earlier nests are destroyed.

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