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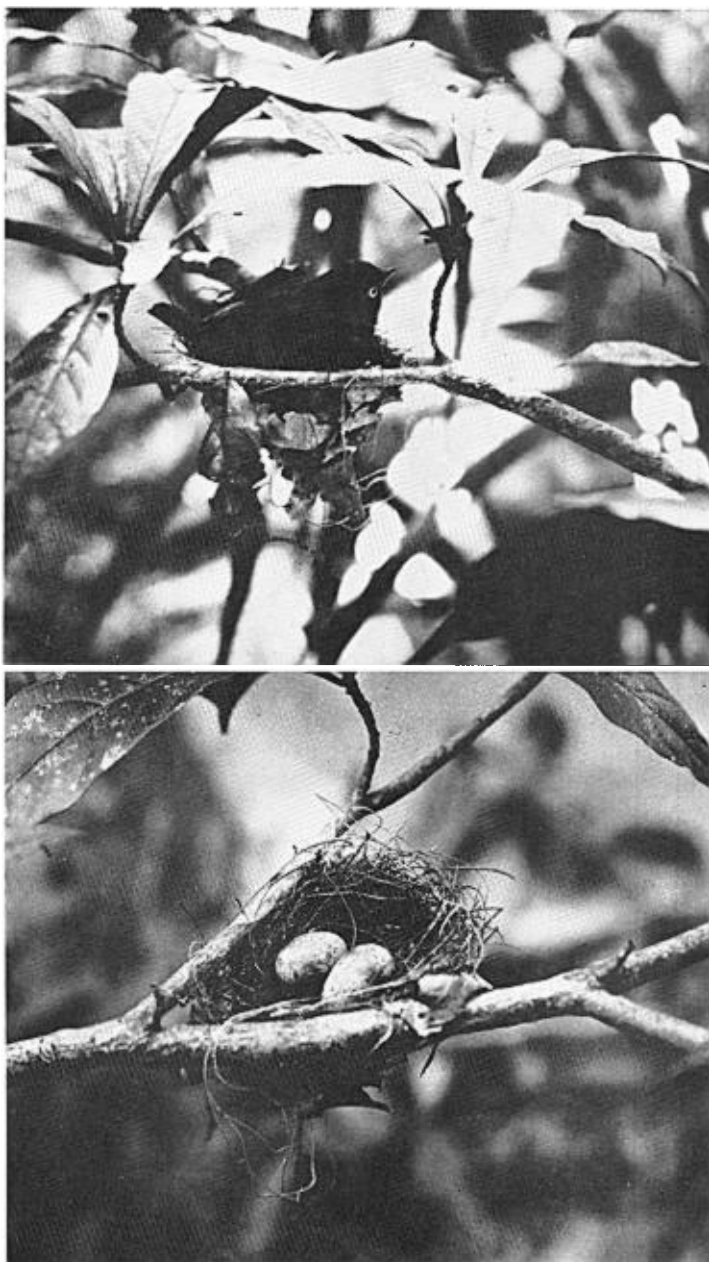
LIFE HISTORY OF THE YELLOW-THIGHED MANAKIN

BY ALEXANDER F. SKUTCH

THE yellow-thighed manakin (*Pipra mentalis*) is one of the smallest, yet one of the most conspicuous of the birds of the Central American lowland forests. Although less than four inches long and clad nearly everywhere in velvety black, the male manakin with his intensely red head and hindneck attracts attention amid the dark underwood of the high forest, where many a bigger but duller bird passes unseen. His bright yellow eyes, yellowish bill, and lemon-yellow thighs add color to his striking attire. His conduct is quite the reverse of retiring; with sharp whistles, loud snapping sounds and brisk movements, he seems to try to draw attention to his flaming head-dress. Throughout the Caribbean lowlands, these manakins appear to be one of the most abundant birds of the forest, although perhaps surpassed in numbers by other birds which, because of more modest attire and secretive habits, seem far more rare.

The female manakin, in her dull olive-green plumage, is also likely to escape detection as she flits through the dim undergrowth of the forest. Although it is quite impossible to confuse the male yellow-thighed manakin with any other Central American bird, the female does not differ greatly in appearance from other small manakins of her sex. She is, however, more olive and less green than the females of Salvin's manakin (*Manacus aurantiacus*), Gould's manakin (*M. vitellinus*) and the blue-capped manakin (*Pipra coronata*), with all of which she mingles in one portion or another of her range. Her feet are dark, not flesh-colored like those of Salvin's and Gould's manakins. Her bill is black except at the base of the lower mandible, where it is horn-color; her eyes are usually brown, rarely yellow as in the male.

The yellow-thighed manakin ranges through the heavy rain-forests on the Caribbean side of the American continent from southern México to Darién. On the Pacific side of the Cordillera it is found in



(Upper) FEMALE YELLOW-THIGHED MANAKIN INCUBATING. BARRO COLORADO ISLAND, MARCH 23, 1935. (Lower) NEST AND EGGS OF YELLOW-THIGHED MANAKIN. BARRO COLORADO ISLAND, MARCH 30, 1935.

the lofty forests of southern Costa Rica, in Panamá, Colombia and northwestern Ecuador. It is absent from the drier forests of the Pacific side of Central America north of Costa Rica. Within its extensive range several geographic races have been distinguished; the present study deals with *minor* of the Canal Zone and *ignifera* of the Térraba Valley of Costa Rica. On the Pacific slope of southern Costa Rica the yellow-thighed manakin is found as high as 3500 feet, where it appears to be resident, but the bird is not abundant above 2500 feet. In the regions where I am familiar with it, this manakin is practically confined to the high forest. At times it may venture for a short distance into adjacent stands of tall second-growth, but it avoids low thickets and cleared lands. Likewise, it seems rarely to ascend into the sun-bathed crowns of the tall forest trees but remains in the shade of the lower half of the forest, probably passing most of its life between five and seventy-five feet above the ground.

FOOD

The yellow-thighed manakin subsists chiefly upon small berries and insects which it plucks from foliage at the end of a rapid dart and without alighting. Not infrequently these manakins join the motley band of birds which forage with the army ants. In the Costa Rican mountain forest I came upon a large and varied aggregation of birds which had congregated about an immense swarm of black army ants. Here were three kinds of antbirds, two species of dendrocincas, the gray-headed tanager, two kinds of flycatchers, a wintering russet-backed thrush, and a number of manakins, the smallest members of all this heterogeneous avian crowd. Among the last-mentioned were several female yellow-thighed manakins and at least one young male, recognized by the traces of red beginning to appear on his crown. There were also a number of female blue-capped manakins, but of neither species was an adult male present. The manakins of both kinds perched amid the undergrowth, above the swarming ants, and made short, swift darts to seize insects that tried to escape the ants by flying, or to pluck off those which crawled up the stems or foliage of saplings. One of the yellow-thighed manakins flew swiftly down to snatch a small lizard from among the ants, then rose with her victim to a low perch, against which she proceeded to beat it. But small as it was, for a lizard, it was too big and heavy for the manakin's small short bill and soon slipped from her grasp. She followed it to the

ground in an attempt to recover it, but the lizard had hidden itself under the dead leaves.

COURTSHIP

The bright colors, the peculiar whistles and mechanical sounds, the bizarre antics, which call attention to the male yellow-thighed manakin and make him the most conspicuous bird of his size—almost of any size—in the forests where he dwells, are significant in relation to his manner of courtship. Like many, perhaps all, other members of the family, the yellow-thighed manakins do not form pairs during the breeding season. The females build their nests, incubate their eggs, and rear their young without help from the males, which during the period of reproduction are to be found day after day in certain definite spots, where they advertise their presence by a variety of devices, and where the females visit them when their developing eggs are ready for fertilization. Male birds of almost all species with similar marital habits depend upon sound, color, or both, to announce their location to the other sex; and for so diminutive a creature as the yellow-thighed manakin it is important that these means of self-advertisement be especially well developed.

Although a number of earlier naturalists and explorers had written briefly about the peculiar 'dances' and other courtship habits of various species of manakins in South and Central America, Chapman (1935) was apparently the first to make a careful study of the habits of any member of this family. In 'The Courtship of Gould's Manakin (*Manacus vitellinus vitellinus*) on Barro Colorado Island, Canal Zone,' he summarized the earlier literature on the courtship habits of manakins, then described how a number of male Gould's manakins gather in one particular locality in the forest, where each clears for himself a small space on the ground, separated by several yards from the similar 'courts' of his neighbors. Each male 'dances' above his own court, snaps his wings and calls, continuing this behavior during a long breeding-season which occupies the greater part of the year. Attracted by these varied sounds produced by the assembled males, the female visits the mating ground but forms no lasting bond with the other sex. In the same paper, Chapman repeats a brief account—which had earlier appeared in 'My Tropical Air Castle' (1929)—of the courtship of a 'Red-capped Manakin', but he made no comprehensive study of this species.

THE DISPLAY PERCH

Like Gould's manakin, the male yellow-thighed manakin selects at the outset of the breeding season a definite post where he will perform

day after day over a period of at least several months. In keeping with the height at which this species forages, rests, and nests in the forest, it does not clear a space on the ground, but chooses a perch well above it. This is typically a straight, slender, more or less horizontal branch, which for a length of several feet is free of foliage and of lateral branchlets and is unobstructed by the surrounding vegetation. The display perch is usually the branch of a small tree, sometimes one of the uppermost boughs. Rarely, a slender vine stretching across a fairly clear space between the trees will be the chosen post of the manakin; but the individuals I have found in such a position were less active in courtship. The chosen branches of nine yellow-thighed manakins which I kept under observation on Barro Colorado Island in 1935, ranged from about 20 to 45 feet above the ground. Most of the boughs on which I have found these manakins displaying in other regions would fall within this range of heights, but one male, which I watched in El General, had selected a display perch about 70 feet up. The horizontal limb where Chapman watched a male perform at the end of December, 1926, was about 15 feet above the ground.

THE COURTSHIP ASSEMBLY

The display perches of the courting males are not scattered at random through the forest, but are gathered into groups or 'courtship assemblies.' I had two of these assemblies under observation on Barro Colorado Island in 1935. The first assembly contained five males. The first bird (A), which was consistently the most active in display, had chosen for his stage a slender horizontal branch near the center of the rounded, open crown of a tree of medium size at a height of about 35 feet above the ground. Two more males (B and b) in adult plumage were usually to be found close together, perching upon vines strung across an open space beneath the forest canopy, about 20 feet south of A and 40 feet above the ground. Two more (C and c) rested much of the time close together in the tops of some slender trees about 40 feet north of A, and about 45 feet up.

The second courtship assembly contained four birds whose display branches were all more widely separated from each other than in the case of the first assembly. The first three manakins occupied positions which formed the corners of a roughly equilateral triangle about 125 feet on a side, as nearly as I could measure distances through the bushy undergrowth between the display trees. The fourth member of this assembly had his display site in a tree about 75 feet from one of the corners of the triangle formed by the first three, amid bushes so dense that it was very difficult to watch this bird.

VOCAL SOUNDS OF THE MALE

Into these exhibitions on the display perches enter so many sounds produced by both voice and mechanical means and so many antics of the most varied sorts, all intermingled in the most changeable sequences, that an account of a complete performance without a preliminary analysis of the elements of which it is composed would likely bewilder the reader. The manakin's outstanding vocalizations are:

1. An exceedingly short, high *psit*.
2. The same note delivered very rapidly but more softly about five times, thus: *psit psit psit psit psit*.
3. The same note given two or three times and followed by a buzzing sound.
4. *Psit psit psit p'tsweeee - - psip*. The final *psip* is not always uttered, but when delivered is sharp and emphatic. This, or the long *p'tsweeee* alone, is perhaps the most characteristic call of the bird—at least, the one most frequently noticed as you walk through the forest. It is uttered at intervals by the males as they sit quietly on their display perches during the hours of the day when they are least active. The whistled *p'tsweeee* is long-drawn, high-pitched and thin.
5. A high, shrill, rather harsh *tseeee* or *eeee*, voiced as he returns to his display perch after a short circling flight, or as he alights upon the back of a female after a similar flight. If one member of an assembly utters this call while his neighbors are resting quietly, it stirs them to renewed vocal and muscular activity.

MECHANICAL SOUNDS

According to Chapman (1935: 473), the male yellow-thighed manakin "possesses marked structural [secondary] sexual characters. Its secondaries are enlarged, curved and stiffened, as in *Manacus*, its rectrices stiffened, its thighs yellow and its tarsi more feathered than in the female." Like other manakins with stiffened wing feathers, the male yellow-thighed manakin uses them to produce loud snapping sounds by rapid movements of his wings, which apparently cause the thick shafts of the plumes to strike noisily together. The snaps somewhat resemble the sound made by breaking a thin but strong dry twig. The wing movements which produce these sounds are so rapid, and the source of the loud mechanical noises so obscure to the casual observer, that some naturalists have hastily inferred that they were made by snapping together the mandibles, or even with the voice.

The snapping sounds may be made singly or in rapid sequence, producing a whirr or a sort of snapping roll. One of the exercises of the male consists in taking short, rapid flights between his display perch and neighboring boughs. When engaged in this display, he customarily delivers a single loud, sharp *snap* each time he leaves the perch. While remaining on his perch, he often produces a short

snapping *whirr* by beating his wings with the utmost rapidity. Indeed, the whole series of wingbeats which accompanies the rapid but brief succession of *saps* is over so soon, that unless I happened to be looking directly at the manakin through my binoculars at the moment he made the noise, I could not be sure that he moved his wings at all. More rarely, while resting quietly on his perch, a manakin will raise his wings and beat out a series of loud *saps* in a more deliberate fashion, the crackling sounds coming more slowly than in the snapping roll and at the same time with greater force. Correspondingly, the wing-beats are more distinct to the eye than when the snapping roll is made, and it is easy to see that the movements of the wings are somehow associated with the production of the sound. Both the single *saps* and the snapping roll of the yellow-thighed manakin are less loud than the corresponding noises of species of *Manacus*.

In addition to these snapping sounds, the male manakins produce various whirring and rustling noises with their wings, either while they fly or by beating their wings while perching. As they approach the display perch in the short circling flight already mentioned, they make a surprisingly loud noise such as may be imitated by holding a piece of stout cloth between both hands and suddenly jerking it taut. At the instant this noise is made there is a momentary break in the bird's flight. After delivering this flourish, the manakin alights upon his display perch or upon the back of the waiting female.

DISPLAY MOVEMENTS OF THE MALE

In their nuptial activities birds of all kinds assume postures which display the most brilliant colors in their plumage. The bright red head of the yellow-thighed manakin is at all times so eye-taking an object that it is hard to imagine anything the bird might do to make it more conspicuous. But the thighs are most of the time less obvious to the beholder, and many of the postures and antics of the courting male seem designed to display these colorful adornments to the best advantage.

1. *The About-face:* The male manakin stands on his display perch with his legs stretched up so that his yellow thighs are plainly revealed. His body is horizontal or even tilted slightly forward. In this posture he about-faces as rapidly as he can. One foot is held on the perch, the other moved from side to side of the stationary foot as the bird pivots back and forth. The changes in the position of the foot are so rapid, however, that without the most careful scrutiny one is apt to overlook them. Each time he faces about, the bird gives his wings a resonant flap.
2. *The Backward-slide:* Standing upon his display perch, the male manakin straightens his legs until his yellow thighs are plainly revealed, as in the about-

face. At times his aspect becomes almost spidery, so high are his slender legs stretched up. He inclines his body forward, sometimes so strongly that his head almost touches the branch, and raises his tail. By short and very rapid, mincing steps, he moves backward along the perch, seeming to slide or glide rather than to walk over it. The foliage at the end of the twig is set into rapid vibration by his innumerable short steps. After covering a few inches he may turn and slide backward in the reverse direction. Often he whirrs his wings, or shakes his tail rapidly from side to side, as he moves tail-foremost over the branch. One male held his wings above his back as he slid backward toward a female perching quietly on his display branch.

3. *Darting Back and Forth:* The manakin flies rapidly back and forth between his display perch and another a few feet away. Each time he leaves the perch he produces a loud *snap* with his wings.
4. *The Circling Flight:* The manakin rapidly flies out several yards from his display perch, circles around in the air and returns to it. As he nears the bough he breaks his flight to make the surprisingly loud noise that has been compared to the sound produced by jerking a piece of stout cloth between the hands. As he alights upon the perch he utters the loud, shrill *eeee*.

ACTIONS OF MALE WHEN FEMALE COMES TO DISPLAY PERCH

Throughout the day, as they wait on their display perches in the shade of the forest, the male manakins repeat their varied notes, snap and whirr their wings, and perform their bizarre stunts, often in a subdued, leisurely fashion. There is almost always some sound and some activity in the courtship assembly. The activity, both bodily and vocal, of the males reaches a higher pitch of intensity whenever a dull, olive-green female appears. This is true not only of the male she favors by visiting his display perch, but of his neighbors as well. The favored one now displays in such rapid sequence, calls and snaps with such vehemence, that the onlooker is all but bewildered by the show. On four occasions I have witnessed the male manakin's courtship activities when a female came to his perch. In the belief that an account of the thrilling display, written soon after its termination, will give a truer picture of what actually happens than any generalized statement reconstructed from old records after the lapse of years, I give here excerpts from my journals of the period.

"March 5, 1935. This morning I reached the manakin's tree at about eight o'clock, just in time to be witness to some exciting events. The manakin (A of Assembly 1) was standing on his usual perch with his legs stretched up so that his yellow thighs were plainly revealed, and his body horizontal or possibly tilted a trifle forward. In this pose he swung about, back and forth, back and forth, just as rapidly as he could, at each turn executing a complete about-face . . . At each rapid turn he gave his wings a loud flap, and all the time he kept his thighs very much in evidence. Tiring of this, he flew rapidly back and forth between this perch and another a few feet distant, making a loud, rustling noise with his wings as he did so.

"In a few minutes a somberly clad female flew into the tree and perched quietly on a limb a few feet below the male. The latter continued his antics, and presently the female flew up to the twig where he was performing, alighting with a little space between herself and him. The male continued his demonstration with renewed ardor, pivoting back and forth and striking out his wings as before. At intervals he advanced toward her with his body raised and tilted slightly forward and his thighs very conspicuous. He moved with a sort of gliding motion produced by very short, rapid steps, a few inches at a time, and with his tail turned toward the female. Sometimes as he slid obliquely backward toward her, he shook his tail rapidly from side to side, but on other advances he held it still. Suddenly he darted away, but returned in an instant to the same perch as though he had been hurled from a catapult. Just as he approached the perch he made a loud noise such as can be produced by holding a stout piece of cloth between both hands and suddenly pulling it taut. This was doubtless produced by rapidly beating his wings, for there was a break in his flight. Upon touching his perch he uttered a high, shrill *tscccc*. Again he slid obliquely backward toward the female, and she slid in his direction, tail somewhat in advance of her body, rapidly beating her wings. When the two had come very close together, the male again leaped into the air, described a small circle, returned with a loud flourish of his wings as before, and alighted on the female's back, where he remained but a moment. Upon separating from her, he continued his twistings and short flights as before, but the female remained perfectly motionless for a minute or so, then flew out of sight. After she left, the male, his energy in no way abated, perched in his usual position and pivoted forty times by actual count, as already described.

"March 7, 1935. This afternoon at 2:40 I visited Group 1 of the red-headed manakins and found bird A and one of the two B birds resting quietly in their usual positions. After I had been there only a few minutes the birds became suddenly more active and called more. Manakin A began to fly quickly back and forth between his principal perch and another small branch a few feet distant and somewhat higher in the tree. At each take-off he made a *snap* with his wings. On the main perch he slid back and forth, sometimes slowly and sometimes rapidly, then about-faced and jumped with a *snap* toward the other perch. I was so engrossed in watching him that I had not noticed that a female had arrived and was perching about a yard from his main perch. After flying back and forth many times, he alighted on the main perch and stayed there, sliding obliquely backward and wiggling his tail. In his backward sliding his body was bent far forward and his head depressed, almost touching the perch. These antics were evidently the invitation for the female to come across to the principal perch, for after a few moments of this she alighted near the male. The latter then began to execute his amazing series of about-faces. After this series of twistings, with the accompanying wing-beats, the male manakin began to slide toward his visitor; but unlike the female who was courted two days ago, this one sidled away at his approach. When this occurred the male took wing, circled around and returned with a loud flourish of wings, alighted on the female's back uttering a high, shrill, rather harsh *eeeeee*, and sexual union took place. This occupied but a few seconds; and when it was over the male flew off, leaving the female perching quietly where the mating had occurred. The male circled off on another flight and attempted to mount the female as before; but just at the proper moment to avoid him she side-stepped and he landed on the branch instead. A second attempt of the male to alight upon her was frustrated in the same manner by the female, who then flew away.

"While all this was taking place the other two males (the B's) were performing just as spiritedly as the favored one, . . . It is noteworthy that, although they seemed very eager to win the female, they made no attempt to intrude upon A's inner domain, or to break into his proceedings. One of them performed on a slender, horizontal branch near the vines where the two usually perch together, and the other among the lower branches of A's tree, but well out of A's way. Both called frequently while A courted and seemed much excited. It is of interest that at this crucial moment these manakins resorted to perches where they do not habitually remain, while the successful manakin won his lady on his customary perch.

"After the female departed, the excitement rapidly died away. At the end of fifty minutes I left A resting quietly in his usual position, and the two B's perching close together among the vines. I did not notice either of the C birds this afternoon."

Later in the season, a female's visit to a display perch had a rather different outcome, as told in an entry made in my journal on May 24, 1935:

"This morning I revisited Group 2 of the red-headed manakins for the first time in many weeks. I found that all four males still sit on the same twigs which they used when I first discovered them in March. Although they still utter their calls and long-drawn whistles, it seemed to me that their voices have become much weaker than they formerly were, and that they have become quieter and less demonstrative than earlier in the season. While I watched, a female manakin alighted on the display perch of male B, who courted her in the fashion I have already described, although he went through the various portions of the act more briefly than I have seen before. When, approaching the perch at high speed and uttering the usual long-drawn *eeeeee*, he was about to alight upon her, she lifted up her open bill to fend him, and he alighted on the twig beside her. She left the display perch but flew about in the vicinity, and soon returned to it again. Once more the male courted her, in a rather sketchy fashion, and once more he was warned to desist when about to complete the act of union. This happened several times over. The female also went through some of the courtship antics beside the male, but in a less spirited fashion. At length she became tired and flew away."

On March 21, I found manakin A of this same assembly standing on a branch at a distance from his display perch, close beside an olive-green bird with yellow eyes, who might have been either a female or an immature male. He behaved in about the same manner as he would have while perching near another adult male on one of the visits so frequent between neighboring males,—going through his courtship displays in a subdued form. The olive-green manakin rested quietly beside him and finally flew away, without having shown any sign of emotion. Then male A returned to his display perch.

INTERRELATIONS OF THE MALES

Each display perch is the private property of a single male yellow-thighed manakin, and I did not once see a second male attempt to trespass upon it. Even during the excitement attendant upon the

arrival of a female, when all the activities of the males are carried on with a swifter rhythm, neglected males do not invade the precincts of their neighbor. Each of them, by his increased zeal in performing, appears to be trying to draw her to him, but each seems to be aware that she is to be won only through strictest compliance with the age-old ritual of the courtship assembly. The choice of a mate rests wholly with the female, and the unchosen males never attempt to influence her by forceful intrusions.

During the long periods when no female comes near the assembly, two males often rest close together upon some bough between their respective display perches. While in the courtship assembly, some males spend most of their time in close association with another and are rarely to be found alone on their display perches; others may very rarely visit a neighbor. In Assembly 1, male A was usually alone on his display perch and did not often go visiting. Males B and b passed most of their time perching close together, as also did males C and c. These four males, when present in the assembly, remained in a certain limited space among the trees, in which there were several slender branches close together that shared their favor almost equally. They were often absent from the neighborhood and abandoned their posts earlier in the season than A. It is significant that male A, who was more constantly on his own display perch, received the only visits, two in number, that I saw a female make to this group.

In Assembly 2, all four males stayed fairly constantly on their own perches, but occasionally two would come together at some midway point. On March 21, while I watched manakin B of this group rest idly on his display perch 35 feet above the ground, manakin C, on his own perch 125 feet away, uttered the long, rather harsh whistle which is usually used as the male flies back to his perch after a short flight in the presence of the female. Upon hearing this, B flew off in the direction of C's perch, and C also advanced toward B. The two met among the boughs about midway between their respective perches. Upon coming together they flitted around each other, making short flights between perches a few feet apart, and snapping their wings at each take-off. Then they perched only six or eight inches apart, half-exposing their thighs and continually flitting their wings. Sometimes one slid backward along the perch toward the other, wagging his tail; but the second generally sidled away and prevented their coming into actual contact. After about five minutes of this idle play, manakin B suddenly flew back to his display perch; then C more slowly returned to his own.

Twice more, during the course of the morning, these two manakins

came together in the same manner and always in the same place. Apparently the males recognize particular perches on which they meet their neighbors, as well as special perches where they display to the females.

When two male manakins visit together, they customarily rest on some slender, horizontal branch, about six or eight inches apart. Here they go through many of their courtship displays, but in a mild and subdued manner. The act most frequently practiced on these occasions is the backward slide, but only half done, not in the whole-hearted manner of actual courtship. Chapman found that, while waiting for a female to appear, two Gould's manakins often rested close together at some point between their courts. One member of such a pair, and always the same, would address little attentions to the other, who consistently refused to return them. Chapman called the former a 'submissive' manakin, the latter a 'dominant' manakin, in the belief that the first, in paying these compliments to the other, recognized his superior social rank. With the yellow-thighed manakins these little displays are not one-sided. Sometimes one of the two males dances toward the other, then the play is reversed. While one bird glides toward the second, the latter may remain perfectly passive and apparently indifferent; but later, perhaps after a considerable interval during which both remain quiet, the second will turn and dance toward the first, who now looks on passively.

A MALE MANAKIN'S DAY

In March, when the season of courtship was at its height, the male manakins arrived at their display perches early, while the light was still dim beneath the forest canopy. Thus on March 6, the five manakins of Assembly 1 took their usual positions between 6:35 and 6:40 a. m. (Canal Zone Time). At this time of year, the bird world in general began the day's activities between 6:15 and 6:20, and some remained quiet until 6:30.

Upon reaching their display perches, the manakins at first called and performed with great energy, just as other birds sing most heartily at dawn; but soon they settled down to a rather inactive morning. By nine o'clock on this particular day, no female had arrived to stir the males into increased activity. The B's and the C's visited together or wandered off through the forest and remained out of sight for long periods. But manakin A was at his post, where much of the time he rested quietly, head drawn in and feathers puffed out, doing nothing save look about with bright yellow eyes and utter an occasional lazy whistle. His absences for hunting food were relatively brief, for he

found much close by. He scrutinized the foliage in his immediate vicinity and, when he espied an insect crawling over a leaf, made a quick dart to snatch it up, returning to his perch to eat it. If the insect was large it would be knocked sharply several times against the branch to still its struggles, before it was gobbled down.

As they rest on their display perches at no great height, the male yellow-thighed manakins are almost fearless of man. One can walk about freely beneath them or even hack at the undergrowth with a machete without driving them away or disturbing their normal routine. They merely peer down inquisitively and perhaps voice a sharp whistle.

The manakins display on their chosen perches during a considerable part of the year. Chapman's observations of a displaying male were made at the end of December, 1926. At the end of May, 1935, at least five manakins occupied the stations where I had first found them in February or early March.

On Barro Colorado Island in November, 1939, I found young males, still in olive-green plumage but flecked with red on head and hind-neck, practicing the courtship displays of the adults, but in a subdued form. They occupied display perches of the usual type; but whether these represented a more or less permanent choice and would be used during the following breeding-season, I could not determine,

COURTSHIP DISPLAYS OF THE FEMALE

When she visits the display perch of a male, the female plays a largely passive rôle. She may rest quietly on the perch and submit to his attentions, or she may respond to his backward slide with a similar movement of her own (see p. 8). But on the four occasions when I saw a female visit a male's display perch I witnessed no more vigorous demonstrations on her part; and the female which Chapman watched on a male's display perch was apparently equally passive.

Yet while wandering through the forest, I have repeatedly seen yellow-thighed manakins in female plumage perform in a fairly vigorous manner many of the courtship displays of the male. Some of these olive-green birds were possibly young males. We have already seen that males just beginning to acquire the adult colors perform persistently, and it is probable that they begin these exercises even before they have progressed far enough in the molt to be distinguished from the females. In El General in October I watched a Salvin's manakin in female plumage, but apparently a young male, 'dance' over a space between young saplings where there was never a bare court. Chapman (1935: 476) watched a *Manacus manacus*, at first taken to

be a female but later proved to be a young male, display in company with adult males in the forests of Trinidad.

On two occasions, however, I watched spirited displays given by female yellow-thighed manakins of whose sex there could be no doubt, because they attended a nest or a fledgling. One of these females had yellow eyes and was more than ordinarily attentive to her nest. When pushed from her eggs, this female performed the 'about-face', at the same time displaying her thighs, which were more yellow than is usual in her sex. As she flitted from perch to perch she sometimes audibly snapped her wings. Another female, found in the forest with a fledgling which had not been long out of the nest, about-faced and snapped her wings, giving once a snapping roll. She also darted rapidly back and forth between perches a few feet apart, in the manner of the courting male; and she uttered a loud, shrill, long-drawn whistle, much resembling that used by the male as he mounts the female. A supposed female, who late in May visited a male's display perch but would not submit to being mounted by him (see p. 9), was more demonstrative than the females I have seen actually accept the male's attentions.

It appears, then, that some of the courtship displays of the male are latent in the female and may find expression, at least in a somewhat subdued form, at times of great emotional stress, as when nest or offspring seems to be in danger.

NESTING

On Barro Colorado Island in 1935, I found six nests of the yellow-thighed manakin. On my farm in the Basin of El General, Costa Rica, at an altitude of 2500 feet above sea-level, I found three more nests during the seven years from 1942 to 1948, inclusive. Seven of these nine nests were placed between five and ten feet above the ground; the eighth was situated about 30 feet above the ground in the bough of a tree at the edge of a light-flooded opening in the forest, left by the falling of a tree; the ninth was about 20 feet up in the midst of the forest. Five of the nests on Barro Colorado Island were situated in the undergrowth of the forest. The sixth Barro Colorado nest and the lowest of the El General nests were in fairly tall second-growth woodland, not far from the heavy forest. Both of the unusually high nests were found in El General; they were at the greatest altitude above sea-level, as well as the greatest height above the ground, of all the nests of the yellow-thighed manakin that I have seen. In the valley of El General, this manakin tends to nest, as well as to display, at greater heights above the ground than on Barro Colorado. In El

General a congeneric species, the blue-capped manakin, is abundant in the forest undergrowth; possibly interspecific competition has resulted in the yellow-thighed species' seeking higher levels than it occupies on Barro Colorado, where apparently it is the only species of *Pipra*.

The nest is a very slight, frail structure suspended between the slender arms of a fork of a thin, horizontal branch. It is too shallow to be called a cup; perhaps 'hammock' is the term that best describes it. The delicate fabric is composed chiefly of fine vegetable fibers, usually brown in color, sometimes lighter. To the outer or lower surface is attached a variable number of small dead leaves or fragments thereof. Sometimes bits of the pinnae of ferns are used along with the leaves of dicotyledonous trees. Some nests have a complete covering of these dead leaves, others are so poorly covered that it is possible to see the eggs through the meshes of the bottom. The nest is bound to the supporting arms of the fork by cobweb and also by passing the fibers over the twiglets. One of the nests in El General contained the short, fine, curled secondary rachises of the twice-pinnately compound leaves of a climbing acacia, in addition to the usual fibrous material. A few slender black fungal hyphae, of the kind that creep over trunks and branches in the undergrowth of humid forests, are sometimes coiled into the bottom of the nest as lining.

The internal measurements of one nest were: diameter 1.75 inches, depth 0.63 inches. The depth of the nest is about equal to the transverse diameter of the eggs it holds, so that they reach to the level of the rim. The incubating female sits upon rather than in the nest. Her body is almost completely exposed, and were it not for her dull olive-green plumage she would be a conspicuous object while incubating and brooding.

It is usually possible to distinguish the nest of the yellow-thighed manakin from that of the other members of the family with which this species dwells in the Central American forests. In the first place, it is usually situated at greater heights than the nests of the blue-capped manakin (*Pipra coronata*), Gould's manakin (*Manacus vitellinus*) and Salvin's manakin (*M. aurantiacus*). The nests of these three species are rarely built much over five feet above the ground, which was the height of the lowest nest of the yellow-thighed manakin that I found. The frail, shallow hammocks of the species of *Manacus* are usually built of brown or bright straw-colored bast fibers and lack a covering of dead leaves on the outside. The nests of the blue-capped manakin resemble those of the yellow-thighed manakin in their covering of leaves, but this outer covering often contains also bits of green moss, which I have not seen in nests of the latter. There

is no possibility of confusing the thrush-like manakin's (*Schiffornis turdinus*) big, bulky nest of dead leaves with the delicate little structures built by *Pipra* and by *Manacus*.

NEST-BUILDING

On March 17, 1943, I found a recently started nest of a yellow-thighed manakin in a tall, second-growth woodland near the edge of primary forest in El General. It consisted of a few, small, dead leaves, fine petioles and much cobweb, suspended between the slender arms of a horizontal fork, ten feet above the ground. The female worked in a most leisurely fashion and building proceeded slowly. On March 19 I watched for two hours. From 7:10 to 7:50 a. m. the female brought material eight times. From 7:50 to 8:28 she remained out of sight. From 8:28 to 8:50 she came twice more, then again suspended her labors. She brought chiefly sheaves of the slender, bow-shaped secondary rachises of acacia leaves and cobweb but also long, light-colored fibers doubled in her bill. She was always alone; I did not see a male of her kind in the vicinity. With an audible whirr of wings, she would alight on a twig near her nest, look around carefully, flit to the nest to lay her material upon it, and then sit in it to give it shape. She was quite indifferent to my presence, although I sat on a rock close by without the least concealment. She was at all times silent. It was March 26, nine days after I found this nest, before I saw the first egg in it. The second was laid the following day.

A female which I watched build in the same locality on June 6, 1948, behaved in much the same manner. Her nest, about 20 feet up in a fork of a thin, horizontal branch of a tall and very slender young tree on a ridge in the forest, was close beneath the feathery frond of an *Euterpe* palm. When I found the nest at 7:55 in the morning the female was building actively, and during the next half-hour she brought material eight times. Each time she flew up with something in her bill she alighted on the supporting branch about two feet from the nest and paused there to look around carefully before advancing to her nest-site. Here, after placing her latest contribution, she carefully shaped the shallow cup with bill and feet. She was quite alone and perfectly silent. Her eyes were dark, and her bill was yellowish.

THE EGGS

I have records of eight sets of eggs, each of which contained two, a number which appears to be as constant among manakins as with antbirds and hummingbirds. In one instance, at least, several days intervened between the laying of the first and second eggs. On

March 11, 1935, I found on Barro Colorado Island a nest containing a single egg. The female was covering it and allowed me to approach within three or four feet before flying away. I revisited this nest on the afternoons of March 12 and 13, and on both occasions found the female absent and the egg cold. Believing that the nest had been deserted, I now neglected it and did not see it again until March 18, when to my surprise the female was covering two eggs. An interval of at least three days had separated the laying of the first and second eggs.

The eggs of the yellow-thighed manakin are dark grayish-buff, heavily mottled with brown, especially in a wreath around the thicker end. The measurements of eight eggs average 21.5 by 15.4 millimeters. The eggs showing the four extremes in size measured 22.2 by 15.9 and 21.0 by 14.3 millimeters.

My earliest date for eggs is March 10, when I found a nest with a completed but apparently newly-laid set on Barro Colorado Island. Two more nests with eggs were found on the island during the remainder of March, two in April, and the last of my six nests in this locality on May 7, when it held its full complement of two eggs. My three nests in El General were built in March, April, and June. March, April, and May are the months of greatest reproductive activity; but observations on the behavior of the males, and analogy with the habits of other species of manakins, suggest that the nesting-season is actually considerably longer than the foregoing nest records show it to be. Proof of this is furnished by a record kindly sent to me by Mrs. Dorothy Hobson, who on July 7, 1947, found a nest with two eggs on Barro Colorado. She sent me the empty nest as a check on identification.

INCUBATION

The eggs of the yellow-thighed manakin are incubated by the female alone. I made a great many visits to seven nests with eggs; I often saw the female sitting, but a male was never present. The males spend so much time in the courtship assembly that they could hardly be supposed to take turns on the eggs. With his bright red head, the male manakin would probably be fatally conspicuous as he sat upon the obscure little nest, which is difficult to detect amidst the dark shadows of the forest when the olive-colored female is sitting.

From a blind, I watched nest 1 for an entire day, nest 3 for the first six and one-half hours of a day. The female of nest 1 sat less faithfully than her neighbor of nest 3. During 12 hours I timed seven sessions on the eggs which ranged in length from 29 to 108 minutes

and averaged 65.1 minutes and an equal number of recesses ranging from six to 21 minutes in length and averaging 14 minutes. This manakin was on the nest 82.3 per cent of the 12 hours.

At 6:05 a. m. on March 22, while it was still dark in the forest, I entered the blind before nest 3. At 6:26 the female manakin flew from the nest for her first recess of the morning. At 6:52 she returned and incubated until 8:30. Returning again at 9:04, she flew directly onto the eggs, without first alighting upon the rim. Such a mode of entering the nest is customary with hummingbirds, but nearly all heavier birds come to rest first on the rim of the nest and then hop gently down to cover the eggs. The manakin now sat continuously until 12:38 p. m. Thus the entire morning was taken up by two long sessions of 98 and 214 minutes and two recesses of 26 and 34 minutes. The manakin incubated 83.9 per cent of the morning.

While sitting on the nest, the female from time to time regurgitated small seeds, held each in her bill for a few seconds, then allowed it to drop to the ground. From time to time she rose up to adjust the eggs beneath her. During her long session of three hours and 34 minutes, the bird on nest 3 preened her feathers while she sat. Both birds incubated in perfect silence.

Nest 3 was far from any courtship post of the males; but while sitting in the blind before nest 1, I could hear the calls of a male, and at times glimpse him on his slender, horizontal display perch at the end of a long vista through the foliage. He never came near the nest, and the female appeared to ignore his existence. Sometimes when she left the eggs he would call and snap his wings with renewed energy, as though he had seen her and was trying to attract her to his perch. At other times, while the female was at recess, he would leave his post and advance about halfway to the nest; once he displayed amid the underwood here; whether the female was with him I could not see. The position of this nest within sight of a male's display perch was probably only incidental and not significant of intimate relations between the female manakin and the male.

As she sits upon her tiny nest, the olive-green female yellow-thighed manakin is a most inconspicuous object. Upon the approach of danger she depends upon her immobility to escape detection. Most of the females that I found nesting permitted me to come almost or quite within reach of them before taking flight. At nest 1, the female allowed me to advance my hand to within a few inches of her before she darted from the eggs; it was not until after the nestlings hatched that she allowed me to touch her and to smooth the feathers of her back with a finger. At nest 2, the female also became bolder as incubation

proceeded and would sit until my advancing fingers were only a few inches distant from her. Then, unlike the other manakins, she would jump from the nest and flutter downward, to come to rest upon some low support only a few inches above the ground, where she spread and beat her wings. Although her actions somewhat resembled those of a bird that practices a distraction display, she did not appear to be feigning injury. Her act was never long continued; if I walked toward her she flew directly out of sight, instead of trying to lure me farther away from the nest by fluttering over the ground, as many birds do.

At nest 8 in El General, on the afternoon of the day the female laid her second egg, I came to look into her nest, ten feet above the ground, with a mirror attached to the end of a long stick. She remained on the nest while I stood below and watched her. Shaking the slender nest-tree did not cause her to desert her eggs. Only when I raised the mirror to the level of the nest and shook the foliage immediately surrounding it, would she leave and allow me to see what she had beneath her. Within a few minutes she was back on her eggs again.

But the most resolute of all the female yellow-thighed manakins—indeed, the most attentive to her nest of all birds of whatever kind that I have known—was the owner of nest 3 on Barro Colorado Island. This nest was situated ten feet above the ground in the fork of a thin, horizontal branch of a small bush. On the day it was found I tried to view its contents in a mirror, but no amount of shaking the bush, consistent with the safety of the nest it supported, would cause the bird to leave. I even touched her bill with the end of a stick. At length I went away without having seen what was beneath her.

I returned again and again, hoping to find the manakin absent, so that I might see what the nest contained without running the risk of molesting her unduly and causing desertion, but at every visit I found her sitting as before. Subsequent studies showed that she was present more than 80 per cent of the time. At last I came with a ladder resolved to see the contents of the nest. I climbed up, gently touched the manakin's tail with a finger, but she would not leave. I lightly smoothed the silky feathers of her back. Next I tried to push two fingers beneath her, in order to lift out an egg. It was not the weight of her tiny body that made her so difficult to raise; she was clinging to the nest with her feet. But finally she yielded and darted to a neighboring perch, where she turned to watch me.

Her departure revealed two eggs resting in the shallow depression of the nest. As I lifted one out to examine and measure it, the owner returned and hovered a few feet above my head, opened wide her bill revealing a yellow-lined mouth, and "screamed" at me. Her cries

drew two sympathizers. One was a bird even smaller than herself, a bent-billed flycatcher (*Oncostoma olivaceum*), which alighted a few feet away and uttered a peculiar, harsh, growling note, stretching forward and bending down its neck as it uttered its little scold. The other was a female hummingbird which hovered close around my head, then darted off through the forest. The growls of the little bent-bill seemed to irritate the manakin, for she darted at it and caused it to retreat.

I noticed that this female manakin was different from the others I had seen. Her eyes were yellow, like the males', and her plumage darker than usual in her sex, tending toward the black of the male. Her thighs were pale yellowish, and she exposed them as she darted and twisted around. She even about-faced a few times, flitting her wings and exposing her thighs as she did so, in the fashion of the male. As she flitted from perch to perch, she sometimes audibly snapped her wings. After a while the manakin left me to complete my notes. I returned half an hour later and found her sitting on her nest as before.

Thereafter, when I made my daily visit to this nest to learn whether the eggs had hatched, I did not hesitate to feel beneath the sitting manakin with a finger. The first time that I touched the end of her bill she attempted to bite, but afterward she never made a hostile move. I smoothed the feathers of her back with a finger, and she did not move even when I touched the top of her head. One day I came with two visitors to the island; the bird sat quietly while each in turn climbed the ladder and laid a finger gently upon her plumage.

On the evening of the day when her eggs hatched, this female manakin alighted on the rim of her nest just as I was approaching it with a ladder. When she noticed me coming she 'froze' there, remaining perfectly immobile while I set the ladder beneath her and climbed up. When I reached the top of the ladder my head was only a foot from her, and I could see the legs of a small spider sticking out of her bill. The nest was still a few inches above the level of my eyes, and as I pulled it down to look in, the manakin flew to the next tree.

Photographing this manakin was an unique adventure. She did not move while I screwed the camera to the tripod head (lashed to a ladder), although the lens was only a foot away from her. Then, since she was sitting with her tail toward the camera, I pushed her around until she sat with her side toward it. She sat through all the complicated business of focusing, adjusting the shutter, putting in and taking out the film-holders, while I made five time-exposures. She persisted in keeping her head turned away from the camera. To remedy this, I tried to turn her around until her head was toward the camera, for

the sixth exposure. This was too much; she darted from the nest. Later in the day she was at her post again.

The only accessible nest that I found before the eggs were laid was despoiled a few days after the set was complete. In nest 1, the eggs hatched 15 days after the nest was found with its full complement, but probably the eggs had already been incubated for a few days. In one instance I was able to determine the incubation period of a related species, *Pipra coronata*, and found it to be 19 days. Van Tyne (quoted by Chapman, 1935: 506) found the incubation period at one nest of *Manacus vitellinus* to be 19 days; and at two nests of *M. aurantiacus* that I studied in El General, the eggs hatched after this interval of incubation. It is likely that the period of incubation of the yellow-thighed manakin does not differ greatly from that of these other manakins.

THE YOUNG

On March 24, both eggs hatched in nest 3 and one of those in nest 1. The second egg in nest 1 hatched the following day. The newborn manakins had pink skin and bore sparse gray natal down of the usual passerine type. Their eyes were tightly closed, their bills light yellow. They developed slowly. When they were five days old, I noticed that their bills were turning black, their eyes were opening, and the pinfeathers were pushing through the skin. When eight days old they were still nearly naked, but the feathers were beginning to escape from the ends of their sheaths.

On April 2, when the two nestlings in nest 1 were respectively eight and nine days old, I watched them during the first four hours of the day. Their mother, who had brooded during the night, flew from the nest at 6:27 a. m. At 7:13 she returned to the nest-tree followed by a male, apparently the one whose display perch was in sight of the nest. For a few minutes both rested near the nest, but he showed no interest in it; then both flew away. At 7:33, more than an hour after she became active, the female gave the nestlings their first meal of the day. Then she remained standing on one of the supporting twigs at the edge of the nest for six minutes, at the end of which she went off again. At 7:48 she returned with nothing visible in her bill, which was, however, slightly open. She first came to rest on a branch about a yard from the nest, lingering there several minutes while she looked from side to side. Then she advanced to the nest, alighted on one of the arms of the supporting fork, and regurgitated many pieces of food, the nature of which I could not determine, placing some in the bill of each nestling. After receiving their meal, the nestlings voiced soft

little *peeps*, while their mother twice uttered a low, soft whistle. After lingering on the rim for several minutes, she entered the nest and brooded the nestlings, which were now so big and so completely filled the nest that she could hardly cover them. She brooded quietly for 52 minutes, from 7:51 to 8:43, then flew away.

At 8:54 she was back again and fed the nestlings alternately four times each, then flew away without brooding. At 9:10 she returned, alighted on a branch a yard from the nest, and rested there quietly for a quarter of an hour, as though guarding the nestlings. Then she advanced to the nest and began to feed. She regurgitated about ten objects in all, apparently small purple berries. The nestlings were satiated and sank back into the nest before she had exhausted the contents of her crop, and with a very low, twittering call she coaxed them to take more. Slowly they rose up to receive the remainder of the food. Then, after lingering four minutes on the rim of the nest, the mother flew away. At 9:58 she returned and regurgitated eight objects of food for the nestlings, then remained for two minutes standing quietly beside the nest before she flew off. She did not return before I left at 10:27. During four hours she had brought food to the nest only five times, but each time a liberal amount, which she divided rather equally between the two nestlings.

The female manakin did not once carry away the droppings of the nestlings, as nearly all passerine birds do. Instead of this, the nestlings voided their excreta over the side of the narrow nest, much in the manner of hummingbirds—a habit also of nestling blue-capped manakins and Salvin's manakins, after they are strong enough. The waste matter contained many small seeds, indicating that berries formed an important element in the young birds' diet. After his early morning visit, the male manakin did not return to the vicinity of the nest; to the female alone fell the entire task of attending the nestlings.

None of the seven accessible nests was successful. From three nests the eggs were lost before hatching; from three more, unfeathered nestlings disappeared. The seventh nest was deserted as a result of an ill-considered experiment in photography. Because of these repeated disasters, I was unable to follow the later development of the nestlings or to determine the period they remained in the nest. The nestling period of the related blue-capped manakin is 13 or 14 days; of Salvin's manakin, 13 to 15 or exceptionally 17 days.

On April 11, 1935, I found a female yellow-thighed manakin with a fledgling that was still somewhat fuzzy and certainly had not been many days out of the nest. It rested about 12 feet above the ground in the midst of the forest. While I watched, its mother behaved

most oddly, performing in a subdued form many of the antics of the courting male. She flew back and forth above my head, uttering repeatedly a loud, shrill, long-drawn whistle. She about-faced on a branch and snapped her wings, giving once a rolling snap. She flew briskly back and forth between branches on opposite sides of the fledgling, much as a male darts back and forth between his display perch and a neighboring twig. Sometimes she rested close beside her fledgling; but when I stood directly below it she vanished and remained out of sight as long as I stayed there. Her conduct contrasted sharply with that of female blue-capped manakins with fledglings; the latter flutter widespread wings and voice low, soft trills in an effort to draw the intruder away from their young by feigning injury.

Young male yellow-thighed manakins resemble the females in their olive-green plumage. On Barro Colorado Island in November, I saw a number of young males in olive-green attire but flecked with red on the head and hind-neck, who had taken up stations in the undergrowth of the forest and were practicing their courtship rites in a subdued form. There were at the same time males in full black, red, and yellow plumage, whose presence at this season weighed against the assumption that there was an annual change in coloration of the adult males in this species. At the end of March, I met among the forests of El General a young olive-green male, which had a single inconspicuous red spot on the back of his neck. His eyes were yellow as in the adult male. The earliness of the season made it unlikely that he had been hatched that year. Among most of the small passerine birds of Central America, the young males acquire the nuptial plumage of the adults at the postjuvinal molt. But these observations on the manakins make it seem probable that the young males go through the 'winter' in the juvenal plumage and take on the adult colors by means of the prenuptial molt—if they do not indeed pass a whole year or more in the juvenal attire, in the manner of the sharp-tailed manakin and the cock-of-the-rock.

SUMMARY

1. The habits of the yellow-thighed manakin (*Pipra mentalis*), including courtship and nesting, were studied on Barro Colorado Island, Canal Zone, and in the valley of El General, Costa Rica.

2. These manakins inhabit primary rain-forest, in which they range vertically from the bushy undergrowth to the lower boughs of the dominant trees. Rarely, they enter adjoining areas of taller second-growth woodland.

3. Their food consists of insects and other small invertebrates, which

they usually catch by darting up to the foliage or twig on which the creature is crawling and plucking it off, without alighting. They consume also many berries. They join the motley throng of birds which follow army ants and prey upon small creatures.

4. These manakins do not form pairs. To the female alone fall all the duties of the nest; while from December through May, and possibly longer, the males spend their time advertising their presence in definite spots. The display perch of the male is a slender, more or less horizontal branch, free of lateral twiglets and foliage for a distance of several feet, and unobstructed by surrounding vegetation. This is situated amidst the forest at heights ranging from 15 to 50 or rarely as much as 70 feet. Usually a number of displaying males associate together to form a courtship assembly, which may contain up to five individuals, whose display perches are from 20 to 125 feet apart.

5. The courtship performance of the male includes a variety of vocal sounds; mechanical noises, chiefly a loud *snap* and a rapid series of *sna**ps* produced by the wings; and an amazing variety of acrobatic stunts, an outstanding feature of which is the display of the lemon-yellow thighs by stretching up the legs.

6. The actions of the male when a female arrives on his display perch are described in detail. While a female is being courted by a male, other males of the assembly perform at an accelerated pace but remain aloof from their rival's display perch. The mating, so far as seen, was always consummated on the display perch.

7. Males respect the privacy of each other's display perches, and no infraction of territorial rights was witnessed. During the quieter periods in the courtship assembly, two males often visit each other on some twig about midway between their display perches. Here they remain perched close together for considerable periods, often practicing the courtship antics in a subdued form. Each in turn may 'court' the other but never with the intensity of a male addressing a female. Some males spend a large share of their time in the assembly perching by twos; others stay more constantly alone on their own display perches. The latter are more successful in attracting the females.

8. Young males in the olive-green juvenal plumage, merely flecked with red on head and hind-neck, were seen practicing courtship antics in November.

9. On the male's display perch the female plays a largely passive rôle. But at other times, especially when nest or offspring seem to be in danger, the female may under emotional stress perform, in a somewhat subdued manner, many of the courtship antics of the male,

including the about-face and wing-snapping. The courtship habits of the male appear to be latent in the female.

10. Six nests were found on Barro Colorado Island and three in El General. Those on Barro Colorado ranged from five to ten feet above ground, those in El General from ten to 30 feet. In the latter region, where *Pipra coronata* is abundant in the undergrowth of the forest, *P. mentalis* tends to display and to nest higher in the trees than on Barro Colorado, where no congeneric species was seen.

11. The nest is built by the female alone, unattended by a male. The slight, shallow hammock is hung in a crotch at the end of a slender, horizontal branch. Small leaves or fragments thereof, attached to the lower side, serve to distinguish it from nests of species of *Manacus*. It appears always to lack the green moss often attached beneath nests of *P. coronata*.

12. Each of eight nests contained two eggs. Eggs have been recorded from early March to early July.

13. The eggs are incubated by the female alone. A constant sitter, she may stay on the nest for three and one-half hours without interruption. One female covered the eggs for 82.3 per cent of 12 hours, another for 83.9 per cent of six hours.

14. Depending upon their minute size and dull color to escape detection, females remain immobile upon the nest and permit a close approach by man. Not infrequently one can touch them with a finger. One extraordinary female, which had yellow eyes like the males, permitted the author to feel her eggs beneath her and when photographing to push her around on the nest into the desired pose.

15. Newly hatched nestlings are blind, helpless, and have sparse natal down. They are fed and brooded by the female alone. Their food, consisting of small insects, spiders, and many berries, is brought to the nest partly in the mother's mouth but chiefly in her throat or crop—sometimes ten articles at once—and delivered to the nestlings alternately as regurgitated. After the young are strong enough, they void their droppings, which contain many seeds, over the side of the nest, and the parent no longer carries them away.

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