

DISPLAY AND RELATED BEHAVIOR OF MALE PIN-TAILED MANAKINS

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One of the most striking members of the highly endemic avifauna of the southeast Brazilian coastal forests is the Pin-tailed Manakin (*Ilicura militaris*). The species has been placed in a monotypic genus, and does not appear to be closely related to any other manakin. The bird is little known, apart from brief references to its display by Sick (1959, 1967), and its nest is undescribed. In this paper we describe the behavior of male Pin-tailed Manakins, and compare their displays with those of other manakin species.

METHODS

We studied the Pin-tailed Manakin in the Boracéia Forest Reserve, in the Serra do Mar about 80 km east of São Paulo, at an altitude of 850 m above sea level. Observations of males in their display territories totaled 44.5 h on 21 d between 14 November and 13 December 1983. We chose this period as it is at or near the height of the breeding season for most of the forest birds of southeastern Brazil. All detailed observations were made on four individual males, one of which was watched for 30-min periods in each hour throughout a complete day; the presence of seven other individuals was noted, but their displays were not recorded. Observations were made with 10× binoculars, usually at distances of 8–15 m. No blind was used, as the birds seemed unaffected by our presence. Tape recordings of their vocalizations were made with a Sony TC 800 B tape recorder and analyzed by sonagraph (Kay 6061B) and by Unigon Spectrum Analyser. Measurements of the elongated central tail feathers (see below) were taken from specimens in the São Paulo Museum of Zoology, University of São Paulo, Brazil.

APPEARANCE

The Pin-tailed Manakin is a typical small, sexually dimorphic manakin, with brightly colored adult male plumage and cryptic olive-green female and juvenile-male plumage. The adult male's upperparts are black, except for a patch of crimson feathers on the forehead, scarlet lower back and rump, and olive-green secondaries. The sides of the head and underparts are white to very pale gray. The iris is bright fawn-brown, and the legs and feet blackish. The central pair of tail feathers is pointed and project 21–25 mm beyond the others (N = 10). These feathers are only slightly elongated in females, usually projecting 2–6 mm beyond the others (N = 32; all 2–6 mm except for one of 7 mm); in juvenile males they tend to be longer, projecting 4–7 mm (N = 8; all 4–7 mm, except for one of 15 mm, this bird being in transitional plumage). Sick (1959) gives the mean weight (sex unspecified) as 13.5 g; an adult male trapped by us weighed

12.2 g. No geographical variation has been described in any part of the range, which extends from Espirito Santo south to Santa Catarina.

MALE TERRITORIES

We found adult males singing and displaying in undisturbed valley forest. On frequent visits to forested ridges, only 100–200 m higher, we found no Pin-tailed Manakins of either sex. Along a long-unused road, which ran for 1.5 km at a level of about 30 m above a small river through primary and old secondary forest, 11 male territories were found. The birds were in four groups consisting of 3, 3, 3, and 2 individuals close enough together for each to be in auditory contact with at least one other member of its group (judged by the fact that they responded to sounds made by their neighbors). Individual males occupied territories of variable shape, 20–30 m across; more exact measurement in most cases was hampered by the steep and broken terrain. The distance between the centers (position of the mating perch—see below) of the two contiguous territories watched most intensively was 37 m, and this seemed typical of the spacing of others less intensively watched. Groups of males were several hundred meters apart.

All the territories had abundant slender perches (5–10 mm diameter) at heights of 4–10 m, mainly side branches of understory trees and vine stems, on which the males spent most of their time, and from which they delivered their frequently repeated songs. In addition, each territory included a main display perch (in one case, two such perches), hereafter called the mating perch, used in the culminating phases of courtship display. The five mating perches examined were more or less horizontal sections, about one m long, of branches with a diameter of about 50 mm, much thicker than the other perches used. Three mating perches were the main stems of small trees that had collapsed partially and had continued to grow in a bent-over position; two were horizontal branches of larger trees. All were well below the forest canopy, their heights above ground ranging from 3.3 to about 13 m. In addition to being horizontal, they were without side branches and clear of entangling vegetation.

Attendance at the territory.—The males were present in their display territories for nearly the whole of the daylight hours. An all-day watch on one male, beginning at dawn and continuing with 30-min observation periods each hour until its activities ceased, showed that it began to display by singing at 05:40 (local time) and sang for most of the time between then and 17:35. It was present for at least 87% of the intervening observation periods. During other early-morning watches totaling 7.5 h, the males (N = 3) were present for 97% of the time.

We never saw males feeding or searching for food in their display territories, but one male fed regularly on fruit from a nearby tree (*Rapanea* sp., Myrsinaceae). His bouts of feeding were easy to record, as the tree was a sparsely foliated emergent near the forest edge. Seven feeding bouts (timed from the bird's flying up into the tree until his departure from it) lasted for 20–47 sec (\bar{x} = 36 sec), and 6–8 fruits were taken per visit (N = 5). This bird started to sing again within seconds of his diving down out of the feeding tree back to his display territory, and his appearance in the feeding tree followed usually within a minute of the end of a singing bout, so that he was absent from his territory for no longer than about 1.5 min. Periods when the other males were not heard and could not be seen in their display territories were taken to indicate foraging trips. These ranged from 1.5 to 3 min (\bar{x} = 2.1 min, N = 7), suggesting that these birds traveled farther to obtain food.

"Gardening."—In the early morning, during the main peak of display (see below), the males regularly cleared their main perches of obstructing vegetation. This was seen on 11 occasions; all but once between 06:00 and 08:00, and mostly between or during bouts of display on the mating perch. "Gardening" consisted mainly of pulling or picking pieces out of leaves growing above the main display perch, or pulling at twigs, either from a perch or while flying. Males hovered for several seconds, hanging onto a leaf, with wings beating, in attempts to detach leaves or pick at them. Twice a male was seen pulling off small pieces of moss from the main perch. As a result of these activities, the upper side of the mating perch is kept clean of moss (and thus stood out from the surrounding moss-covered branches), and the air space above it is kept more or less clear of obstructions and thus suitable for the display jumps.

THE DISPLAY REPERTOIRE

Song.—Males in their display territories advertised their presence by means of a frequently repeated, simple song consisting of a series of downwardly inflected notes of characteristic form (Fig. 1a,d). Most songs consisted of 5–8 notes, each one slightly lower-pitched than the one before and the last note often fainter than the others. Each note spanned a wide range of frequencies, the first note of a song being usually between 7.8 and 6.7 kHz and the last note between 6.6 and 5.6 kHz. The descending series of downwardly inflected notes, ending faintly, sound plaintive to the human ear, and is very unlike the call of any other manakin with which we have been acquainted. Occasionally, much longer songs were given (Fig. 1d), the three recorded having 14–17 notes. In these longer songs, the pitch of successive notes descended in the usual way up to the

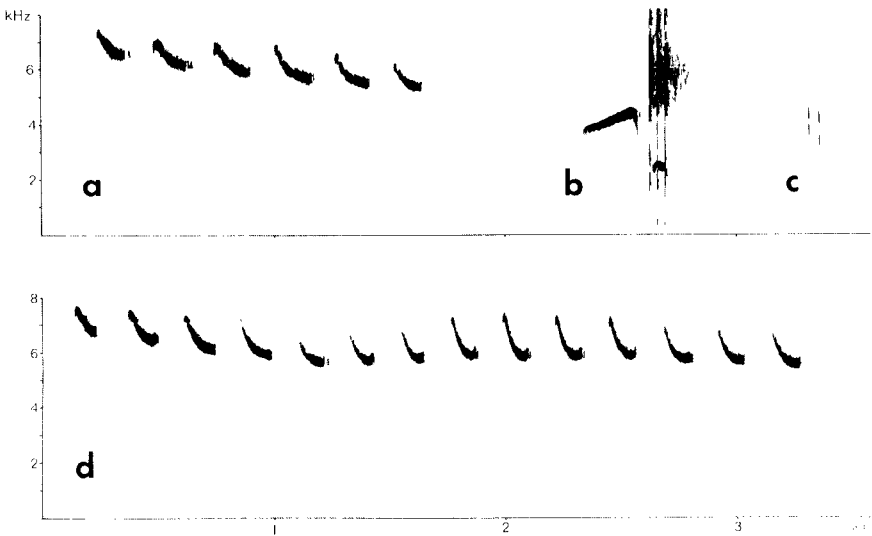


FIG. 1. Sounds associated with displays of male Pin-tailed Manakins (*Ilicura militaris*): (a) normal song, (b) the *weep* call, followed by a snap (made by wings, consisting of three pulses of sound) and a second, lower-pitched note synchronous with the snap, (c) click (made by wings, consisting of four pulses of sound), and (d) "long" song. Duration of calls in seconds.

fifth or sixth note, and then rose, giving the impression that the bird had begun to sing a second song before the first had ended.

While singing, males assumed a fluffed-out posture with the red rump feathers erected (Fig. 2a). This was strikingly different from the sleeked appearance characteristic of the other displays. All individuals watched used a large number of different song perches, mostly in the understory at heights of 6–9 m. At times when display activity was less frequent, they sometimes used higher perches, up to 14 m. Conversely, during periods of high activity, particularly during intrusions by young males, they tended to sing on low perches, sometimes less than 4 m high.

Songs were uttered at short intervals in the early morning with intervals lengthening and becoming less regular as the day went on. Thus one male sang at intervals averaging 11.5 sec ($N = 98$; $SD = 2.31$) between 06:00 and 07:00, 13.9 sec ($N = 94$; $SD = 3.02$) between 07:00 and 08:00, and 24.9 sec ($N = 96$, $SD = 6.40$) between 14:00 and 15:00. The male that was watched for a whole day sang 693 songs during the observation periods, so that its total output must have been of the order of 1400 songs.

Noisy flight.—Adult males in display territories flew silently or with a mechanical whirring sound that undoubtedly was made with the wings. The same whirring sound sometimes was also produced when males

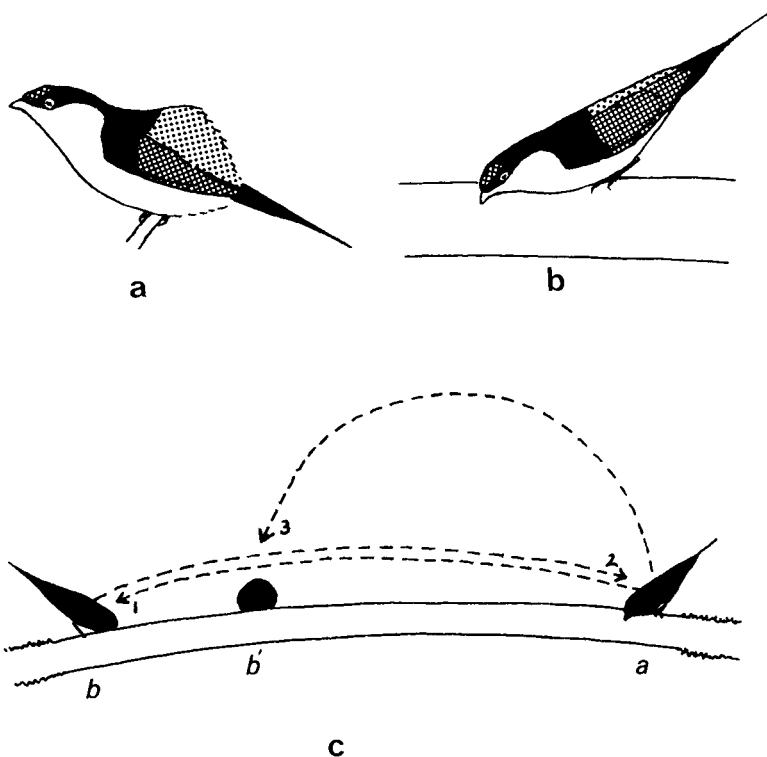


FIG. 2. Postures and displays of male Pin-tailed Manakins (*Ilicura militaris*): (a) singing male, with red feathers of lower back and rump conspicuously fluffed, (b) chin-down posture with plumage sleeked, preparatory to making a snap-jump along the mating perch, (c) sequence of jumps leading to mating. The male makes two snap-jumps over the crouching female, and then mounts with a third, semicircular jump.

jumped between adjacent perches. The change from silent to noisy flight occurred on the arrival of a female or young male in the adult male's territory. When the visitor arrived, the resident male usually flew straight to his mating perch. Thus, most flights to the mating perch were noisy, but noisy flights sometimes occurred elsewhere in the territory.

Single snap.—This display was performed everywhere in the display territory, including the mating perch. Twelve of 37 (32%) single snaps made by the male, whose activity was monitored throughout a whole day, were performed on or near the mating perch. Without adopting any obvious preparatory posture (i.e., from a normal perched position) the bird suddenly would take off with a loud snapping sound and would make a short flight in a curved trajectory to another perch about one m away or,

with a sharply angled trajectory, would return to another position on the perch from which it took off. Often, the snap was immediately preceded by a special call, *weep*, with an upward inflection, followed by a second note synchronous with the snap (Fig. 1b). Because it was swamped by the snap, we were unaware of the second note until we made the sonagrams. Rarely, a call that sounded identical to the *weep* was uttered by a male in its territory, unaccompanied by a snap.

An analysis of recordings of snaps showed that energy was more or less evenly distributed over a wide range of frequencies, with upper limits at 9.6–10.2 kHz and lower limits at 0.08–1.2 kHz. The sound consisted of three pulses separated by gaps of 0.033–0.035 sec, producing a rolling sound just detectable by the human ear. It was undoubtedly produced by the wings, but the wing movement was far too rapid to follow under field conditions.

Double snap-jump.—This display was usually performed on the mating perch (e.g., on 33 of 36 occasions recorded for the adult male most intensively watched). The male would position itself at one end of the cleared part of the perch, then, with plumage sleeked, would lower its breast and chin to the perch and raise its tail (Fig. 2b). A moment later it would jump, with a snap on taking off, and, with a low curved trajectory, would land at the other end of the perch, facing the way from which it came. The bird immediately would jump back with another snap, landing either on the mating perch, again facing the way from which it came, or on a higher perch near by. Double snap-jumps were seen at four different perches and the males were consistent in always starting at the same end of the perch. Only one male was seen to land on a higher perch after the jump back, probably because its mating perch was slightly sloping. The first jump was slightly uphill, so that the bird's trajectory on the jump back took it too high for a convenient landing on the mating perch.

The snaps made during the double snap-jump sounded no different from single snaps; those analyzed consisted of either 3 or 4 pulses of sound, separated by intervals of 0.032–0.035 sec. They were never heard to be preceded by the *weep* call.

Click display.—A faint click (Fig. 1c), audible only over a short distance and, like the snap, undoubtedly produced by the wings, was associated with various stereotyped movements. Sometimes the click display was simply a side-to-side pivoting accompanied by a click, first one way then the other, without changing perches, repeated up to a dozen times. Sometimes a click accompanied ritualized jumps, with sleeked plumage and an upright stance, along the mating perch or to and fro between the mating perch and perches above it. Finally, a click accompanied each jump made during the semicircular jump display, described below. Of 17 click displays

observed, 13 occurred on or near the mating perch; the others were performed from song perches in other parts of the display territory while female-plumaged manakins were perched above the displaying bird.

Recordings showed that clicks consisted of 1–4 pulses, weaker than the snap but with energy similarly distributed over a wide range of frequencies, the pulses being separated by intervals of 0.045 sec.

Semicircular jumps. — This display was only performed on the mating perch. In the chin-down posture with plumage sleeked (Fig. 2b), the bird would jump with a “click” along the perch, following a higher, more semi-circular trajectory than in the snap-jump, and would land facing the way from which it came, and then make a similar jump back or, occasionally, to another perch. On all except one of the occasions when it was seen ($N = 6$; 2–8 jumps on each occasion), the first jump was from the same position on the mating perch as the first jump of the double snap-jump. Once the first jump of a double snap-jump was followed by a semicircular jump back. The semicircular jump was similar to the jump made by the male when it mounted the female, which was seen only once (see below).

RESPONSES OF ADULT MALES TO NEIGHBORS AND VISITORS

On 18 occasions, all between 06:55 and 08:50, birds in female-type plumage were seen visiting an adult male’s display territory, usually flying to the mating perch or occasionally to other perches of similar thickness and orientation. On 13 of these occasions the visiting birds behaved as young males; they performed displays of adult-male type, but the mechanical sounds accompanying them were subdued. On the other five occasions the visitor’s behavior suggested that it was a female; and one of these occasions culminated in mating. When a bird in female-juvenile plumage entered a male’s territory, the male would sleek all his feathers, and they remained sleeked throughout the displays that followed.

Only once was another adult male seen inside a neighboring adult’s display territory. On that occasion the latter was engaged in a long series of snap-jumps directed at an intruding young male. Though such trespassing was evidently rare, adult males regularly reacted to the sounds made by a neighbor. Frequently, when snaps were heard from a neighbor’s territory, an adult male would at once fly to the edge of his territory abutting on his neighbor’s and sing from that position before returning to the center of his territory.

Female visits. — The following was the initial sequence of events when the visitor was probably a female. At the arrival of a female above one of his song perches the male performed click displays on the song perch before flying with noisy flight to the mating perch, closely followed by the female. The male then moved to position *a* on the mating perch (Fig. 2c),

the position from which he took off for the first jump of a double snap-jump, and the female went to b or b' . The subsequent course of events leading to mating was seen only once, and was as follows. At 06:59 on 10 December, a female came to the male's mating perch. The male performed the click display 12 times, jumping between position a and some perches just above b' . While he displayed, the female watched him, and hopped a few times between positions b and b' , before perching across the branch at b' . The male then performed a double snap-jump over her and back, immediately followed by a semicircular jump straight onto her back. By this time the female was in a crouched position; during copulation the male gripped her crown feathers. After mating, the male left the mating perch and began singing almost immediately. The female left after a short preening bout. The whole sequence took just over a minute. Fifteen minutes later the male, followed by a female, returned to the mating perch. On this occasion the male made 18 click-display jumps from the mating perch to a perch just above, returning to the mating perch sometimes at position a and sometimes at b . The female appeared restless and hopped about more than in the previous sequence. Frequently, when the male landed at a he assumed a crouched chin-down presnap posture, only to abandon it and jump with a click back to the perch above. Eventually the male performed a double snap-jump over the female, but the latter did not crouch and both of them left without mating.

Visits by young males.—Presumed young males were seen on 13 occasions within an adult male's display territory. On 9 of these occasions they went to the adult's mating perch in his absence where they practiced single and double snap-jumps, semicircular jumps, and click displays. One individual sang briefly. Twice, two young males came together. Their displays were performed with sleeked plumage, and although the movements appeared identical to those of adult males, the snaps were faint and imperfect (perhaps due to their less modified wing feathers), and no clicks were audible. When performing the double snap-jump, they started from the same position on the perch as the resident male. On occasions when the adult male was present during visits by young males, there were confused interactions between owner and visitor(s), with click displays and noisy flights on and around the main mating perch, and with all birds in sleeked plumage. If a young male persistently tried to intrude and snap in an adult male's territory, the latter would fly with noisy flight between his song perches and chase the intruder with noisy flight. During one such intrusion, the adult male flew with noisy flight to perch just below a White-throated Spadebill (*Platyrrinchus mystaceus*) and there made a few noisy hops from twig to twig, about 60 cm below the spadebill, perhaps mistaking it for the intruding manakin.

DISCUSSION

Our observations show that the Pin-tailed Manakin exhibits typical manakin courtship behavior, having a repertoire of striking, stereotyped postures and movements accompanied by vocal and mechanical sounds. These fulfill important functions in a polygamous mating system in which contact between the two sexes is brief: (1) to attract females to a fixed area by auditory and visual signals; (2) once a female is in the display territory, to indicate the mating perch (by flying to it with noisy flight and displaying there); and (3) to identify the exact position where the female must perch for copulation to be achieved. In their spatial organization, with small groups of males holding adjacent territories in what might be termed "exploded leks," the Pin-tailed Manakins studied by us resembled several other species of manakins, e.g., the Crimson-hooded Manakin (*Pipra aureola*) and the Tiny Tyrant-manakin (*Tyrannetes virescens*) (Snow 1963), and the Blue-crowned Manakin (*Pipra coronata*) (Skutch 1969). This does not exclude the possibility, however, that where Pin-tailed Manakin populations are denser, males may have their display territories closer together. Sick (1967) mentions that he often saw two or three male Pin-tailed Manakins in adjacent trees.

Some elements of the Pin-tailed Manakin's display are similar to elements of the display of other genera. The snap-jump resembles that of *Manacus*, but *Ilicura* differs from *Manacus* in using a horizontal rather than a vertical perch. Although the mechanical wing-noises resemble those made by *Manacus*, *Ilicura* does not show the modification to the secondary feathers seen in *Manacus*, which are apparently used in making the snap, nor does it have thin, stiff outer primaries, which in *Manacus* are almost certainly responsible for the grasshopper-like whirr made in flight. In fact the outer primaries of *Ilicura* are unusually broad at the distal end and narrow at the base. Whereas a whirring sound is always made by an adult male *Manacus* in flight (except during molt of its outer primaries; Snow 1962), male Pin-tailed Manakins evidently can control the production of the sound, indicating that a different mechanism is involved. The most obvious structural modification in *Ilicura*, the elongated central tail feathers, is found elsewhere in the manakins only in *Chiroxiphia*, which also shares with *Ilicura* a red crown patch and performs jumping displays on a horizontal perch (Snow 1963). It is evident that, based on courtship behavior, it is not yet possible to reach any conclusion as to the relationships of *Ilicura* within the family.

SUMMARY

We report observations made in November and December 1983 on the display of the Pin-tailed Manakin (*Ilicura militaris*), a southeast Brazilian endemic genus. Groups of 2-

3 adult males held contiguous display territories, each of which contained a special mating perch. Most displays were performed on or around the mating perch, which was kept clear of encroaching and epiphytic vegetation by regular "gardening." Males advertised their presence in their territories by repeated songs, given at short intervals throughout the day. A repertoire of stereotyped displays served to attract females to the mating perch, mating itself being preceded by ritualized jumps over the female and back. Elements of the courtship displays of the Pin-tailed Manakin resemble those of other manakins, but its relationships within the family are obscure.

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