



## Short Communications and Commentaries

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### Mating System of the Helmeted Manakin (*Antilophia galeata*) in Central Brazil

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The Helmeted Manakin (*Antilophia galeata*), like most manakins (Snow 1956, 1963, Sick 1959, 1967, 1985) is highly dichromatic (see plumage description below), and frugivorous (Marini 1992b), but has a unique distribution (highlands of south-central Brazil). Its sonorous song led Sick (1967, 1985) to believe that the Helmeted Manakin is related to the Cotingidae, and Snow (1975) stated that the genus may be primitive due to its peculiar distribution. Little is known about its mating system and social behavior. We studied aspects of the Helmeted Manakin mating system and speculate on how the mating system could have evolved.

The study was conducted in the "cerrado" (savanna) region of Brazil, near the geographic center of the range of the species, at the gallery forest of the Córrego Capetinga (a creek) in the Ecological Station of the University of Brasília, Brasília, Distrito Federal (15°58'S, 47°56'W). Ratter (1980) described the vegetation of the station. The gallery forest of the Córrego Capetinga has a continuous canopy of 10 to 15 m with occasional 20- to 30-m trees. Ratter (1980) registered 120 species of plants, including 76 trees and large shrubs.

Observations were made from April 1988 to March 1989, mostly in the morning (0630-1300) on a 2.5-ha study plot marked by a grid of 34 points at 30-m intervals. Observations were made for 5 min at each point with a 2- to 3-min interval between points. We made 117.1 h of observations at the points, of which 64.2 h and 52.9 h were during the breeding and non-breeding season, respectively. To help delineate central areas and home ranges, we divided each block into four quadrats of 15 × 15 m, for a total of 136 quadrats in the whole study area. A quadrat was considered to be within a male's central area if the male sang in the quadrat, if the male was seen at least three times engaging in other activities, or if males flew through it between song perches. We defined home

ranges as all quadrats in which an individual was seen at least one time.

We caught birds with mist nets from September 1986 to April 1989. Birds were sexed by plumage and brood patch to distinguish immature males from females. No male maintained the green plumage for two consecutive seasons, but none was banded when in the nest. For this reason, the duration of immature male plumage is unknown. Birds were classified based on the following: (a) adult males had black and red plumage as described above, although some individuals had a few green feathers; (b) subadult males had green plumage mixed with black and red feathers; (c) females and immature males ("green birds") had green plumage with only a few reddish feathers on the body. Of 38 color-marked Helmeted Manakins caught on the study plot, four adult males, three subadult males, one immature male, six females, and seven green birds of unknown sex were observed subsequently on the plot during the study period.

Four banded adult males were observed frequently, which made it possible to delineate central areas (possible territories) and home ranges (Fig. 1A). During our study, only once was an unbanded adult male seen in the study area. The overlap of the central areas of the four males was very small, with only 1.8% of the 54 quadrats being used by more than one male. In contrast the overlap of the home ranges was 16.8% of 95 quadrats used. The central areas of two males were almost entirely contained in the study area. These two males apparently defended these central areas, singing and chasing each other regularly during two years. The central area of male A was approximately 80 × 120 m (0.96 ha) and the central area of male B was approximately 60 × 100 m (0.6 ha) (Fig. 1A).

Of the six confirmed females seen in the study area during the 12-month study, two were observed frequently (female A 18 times and female B 23 times), two were seen nine times each, and two were rarely seen (<4 observations each). The females overlapped the central areas of up to four males during the entire year (Fig. 1). During the breeding season (August 1988-January 1989), however, only two females were seen regularly. Female A was seen 11 times, female

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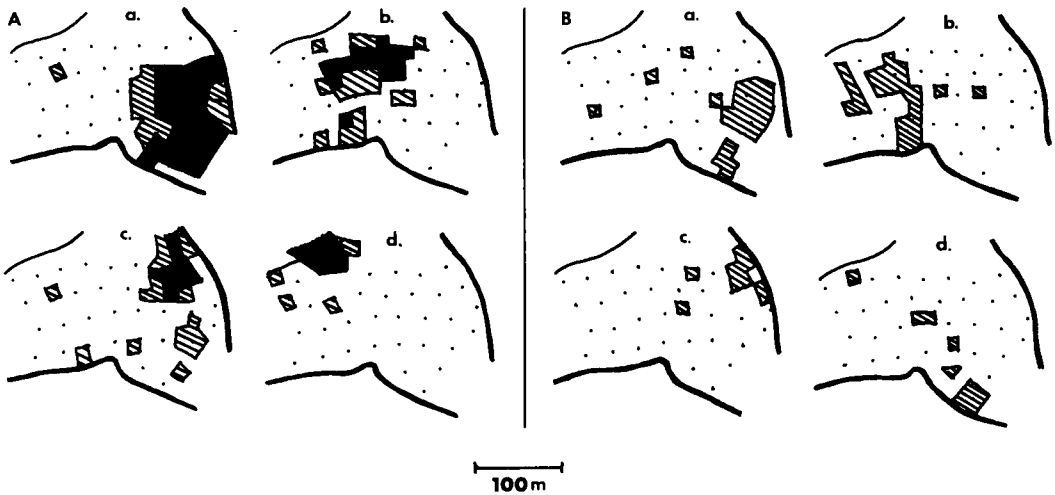


Fig. 1. (A) Central areas (solid areas) and home ranges (cross-hatched areas) of adult males (a, b, c and d) in 2.5-ha study plot. (B) Home ranges (cross-hatched areas) of the four females (a, b, c and d) that were most often seen in the 2.5-ha study plot.

B 13 times, and the four remaining females were seen 4 or fewer times each.

There is some evidence of pair-bond formation between females and adult males, at least during the breeding season. Female A had its home range mostly overlapped by the central area of adult male A (Fig. 1). Of 20 quadrats used by female A, 85.7% were inside or adjacent to the central area of male A. Female A was also observed twice in the same group with male A in May 1988 during the nonbreeding season. The first time they were seen together, the two individuals sang a duet inside male A's central area; they were accompanied by an unmarked green bird. The second time they were together, during the nonbreeding season, they engaged in a group display with another adult male, a subadult male, and two green birds. All six individuals called simultaneously and jumped from twig to twig in the same tree. Female A was seen with an unidentified adult male two times, and male A was seen four times with one unidentified green bird during the 12-month study. Female A was never seen with any of the three other males that defended central areas in the study area. Male A was never seen with any marked female other than female A.

Another possible pair bond occurred between male B and female B. Of the 30 quadrats used by female B, 56.7% were inside the home range of male B (Fig. 1). These two individuals responded together to song (an eight-note piercing whistle) and call ("qua" notes) playbacks two times outside the breeding season (on the same day in March 1989). The male answered by singing and flying in the direction of the speaker, and the female flew and called close to the male. Female B was seen four times with unidentified adult males, and male B was seen with one unidentified green bird twice, inside and close to his central area.

Male B was never seen with any other marked female besides female B. Groups of one unidentified adult male and one unidentified green bird were seen during the whole year throughout the study area.

Several lines of evidence suggest the existence of pair bonding for the Helmeted Manakin. First, there was considerable overlap in the home ranges of a single male and a single female. Second, we observed one male and one female together frequently. Third, we noted responses of pairs with overlapping use areas to song and call playbacks. Finally, observations of groups of one adult male and one green bird throughout the year provide evidence for the hypothesis that the Helmeted Manakin forms pair bonds for at least one reproductive season. The evidence of pair bonds of one male and one female suggests a possibly monogamous mating system.

There are several possible problems with this interpretation. First, the number of individuals observed is small, which limits our ability to generalize to the population. Second, the unidentified green birds seen with adult males may be immature males instead of females, which would mean that immature males may share home ranges with adult males. Third, females may use the central areas of more than one male, which would mean that extrapair copulations may occur. Although extrapair copulations may occur, Wittenberger and Tilson (1980) argued that they do not negate the existence of monogamy. Fourth, the fact that a male and a female were seen together does not mean that they do not have other mates. The first two criticisms are valid. The third criticism seems implausible because other known females were only rarely seen in the males' central areas and were almost never seen during the breeding season.

The Helmeted Manakin's distribution follows the

distribution of the cerrado vegetation (with the bird inhabiting mainly gallery forests), and it does not occur in the Amazonian and Atlantic forests, where the diversity of manakins is high. Besides being the only manakin with sexual plumage dichromatism that occurs mainly in the cerrado region, it is also the only dichromatic manakin with a possibly nonpromiscuous mating system. Perhaps, differences in food availability may exert different selective pressures on manakins in the gallery forests of the cerrado region. However, near the southern edge of its range (in the state of São Paulo), the Helmeted Manakin occurs in the same forest as the Swallow-tailed Manakin (*Chiroxiphia caudata*; Sick 1985), which is promiscuous (Foster 1981). Possibly, in these forests the mating system of the Helmeted Manakin is different from the one observed in the center of its range.

Other possible evidence against a promiscuous system for the Helmeted Manakin comes from the finding of an active nest in September (Marini 1992a), probably of female A, close to the center of male A's central area. We expect that in promiscuous systems the females will nest on sites that are independent of the male's location and, for lekking birds, away from display grounds that are likely to attract attention by predators (Trail 1987).

Sexual plumage dichromatism is not necessarily related to lek-mating systems in the tropics (Höglund 1989). Sexual dichromatism occurs in monogamous tropical passerines such as the *Pipreola* cotingas (Snow 1982), and the Blue Bird-of-paradise (*Paradisaea rudolphi*; LeCroy 1981). The strong sexual selection resulting from lack of male help at nests does not lead necessarily to group displays; some hummingbirds, cotingas and manakins (*Neopelma*, *Tyrannetes* and *Pipra pipra*), for example, have "exploded" leks in which males display solitarily (Snow 1963).

The Helmeted Manakin is similar to other manakins in morphology (Marini 1989), syrinx anatomy (Prum 1989), and nesting characteristics (Marini 1992a), as well as foraging behavior and diet (Marini 1992b). However, it has an unusual geographic distribution, habitat and, possibly, mating system. The possibly nonpromiscuous mating system of the Helmeted Manakin is unusual among the sexually dichromatic manakins and may be related to fruit availability in the gallery forests of the cerrado region. The proposed nonpromiscuity of the Helmeted Manakin should be viewed as a starting point for a discussion of the mating system of this species, and not as a definitive conclusion.

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