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BEHAVIOR AND VOCALIZATIONS OF *GYALOPHYLAX* AND *MEGAXENOPS* (FURNARIIDAE), TWO LITTLE-KNOWN GENERA ENDEMIC TO NORTHEASTERN BRAZIL¹

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Among the least-known members of the large and diverse family Furnariidae are two locally distributed, monotypic genera endemic to northeastern Brazil: *Gyalophylax* Peters (1950) and *Megaxenops* Reiser (1905). In September 1991 and November 1993, as part of an avifaunal survey of Ceará, western Pernambuco, and

northern Bahia, we observed the habitat, behavior, and vocalizations of the Red-shouldered Spinetail (*Gyalophylax hellmayri*) and the Great Xenops (*Megaxenops parnaguae*). Our observations are the most detailed to date on these birds, and allow a more informed elucidation of intra-familial relationships than has been possible in the past.

Terminology for foraging behavior follows Remsen and Robinson (1990). Tape recordings were made with Nagra 4.2 and Sony TCM-5000 tape recorders, and Sennheiser ME-80 shotgun microphones. All tape recordings have been, or will be, archived at the Library of Natural Sounds (LNS), Cornell Laboratory of Ornithology, Ithaca, New York, and the Arquivo Sonoro

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Prof. Elias P. Coelho (ASEC) sound collection, Universidade Federal do Rio de Janeiro, Rio de Janeiro. Sonagrams were produced with "SoundEdit" of Farallon Computing, Inc., Emeryville, California, and "Canary" of the Bioacoustics Research Program at the Cornell Laboratory of Ornithology, Ithaca, New York.

GYALOPHYLAX HELLMAYRI DISTRIBUTION AND HABITAT

Gyalophylax hellmayri is known from 14 localities in northern Bahia and western Pernambuco, and one locality in northeastern Piauí. These include seven localities based upon documented (tape recordings) or well-corroborated non-specimen records.

The first description of the habitat of *Gyalophylax* appears to be that of Vaurie (1980), who reported it as "thick undergrowth in forest and savanna," but did not cite his source. The only first-hand accounts we have found are the brief mention by Sick et al. (1987) that *Gyalophylax* lives "na densa caatinga dos rasos," referring to caatinga at the Raso da Catarina in north-central Bahia, and that of Coelho (1987) who designated it as occurring in caatinga at the Serra Negra Biological Reserve, Pernambuco. We found *Gyalophylax hellmayri* in three localities in Pernambuco (Ouricuri [370 m], Lagoa Grande [350 m], and Petrolina [325 m]), and two localities in Bahia (Canché [270 m] and Jeremoabo [280 m]). The Pernambuco localities are in the most arid, brushy sector of the caatinga, which is on a generally level plain that drains into the Rio São Francisco. There is no permanent source of water away from the Rio São Francisco, and the only temporary supplies of water, in the form of perennial streams and ponds left over from a variable rainy season, are widely scattered. The region was exceedingly dry during late September 1991, slightly less so in late November 1993. According to local people, this is near the middle of the long dry season, which lasts from July to January. Daytime temperatures were approximately 35°C, accompanied by hot winds after late morning. Most of the woody vegetation, consisting principally of tangled, brushy trees less than about 4 m tall, was entirely bare of leaves, and appeared grayish and dead. Scattered emergent trees, which reached heights of 8–10 m and probably had roots extending to the water table, were completely foliated. Perhaps the most conspicuous element of the vegetation was the abundant, large, and terrestrial bromeliad *Bromelia laciniosa* known locally as "macambira." This plant has thin, reddish, slightly rolled, spine-edged leaves usually more than 1 m long, and occasionally in excess of 2 m in length. In the areas we visited, *Bromelia laciniosa* grew in impenetrably dense, irregularly scattered patches beneath leafless trees and, less commonly, in open spots within the caatinga. Rizzini (1979) described five types of caatinga of which his "caatinga arbustiva densa" most closely matches the habitat in which we found *Gyalophylax* in western Pernambuco, and in which the species was recorded at Raso da Catarina, Bahia (L.P. Gonzaga, pers. comm.). This type of caatinga is characterized by tangled, small trees and some cacti (*Cereus* spp., *Pilocereus gounellei*, and *Mellocactus* spp.) and abundant terrestrial bromeliads. Rizzini (1979) also listed some of the dominant shrubs

and trees in the caatinga of western Pernambuco as "faveleira" (*Cnidioscolus phyllacanthus*), "imbuzeiro" (*Spondias tuberosa*), "imburana" (*Bursera leptophloeos*), and "joazeiro" (*Ziziphus joazeiro*). The subfamilies Cesalpinoioideae and Mimosoideae (Leguminosae) are also numerous in the caatinga, especially in the Raso da Catarina region (Guedes 1985; pers. observ.). In areas that we visited around the edge of the Raso, the vegetation was generally sparser (perhaps owing to heavier grazing by goats) and the soil rockier than in the caatinga of western Pernambuco.

BEHAVIOR AND VOCALIZATIONS

We found *Gyalophylax* most consistently in or at the edge of dense patches of *Bromelia laciniosa* (from which the local name for *Gyalophylax*, "maria macambira," [Sick et al. 1987] is derived), but we also observed pairs foraging beneath other dense, woody vegetation, sometimes more than 100 m from the closest patch of *Bromelia*. Beneath the protective cover of bromeliads, the birds foraged primarily on the ground, occasionally ascending to a height of about 10 cm to pick at the bark and stems of woody vegetation. We observed the birds foraging directly in bromeliads on several occasions in which dead leaves caught low between the leaves of bromeliads, or the leaves of the bromeliads themselves, were tapped lightly with the bill, in an exploratory manner. While on the ground, the birds sometimes reached up to pick at something on the base of a bromeliad or other plant, but most of the time foraging activity was directed at the leaf-litter directly on the ground. Arthropods hiding in and under dead, curled leaves on the ground were sought in three ways: tapping and probing leaves with the bill, tossing leaves aside with the bill, and kicking and scratching the leaf-litter with the feet. During terrestrial foraging the head was kept close to the ground, presumably to aid in hearing movements of hidden arthropods and to allow rapid capture of fleeing prey. The tail was held about 30° above the horizontal but not cocked. The birds moved forward in short, low hops of about 7 cm, then inspected dead leaves within reach. Leaves were tapped, then picked up and tossed aside (sometimes brushed or "flaked" aside) frequently. Occasionally the legs and feet were scratched back and forth simultaneously in the same direction for 1 or 2 sec while the bird peered downward to watch and listen for prey items. Small spiders and a small orthopteran were the only identifiable prey items that we saw the birds capture. The head-down, tail-up posture and foot-scratching motion employed by *Gyalophylax* is, we believe, rare within the Furnariidae, but is similar to the foraging behavior of the North American *Pipilo* spp. (Emberizidae). Members of a pair usually foraged close together, and both sexes foraged in the same manner. While foraging, the tail was often jerked slightly but the wings were not flicked or pumped. We did not see *Gyalophylax* interacting with any other birds.

That almost all foraging of *Gyalophylax* was on or very near the ground may have been due in some measure to the exceedingly dry condition of the habitat in the September to November period. At this season, the greatest biomass of potential prey items is probably in the leaf-litter and soil, as there is little foliage, alive or

dead (except high on emergent trees), above this. Observations conducted during the wet season, when leafy vegetation and (almost certainly) prey items are more evenly dispersed through the habitat may reveal that *Gyalophylax* is somewhat more arboreal in its habits than our observations indicate for the dry season. Such considerations as seasonal and spatial fluctuation in prey abundance await more detailed study. It is also possible, however, that *Gyalophylax* is indeed principally a terrestrial forager (as suggested by its strong legs and feet and rather specialized prey-search method), like *Poecilurus scutatus* (Ochre-checked Spinetail; pers. observ.), *P. candei* (White-whiskered Spinetail; D. Stejskal, pers. comm.), and *Synallaxis cinerascens* (Gray-bellied Spinetail) and *S. rutilans* (Ruddy Spinetail; pers. observ.).

Gyalophylax was generally quiet and inconspicuous. We heard songs at irregular intervals through the early morning, usually not more frequently than once every 5 min, and intervals of more than 15 min were common. Through the remainder of the day we heard almost no songs. This paucity of song, when considered in the context of frequency of singing in non-breeding versus breeding seasons for other synallaxines inhabiting seasonally arid regions of South America (pers. observ.), suggests that breeding activity of *Gyalophylax* is low or quiescent during the middle dry season. Playback of recordings of the song or calls elicited only a mildly interested response from the birds, which we believe further indicates a low level of breeding activity at this season. The only reported nest of the species, however, is from October (von Ihering 1914). The nest was found by E. Garbe (a collector at Museu Paulista, São Paulo) who reported that it was a great agglomeration of spines from the cactus called "chique-chique" (*Pilocereus gounellei*). He described it as very distinctive, and one-meter long including the entrance tube ("tubo de entrada"). Garbe collected one of three eggs he found in the nest, describing them as wide and spherical with a smooth, lusterless, light-green surface. von Ihering (1914) did not describe the nest-site, nor whether Garbe collected an adult bird directly associated with the nest.

Sick (1985) provided the only information on the voice of *Gyalophylax*: "bissilábico 'tetrê' ou tchi-krrr' repetido." We observed the birds giving this vocalization and noted that it was often given in a counter-calling pattern between members of a pair, always while the bird was foraging (Fig. 1A). It is often delivered loudly, and seems to function to keep members of a pair in contact when they are not close together, and perhaps as a contact call between neighboring pairs that are otherwise occupied with foraging; it is not a song. This vocalization is basically similar to the two-note vocalizations of several species of *Synallaxis* and *Poecilurus*, although in some of these species it appears to be a song (pers. observ.). In its two-noted structure and rate of delivery, this call of *Gyalophylax* is also similar to the calls of some *Automolus* spp. foliage-gleaners (e.g., *infuscatus* [Olive-backed] and *leucopthalmus* [White-eyed]; Hilty and Brown 1986, pers. observ.). When startled by us or when we squeaked, *Gyalophylax* occasionally uttered a quiet, oscillating scold or mobbing vocalization lasting about 0.5 to 1

sec (Fig. 1B), sometimes ascending low trees to a height of 2 to 3 m while directing their attention at us. Other non-song vocalizations given by *Gyalophylax* were individual short, scratchy notes repeated at irregular intervals while members of a pair foraged in close proximity.

Gyalophylax sang from a slightly elevated perch, usually between 1 and 2 m above the ground in a hidden place below the canopy of bushes and low trees. When singing, the birds adopted a rather vertical posture in which the head was held up and the tail was oriented nearly straight down toward the ground. After delivering one or two songs, the birds hopped down through the tangle of bare limbs and bromeliads to the ground to forage. The song is a far-carrying series of very closely spaced notes at about 2.5 kHz lasting 3.5 to 4.5 sec. This series begins with five or six notes delivered just slowly enough to count, then rapidly accelerates as it trails off in intensity toward the end. In addition, the song is usually introduced with one to four quiet, relatively widely spaced, slightly lower-pitched notes with a more scratchy quality (Fig. 1C).

Our observations suggest that *Gyalophylax* is sexually dichromatic to a degree greater than is usual within Furnariidae (pers. observ.). Each of seven pairs (observations in both September and November) consistently displayed three conspicuously dichromatic characteristics: depth of hue of gray and black body plumage, brightness of red wing coverts ("shoulders"), and iris color. This, together with the fact that we never encountered more than two individuals together, each of which always foraged completely independently of the other (i.e., no food-begging or vocalizations solicitous of food), suggested that we observed male-female pairs. We noted that one member of a pair had deeper charcoal tones in the plumage, a blacker throat, considerably brighter red on the shoulders, and red or deep-orange eyes, while the other was paler gray throughout the head and body, with duller throat and shoulders, and bright-yellow or pale-orangish eyes. We observed both morphotypes singing. Clearly, careful analyses of collected specimens are needed to explore this situation.

INTRA-FAMILIAL COMPARISONS

The Red-shouldered Spinetail was originally described as *Synallaxis griseiventris* Reiser (1905), but Reiser quickly realized that the name was preoccupied, and renamed the species *S. hellmayri*. Cory and Hellmayr (1925) moved *hellmayri* to *Asthenes* stating that "This species which has no near ally is a typical *Asthenes*, both the type and our specimens possessing twelve rectrices." Peters (1950) erected the monotypic genus *Gyalophylax* for the species *S. hellmayri* on the basis of its twelve (rather than eight or ten) rectrices, "much stouter" legs and feet, and "very peculiarly shaped bill." H. Sick (in litt. to F. Vuilleumier; Vaurie 1980) related that "as I saw [*Gyalophylax hellmayri*] for the first time, I thought of an *Asthenes*. As I held it in the hand I saw that it was very different from both genera [*Synallaxis* and *Asthenes*]. Peters was just correct to call attention on this." Among the members of *Synallaxis*, the song of *Gyalophylax* is much more similar to the song of *hypospodia* (Cinereous-breasted Spinetail; Fig.

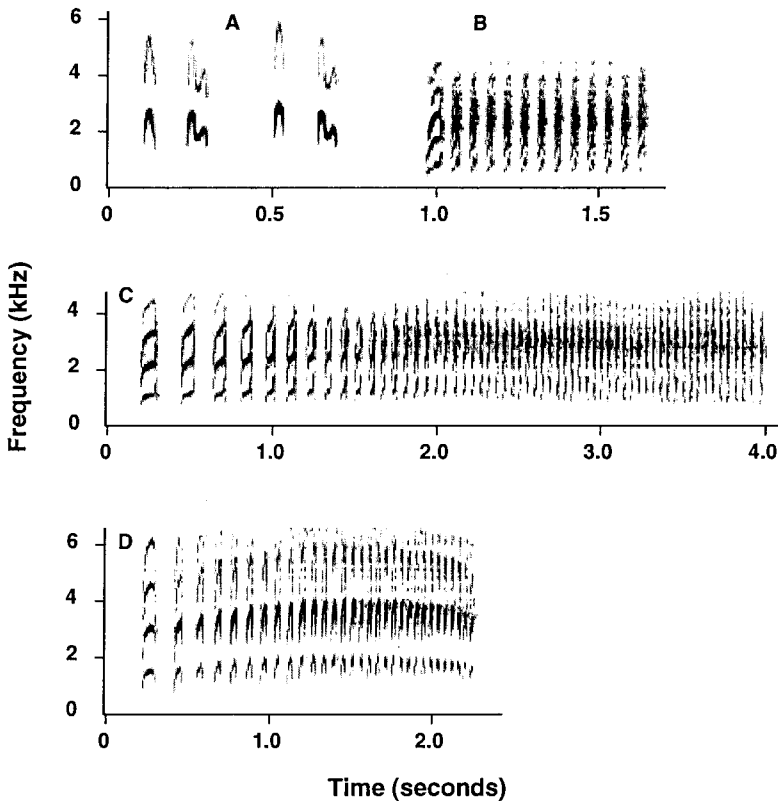


FIGURE 1. Vocalizations of *Gyalophylax hellmayri* and *Synallaxis hypospodia*. (A) Bisyllabic pair-contact call of *G. hellmayri* (recorded by J. L. Rowlett near Petrolina, Pernambuco, 23 Sept. 1991). (B) Scold or mobbing vocalization of *G. hellmayri* (same locality, 23 Nov. 1993). (C) Song of *G. hellmayri* (same locality, 23 Sept. 1991). (D) Song of *S. hypospodia*; compare with 1C, which differs primarily in being about twice as long (recorded near P. N. Brasília, D.F., Brazil, 02 Jan. 1987). All recordings except (A) by Whitney.

1D; compare with Fig. 1C) than that of any other species (pers. observ.). Among the *Asthenes*, it is much more closely approached by a song of *Asthenes steinbachi* (Chestnut Canastero, of the Andes of northwestern Argentina) than any other species (pers. observ.). In our opinion, the closest relatives of *Gyalophylax* are to be sought among the members of *Synallaxis* rather than *Asthenes*.

We suggest that *Synallaxis hypospodia* is perhaps the synallaxine most similar to *Gyalophylax* both vocally and morphologically, having dark, relatively blunt-tipped rectrices broader than in any other *Synallaxis* (Vaurie 1980) as well as overall dark plumage highlighted by entirely rufous wing-coverts. *S. hypospodia* is a poorly known species inhabiting seasonally dry, brushy savanna (a habitat patchily distributed through the cerrado of central Brazil) from southeastern Peru and northeastern Bolivia across south-central Brazil to northeastern Brazil (pers. observ.; Vaurie 1980). Like *Gyalophylax*, *S. hypospodia* stands a measure apart from other "*Synallaxis*" in its morphology and known vocalizations, which begs the question of the monophyly of *Synallaxis*. In spite of the similarity in vo-

calizations of *Gyalophylax* and some synallaxines mentioned above, and the arguments for submerging *Gyalophylax* under *Synallaxis* presented by Vaurie (1971, 1980), we recommend retention of the monotypic *Gyalophylax* for the generally distinctive species *hellmayri* until more comparative information on some other synallaxines (including the northern members of the genus *Poecilurus*) and a well-corroborated phylogeny for the Synallaxinae become available.

MEGAXENOPS PARNAGUAE DISTRIBUTION AND HABITAT

The known distribution of *Megaxenops parnaguae* has been greatly amplified very recently, primarily owing to the work of Mattos et al. (1991) in northern Minas Gerais. The current distribution is reported in Collar et al. (1992), who also summarized the habitat of *Megaxenops* as ranging from gallery woodland and semi-deciduous forest to caatinga.

We observed approximately ten *Megaxenops* in the Floresta Nacional da Chapada do Araripe, in fairly dense woodland as described for this area by Willis (*in* Vaurie 1980), at about 915 m elevation. We found

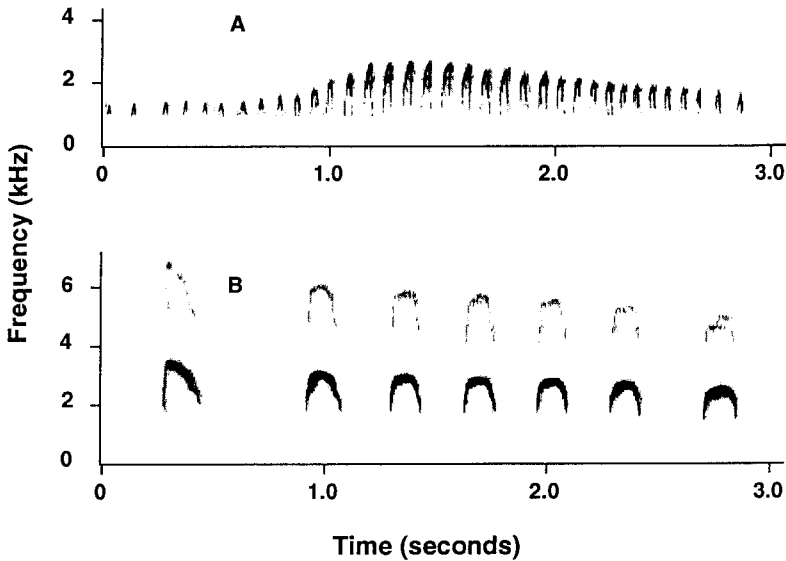


FIGURE 2. Vocalizations of *Megaxenops parnaguae*. (A) Song delivered at intervals of 10 to 15 sec. soon after first light. (B) a typically sharp, loud, "peeyk!" call followed by a pause, then a descending series of more rounded notes. The sharpness of the first call (vertical left edge) probably indicates a very sudden opening of the syrinx. Both recordings from Chapada do Araripe, Ceará, 20 Sept. 1991.

most of the birds in places where trees were about 5–12 m tall (few trees with trunks greater than about 50 cm diameter at breast-height) and growing on poor, very sandy soil. Woody vines with fissured bark up to approximately 8 cm in diameter were abundant and these, in conjunction with the many thin trunks of the woodland trees, made for a generally dense, tangled growth in the understory and midstory. Epiphytic growth was sparse. Our observations were conducted primarily in mid-September, during the middle of the dry season. Although the general region was quite dry and some deciduous trees were bare, the majority of the trees and shrubs were completely foliated. This woodland is very different from the dry caatinga brush and woodland that occurs in the lower region around the base of the Chapada, where we did not find *Megaxenops*.

BEHAVIOR AND VOCALIZATIONS

Megaxenops foraged primarily in pairs with mixed-species flocks of other insectivores, but on at least two occasions we encountered individuals that did not seem to be associated with other birds. Whether as members of mixed-species flocks or solitary, *Megaxenops* searched for food mostly between about 3–8 m above ground, moving along limbs and vines with short hops or hitching motions ("hitching" defined as the sideways movement of one foot followed immediately by the other producing short advances of less than about 2 cm, or the distance between the legs when perched normally) or in short flights between limbs or adjacent trees. The birds foraged primarily in the outer two-thirds of trees, less often close to the trunk. We never observed *Megaxenops* directly on the trunk of a tree

at a point where it was greater than about 8 cm in diameter. While hopping along limbs and vines the birds maintained a head-up attitude; we did not observe *Megaxenops* move down a vertically inclined substrate. Hitching along a limb or vine usually was done with the head and body parallel to the substrate, while hopping usually was accomplished with the body perpendicular to the substrate, and often was accompanied by reversing the head and body orientation 180° in mid-air. During routine foraging the wings were not moved; the tail, however, was jerked up and down through about 45° frequently, but at irregular intervals. The tail was oriented in roughly the same plane as the substrate and, as has been reported by other observers recently, it was not used for support.

Megaxenops employed a variety of prey-attack behaviors including both surface maneuvers such as gleaning and hanging, and subsurface maneuvers such as probing, pecking, hammering, and prying. All attacks were directed at the bark of limbs and vines that usually were between about 2–10 cm in diameter; we did not observe *Megaxenops* foraging in foliage. As noted by Willis (*in* Vaurie 1980), *Megaxenops* paid particular attention to the dead or broken ends of stubs. The birds sometimes spent as much as 1 min pecking at such a place or pecking and (more rarely) hammering at small knot-holes or crevices in the bark of a limb. Sometimes these behaviors caused tiny pieces of the substrate to be dislodged and fall to the ground. Foraging attacks usually were accomplished with the head and body oriented above the substrate, but occasionally birds hung beneath limbs to probe or peck into crevices in the bark. *Megaxenops* most frequently foraged, however, by probing and prying bark. Just as

described by Willis (*in* Vaurie 1980), the bill was inserted under loose bark then pried upward while the bird watched for arthropods beneath. The bark was not flaked loose from the tree or vine during these rather gentle prying motions, and an individual *Megaxenops* rarely spent more than a few seconds investigating any particular piece of bark. Prey items we were able to see were two whitish grubs that appeared to be beetle larvae less than 1 cm long that were found beneath pried bark, and a small arthropod that was gleaned from the upper surface of a limb. All of these were swallowed quickly.

Willis (*in* Vaurie 1980) provide the following statement on the vocalizations of *Megaxenops*: "It had some loud calls and songs more like those of a *Sclerurus* than those of a *Xenops*." Teixeira et al. (1993) reported the only substantive description of the voice of *Megaxenops*: three or four powerful, descending notes have the quality of a *Furnarius* (hornero): "kaak, kaak . . ." ending with a guttural, closed-off "grô-grô" that is sometimes given by itself in the manner of a call.

Megaxenops seems to have a rather extensive vocal repertoire. On clear mornings in late September, *Megaxenops* began singing soon after first light. One individual that was monitored for several minutes delivered a song once every 10–15 sec. The song is a bubbling series of closely spaced notes at about 1.5 to 2 kHz that begins quietly then rapidly loudens as it rises and slows slightly through the middle, then accelerates as it trails off at the end, the whole lasting about 3 sec (Fig. 2A). The most common call is a sharp, loud note at about 3.5 kHz sounding something like "peeyk!" One or two of these calls are sometimes followed by a brief pause then a slightly descending series of three to six less penetrating, evenly spaced notes (Fig. 2B), in a pattern similar to some *Furnarius*, some *Phacellodomus*, and a few other furnariids (possibly the vocalization described by Teixeira et al. 1993). *Megaxenops* also occasionally delivers a duet in which one bird begins with the descending series of notes described above and the other joins in with a long, steady chopping series of more closely spaced notes. We also recorded several distinctive variations on the basic theme of the song, some of which were heard only in response to tape playback.

When presented with playback of tape recordings of the calls or songs (i.e., artificially stimulated), *Megaxenops* usually responded aggressively by flying in to perch near the tape recorder, erecting the feathers of the head and neck to some extent, and sometimes moving the wings in a rapid, high flick over the back in the manner characteristic of several other groups of furnariids such as (among others) *Syndactyla*, *Philydor*, *Automolus*, and *Sclerurus* (pers. observ.). In the context of performing these actions, *Megaxenops* often delivered a long, stuttering series of notes that, after several minutes, began to approximate the natural song.

INTRA-FAMILIAL COMPARISONS

Megaxenops, with its large size, unstreaked, bright-rufous plumage, and pinkish (pers. observ.), *Xenops*-like bill, is a highly distinctive bird not obviously closely related to any other furnariid. Superficially, the morphology and foraging behavior of *Megaxenops* seem most close-

ly matched by *Xenops* spp., *Pygarrhichas albogularis* (White-throated Treerunner) of the *Nothofagus/Arcaucaria* forests of southern South America, and *Heliobletus contaminatus* (Sharp-billed Treehunter) of the subtropical forests of southeastern Brazil, all of which have bills specialized for bark foraging (pers. observ.). All modern taxonomic works have placed these four genera together near the end of the Furnariidae. We suspect, however, that the peculiar bill shape (and concomitant foraging behavior) shared by some of these taxa may not be the result of convergence. The four genera show no particular similarity in their vocalizations, with *Megaxenops* the most distinctly different (*Xenops* and *Heliobletus* seem to be the most similar to each other; pers. observ.). The high wing-flick and to a lesser extent the shape of the bill and foraging movements of *Megaxenops* find parallel in the species of *Syndactyla* and *Simoxenops*. However, *Syndactyla* is characterized by close uniformity of calls and songs across its four or five members (pers. observ.), and the two species of *Simoxenops* likewise share very similar vocalizations (Parker et al. 1992); the vocalizations of *Megaxenops* seem quite different from both.

The movements and foraging behavior of *Megaxenops* reminded Teixeira et al. (1989, 1993) of "other arboreal Furnariidae like *Automolus* and *Philydor*." Although no such general similarity is apparent to us, we can suggest some other parallels between *Megaxenops* and *Philydor*. The plumage of *Megaxenops* is unstreaked and the underparts are entirely orange-rufous, characters that, among the Philydorinae, are shared only by some of the members of *Philydor*. The high wing-flick of *Megaxenops* is shared by some, perhaps all, of the species of *Philydor*. The song of *Philydor pyrrhodes* (Cinnamon-rumped Foliage-gleaner), one of the brightest-rufous members of the family, is similar in quality and in its overall pattern (rise and fall) to that of *Megaxenops*, although it consists of a much faster and longer series of notes. Additionally, the dry woodlands of interior northeastern Brazil inhabited by *Megaxenops* are perhaps the only extensive (historically) tropical woodlands in South America not occupied by any member of *Philydor* (pers. observ.). Although the evidence is not very convincing, it seems plausible to us that *Megaxenops* branched off of *Philydor*, and that its unusual bill might reflect heightened modification of foraging on endophytic arthropods in the seasonally dry habitats of northeastern Brazil. Elucidation of the relationships of *Megaxenops paraguayae* beyond this point will probably require a thoroughly tested molecular-based phylogeny for the Furnariidae, but the above considerations may at least provide some reference for the focus of such work.

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