

Molecular systematics and taxonomic revision of the Amazonian Barred Woodcreeper complex (*Dendrocolaptes certhia*: Dendrocolaptidae), with description of a new species from the Xingu–Tocantins interfluve

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The Barred Woodcreeper (*Dendrocolaptes*⁵ *certhia*) is a polytypic species with its taxa distributed throughout the Amazonian lowlands, with an isolated population in the northeastern Brazilian Atlantic Forest. Currently six subspecies are recognized (Marantz *et al.* 2003), and some authors (Peters 1951) have treated one of these subspecies (*D. c. concolor*) as a species level taxon, while others have interpreted some taxa as merely representing hybrid swarms (*D. c. polyzonus* and *D. c. ridgwayi*; Zimmer 1934, Marantz *et al.* 1997, Marantz *et al.* 2003). Despite the overall morphological and vocal similarity among these taxa, a previous preliminary molecular study found *D. c. radiolatus* and *D. c. concolor* to diverge from each other as much as or more than either does from *D. c. certhia*'s sister species (*D. sanctithomae*), suggesting that the complex, as currently defined, may include more than a single species (Marantz *et al.* 2003). Consistent with this finding, a molecular phylogeny (Fig. 1) showed the existence of seven reciprocally monophyletic groups in the polytypic *D. certhia*. Each of these groups corresponds to an already named taxon, except one group that includes birds from the Xingu – Tocantins interfluvium, which had been considered until now a hybrid swarm between *D. c. concolor* and *D. c. medius* (Zimmer 1934, Marantz *et al.* 2003; Fig. 2). Since no valid name is available for birds from this morphologically cryptic but genetically diagnosable group, we propose to name it as:

Dendrocolaptes retentus

Xingu Woodcreeper

arapaçu-barrado-do-xingu (Portuguese)



Holotype.— Museu Paraense Emílio Goeldi (MPEG) 71346, skin, female, ovary 8 × 3 mm, collected in the understory of *terra firme* forest in Brazil, state of Pará, municipality of Melgaço, Floresta Nacional de Caxiuanã (01°44'S / 51°27'W) by a MPEG team (AA, M. P. D. Santos, and G. Thom) on 27 November 2010, and prepared under field number PGZOO 009. Pectoral muscle tissue preserved in approximately 96% alcohol: MPEG 71346, field number PGZOO 009. Hologenotype (Chakrabarty 2010) sequences of the mitochondrial genes cytochrome *b* (1,076 pb) and NADH subunit 2 (1,041bp) deposited in GenBank (accession numbers KC874976 and KC815111, respectively).

Diagnosis: Morphology.— Alphanumeric color designations determined through direct comparison with Smithe (1975). The new species belongs to the weakly barred group in the *D. certhia* com-

plex (along with *D. concolor* and *D. ridgwayi*), even though it is sister to *D. medius* (Fig. 1) included in the barred group (Marantz and Patten 2010), from which it differs by the more discrete and narrow barring of the head and belly and a pale pinkish buff (color 121D) rather than chamois (color 123D) throat. Even though not sister to either of the other weakly barred taxa *D. concolor* and *D. ridgwayi* (Fig. 1), the new species is morphologically closest to *D. ridgwayi*, from which it also differs by throat color (pinkish buff rather than smoke gray [color 44]) and noticeably brighter yellow ocher (123C) instead of paler clay color (123B) submarginal edges of head stripes. **Genetic divergence** – Separated from its sister-taxon *D. medius* by 0.7% sequence divergence in the mitochondrial genes cytochrome *b* and NADH subunit 2. Based on these two genes, both *D. retentus* and *D. medius* diverge from their sister group (*D. ridgwayi*) by 0.9% (Fig. 1).

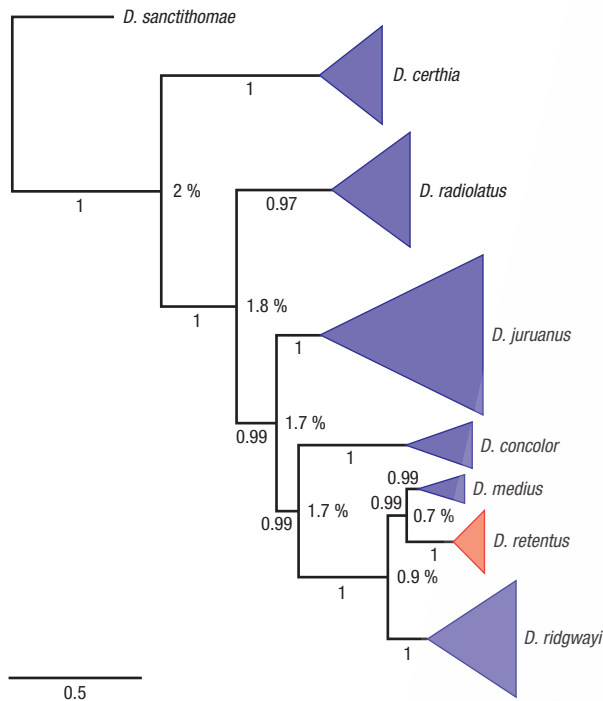
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⁵ Genus *Dendrocolaptes* 8: 419.



Distribution.— *Dendrocolaptes retentus* has been documented from several localities in the Xingu-Tocantins interfluvium (i.e. Xingu area of endemism; *sensu* Silva *et al.* 2005) in the Brazilian state of Pará. Its distribution is thus bounded to the north by the Amazon River, to the west by the Xingu River and to the east by the Tocantins River. To the south available records extend as far as Santana do Araguaia, near the borders of the states of Pará and Mato Grosso (Somenzari *et al.* 2011).

Description of holotype.— See color illustration. Alphanumeric color designations determined through direct comparison with Smithe (1975). Head with stripes having bright yellow ocher (123C) subterminal bands adjacent to sepia (119) edges. Throat pale pinkish buff (121D). Chest and belly cinnamon (123A). Throat, chest, and belly with narrow cinnamon brown (33) bars. Primaries, secondaries, and wing coverts unmarked and warm sepia (221A) in color. Unmarked prout's brown (121A) back. Rump chestnut (32). Rectrices essentially concolor with rump. Tail graduated, each rectrix with a stiff shaft, softer at the tips. **Soft parts in life:** Iris brown. Maxilla dark brown; mandible dark brown; tarsi and feet light brown. **Measurements of holotype:** wing 127 mm, tail 128 mm, tarsus-metatarsus 25 mm, bill length from anterior edge nares 30 mm, bill height at anterior edge nares 8 mm, and bill width at anterior edge nares 10 mm.

Etymology.— The Latin term *retentus* (from the verb *retineo*), translated into English as restrained, delayed or repressed, is used to name the new taxon to highlight its mistaken treatment (along with taxon *ridgwayi*) as an introgressed population (based on overall plumage intermediacy) between, respectively, weakly barred and barred subspecies *D. c. concolor* and *D. c. medius*. The genetic data show not only both *D. retentus* and *D. c. ridgwayi* as independent and reciprocally monophyletic lineages (supporting their treatment at least as separate evolutionary species), but also that weakly barred and barred taxa of *D. certhia* are polyphyletic (Fig. 1), thus demonstrating that degree of barring is not a useful taxonomic character for this group.

REMARKS

Type series.— Paratypes of *Dendrocolaptes retentus* are the following three specimens: MPEG 70633: skin, adult female, ovary 9×4 mm, collected in *terra-firme* forest by a MPEG team (S. M. Dantas, E. Rodrigues, L. E. Araújo-Silva, M.S. Facio) on 5 August 2010 at Carajás, Projeto Salobo, Área Controle, state of Pará, Brazil ($05^{\circ}46'16''S / 50^{\circ}33'09,5''W$), under field number SLB 106; tissue sample deposited at MPEG and mitochondrial cytochrome *b* and NADH subunit 2 sequences deposited in GenBank (accession numbers KC874977 and KC815112, respectively). MPEG 69964: skin, adult male, testes

12×6 mm, collected by L. S. Carneiro in June 2009, at Marabá, state of Pará, under field number MAR 012; tissue sample deposited at MPEG and mitochondrial cytochrome *b* and NADH subunit 2 sequences deposited in GenBank (accession numbers KC874978 and KC815114, respectively). MZUSP 82177: skin, adult male, skull ossification and testes size not recorded, collected in the understory of *terra firme* forest at Brazil, state of Pará, municipality of Santana do Araguaia, Fazenda Fartura ($9^{\circ}47'S / 50^{\circ}25'W$) by MZUSP team (LFS, V. Piacentini, M. Somenzari, L. Novaes and R. Marcondes) on 20 January 2009, and prepared under field number 72; tissue sample deposited at MZUSP (82177) and mitochondrial cytochrome *b* and NADH subunit 2 sequences deposited in GenBank (accession numbers KC874979 and KC815116, respectively).

Ecology and behavior.— *Dendrocolaptes retentus*, like other members of the *D. certhia* complex, forages alone or in pairs in all strata of primary and disturbed *terra firme* and foothill forests, often along forest edge, and in association with army-ant swarms and mixed-species flocks, sometimes venturing into seasonally flooded *várzea* forest. Individuals typically forage by hitching along tree trunks and branches, where they strike for arthropods and small invertebrates in the air and on the surface of foliage and bark. Its nest and eggs remain unknown.

Vocalizations.— The loudsong of *D. retentus* seems not to differ constantly from those of other taxa in the *D. certhia* complex, even though a careful quantitative analysis has yet to be done.

Phylogenetic relationships.— DNA sequence data for the mitochondrial genes cytochrome *b* (*cyt b*, 1016 base pairs) and NADH subunit 2 (ND2, 1045 base pairs) were obtained for 73 individuals (see Table 1 in SI file for a list of specimens sequenced) of all taxa currently grouped under the polytypic *Dendrocolaptes certhia* (*sensu* Marantz *et al.* 2003; i.e., *certhia*, *radiolatus*, *juruanus*, *polyzonus*, *concolor*, *ridgwayi*, and *medius*; Fig. 2). Trees were rooted in *Dendrocolaptes sanctithomae*, which is the sister-species of the polytypic *Dendrocolaptes certhia* (Derryberry *et al.* 2011; Fig. 1). The phylogeny estimated by Bayesian inference recovered with high statistical support a topology whereby seven main lineages not corresponding entirely to current subspecific limits within the polytypic *D. certhia* were found (Fig. 1). The first clade includes specimens from the Guiana area of endemism (*sensu* Silva *et al.* 2005), i.e., east of the Negro / Branco rivers in Brazil, Venezuela, Guyana, Suriname, and French Guiana, and attributable to the nominate form. The second clade groups specimens from between the Negro and the northern bank of the Amazon / Solimões in Brazil, Colombia, Ecuador, Peru, and Venezuela and to which the name *radiolatus* applies. The third clade consists of birds distributed west of the Madeira and south of the Amazon / Solimões rivers

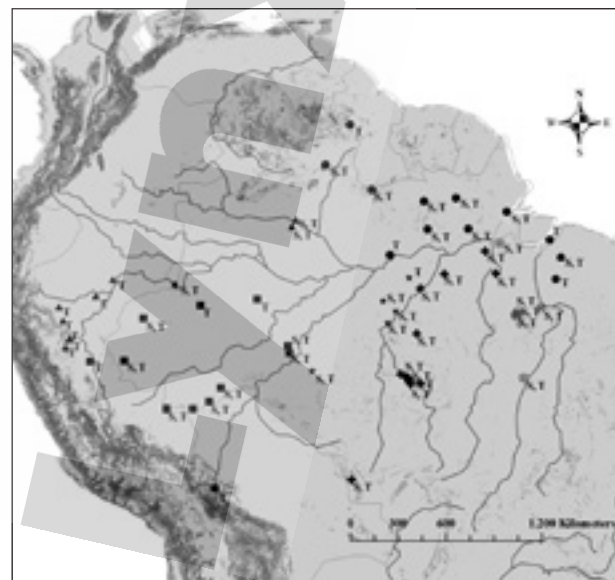


Figure 1. Phylogenetic relationships within the *Dendrocolaptes certhia* complex recovered by Bayesian analyses based on sequences of the mitochondrial genes cytochrome *b* (1076 bp) and NADH subunit 2 (1041bp). Numbers refer to posterior probabilities values and genetic distances (% of average uncorrected *p* sequence divergence) between sister groups associated with the labeled nodes. High support values (i.e., equal and above 0.95) associated with nodes grouping samples of *certhia*, *radiolatus*, *juruanus*, *concolor*, *ridgwayi*, *retentus*, and *medius* in reciprocally monophyletic clades are consistent with their recognition as species level taxa.

Figure 2. Geographic distribution of specimens, and tissues of *Dendrocolaptes certhia* taxa analyzed in this study. Dots = *certhia*; triangles = *radiolatus*; squares = *juruanus*; stars = *concolor*; crosses = *ridgwayi*; encircled x = *retentus*, and pentagons = *medius*. Letters next to a symbol represent material available for that given locality: "S" = skins only; "T" = tissues only; "S,T" = skins and tissues.

to the foothills of the Andes in Brazil, Bolivia, and Peru, which are attributed to *juruanus* (all samples of *polyzonus* clustered together with *juruanus* in this clade, the latter name with priority). The fourth clade groups birds inhabiting the Madeira – Tapajós interfluvium in Brazil and Bolivia, to which the name *concolor* is applied (type locality Borba; Peters 1951). The fifth clade includes birds south of the Amazon, east of the Tapajós, and west of the Xingu rivers, and to which the name *ridgwayi* is correctly applied (type locality Santarém; Peters 1951). The sixth clade groups birds restricted to the central and northern portions of the Xingu – Tocantins interfluvium, which are currently placed under *concolor* and thought to represent a hybrid swarm between the latter taxon and *medius* (Marantz 1997, Marantz *et al.* 2003, Marantz and Patten 2010). The obtained molecular data do not support a hybrid status for this population, neither for that attributable to *ridgwayi* (Fig. 1), which has also been submerged under *concolor* based on the same argument of representing a hybrid swarm (Marantz 1997, Marantz *et al.* 2003, Marantz and Patten 2010). Hence, the fact that *ridgwayi* and the neighboring population endemic to the Xingu – Tocantins constitute non-sister, independent, and reciprocally monophyletic lineages separated by 0.9% of uncorrected sequence divergence from each other, and 1.7% from the taxon under which they have been submerged (*concolor*), argues for their validity as distinct taxa, supporting the recognition of the former group (for which no previous name is available) as a new taxon (*D. retentus*). Finally, the seventh clade includes specimens from east of the Tocantins and south of the Amazon rivers, and to which the name *medius* applies (type locality Benevides in the Belém metropolitan area; Peters 1951). Thus, based on the reciprocal monophyly and phenotypic diagnoses of these taxa, we recommend the recognition of seven species and vernacular names in the *D. certhia* complex: Amazonian Barred Woodcreeper (*D. certhia*; distributed on the Guianan shield north of the Amazon and east of the Negro River in Venezuela, Brazil, Guyana, Suriname, and French Guiana); Napo Woodcreeper (*D. radiolatus*; found west of the Negro River in Amazonian Brazil and Venezuela westward towards the base of the Andes in Colombia, Ecuador, and Peru north of the Amazon / Solimões rivers); Juruá Woodcreeper (*D. juruanus*; distributed west of the Madeira and south of the Amazonas / Solimões rivers in Amazonian Brazil and towards the base of the Andes in Bolivia and Peru); Plain-colored Woodcreeper (*D. concolor*; found in the Madeira – Tapajós interfluvium in Amazonian Brazil south to northern Bolivia in Dept. of Santa Cruz); Ridgway's Woodcreeper (*D. ridgwayi*; distributed in the Tapajós – Xingu interfluvium in Amazonian Brazil); Xingu Woodcreeper (*D. retentus*; occurring in the Xingu – Tocantins interfluvium in Brazil); and Todd's Woodcreeper (*D. medius*; found east of the Tocantins River in Pará towards western Maranhão, with an isolated population in the Brazilian states of Alagoas and Pernambuco).

Conservation.— *Dendrocolaptes retentus* is generally fairly common in its preferred habitat (primary upland *terra firme* forest), but tolerates some degree of disturbance, being found in secondary and logged forests as well. It occurs in some conservation units, e.g. Floresta Nacional de Caxiuanã (Silva and Pimentel Neto 1997); Floresta Nacional de Carajás (Pacheco *et al.* 1997, Aleixo *et al.* 2012), and Floresta Nacional Tapirapé-Aquiri (Pacheco *et al.* 1997). Nevertheless, it has one of the most restricted global populations of any species in the genus *Dendrocolaptes*, being endemic to one of the most heavily anthropogenically affected parts of Amazonia (the Xingu area of endemism) which has already lost 60% of its primary forest cover over the past 40 years (Bird *et al.* 2012). Based on a comparison with a species in the same family sharing a similar distribution (*Hylexetastes brigidai* - Dendrocolaptidae), *D. retentus* is expected to suffer a reduction of at least 40% in its current extent of occurrence in the next 15 years (3 generations; Bird *et al.* 2012). Much of this species' distribution is threatened by the expanding agricultural frontier (particularly cattle ranching and soybean plantations) and hydroelectric schemes; these and other infrastructure improvements (such as road-paving) may catalyze forest loss and hence imperil this and many other en-

demically *terra-firme* species within the interfluvium unless adequate government controls on deforestation are enforced. Based on past and predicted future forest loss, fragmentation and degradation within its limited range (cf. Bird *et al.* 2012) this species is likely to qualify for Vulnerable status on the IUCN Red List and the Brazilian National List of Endangered Species, currently under revision.

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