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ON THE GEOGRAPHIC DISTRIBUTION OF THE RED-HANDED HOWLING MONKEY, *ALOUATTA BELZEBUL*, IN NORTH-EAST BRAZIL

The red-handed howling monkey, *Alouatta belzebul*, has a wide geographic distribution which includes a large part of the lower Amazon, south of the Rio Amazonas, in the states of Amazonas, Pará, and Maranhão, and also North-east Brazil (Hill, 1962; see also Hirsch *et al.*, 1991). Langguth *et al.* (1987) and Bonvicino *et al.* (1989) reviewed the distribution of this species and the sparse information available regarding the non-Amazonian part of its range. They listed records for the coastal regions of the states of Ceará, Paraíba and Alagoas (Fig. 1), and indicated that the original range also included Piauí, Rio Grande do Norte, and Pernambuco, and that the southern limit to the Atlantic forest population was the Rio São Francisco. They argued that the similarity in pelage

coloration with Amazonian populations of *A. b. belzebul* indicates that the connections between the now disjunct populations were through the interior, western portions of these states as well as along the coast. Since these reviews, further, very small, remnant populations have been recorded for the states of Pernambuco and Rio Grande do Norte, again near the coast (Fig. 1). Due to the widespread and almost total destruction of the Atlantic forest of North-east Brazil information concerning the extent of its non-Amazonian distribution is extremely scarce and difficult to obtain.

The first reference to *A. belzebul* was by Marcgrave (1648) who obtained specimens from rain forest in the state of Pernambuco. Two-hundred and sixty-six years later, Marcgrave (1648) was probably the source that led Ihering (1914) to give the Rio São Francisco as the southern limit to its distribution, besides the fact that extensive rain forest still existed along the coast of Alagoas at the beginning of the century. Ihering's (1914) supposition was endorsed by Hill (1962) who, lacking further concrete information however, merely placed an arrow on the distribution map for the genus (opposite p.136), which extended the range of *A. b. ululata*, otherwise known from coastal Maranhão.

As was recorded by Ihering (1914) and Bonvicino *et al.* (1989), Burmeister (1854) registered the distribution of the brown howling monkey, *A. fusca*, as extending north in the Atlantic forest as far as the Rio São Francisco. The presence of gallery forests along the tributaries of the Rio São Francisco in the 16th Century would indicate that both species extended well inland, and that a large part of the basin was occupied by howling monkeys: *A. fusca* along its right margin and *A. belzebul* along its left margin. *A. fusca* is extinct throughout a large part of Bahia, with very small populations possibly still surviving only in the southernmost regions of the state, but in the past it undoubtedly occupied gallery forests and forests along the slopes of the mountain ranges inland, from the coast as far west as the Rio São Francisco, in regions which are today characterized by semi-desert scrub.

The survival of *A. belzebul* in North-east Brazil was first documented during an expedition of Olivério Pinto to Alagoas in 1967, when two specimens were collected in the forest of the Usina Sinimbu, although this fact was only recorded in 1981 by Silva (p.899). Nearly a decade later, Paiva (1973, 1974) referred to the existence of howling monkeys in Ceará, but confused *A. belzebul* with the black howling monkey, *A. caraya*, typical of central and southern Brazil. Coimbra-Filho and Maia (1979) were also mistaken

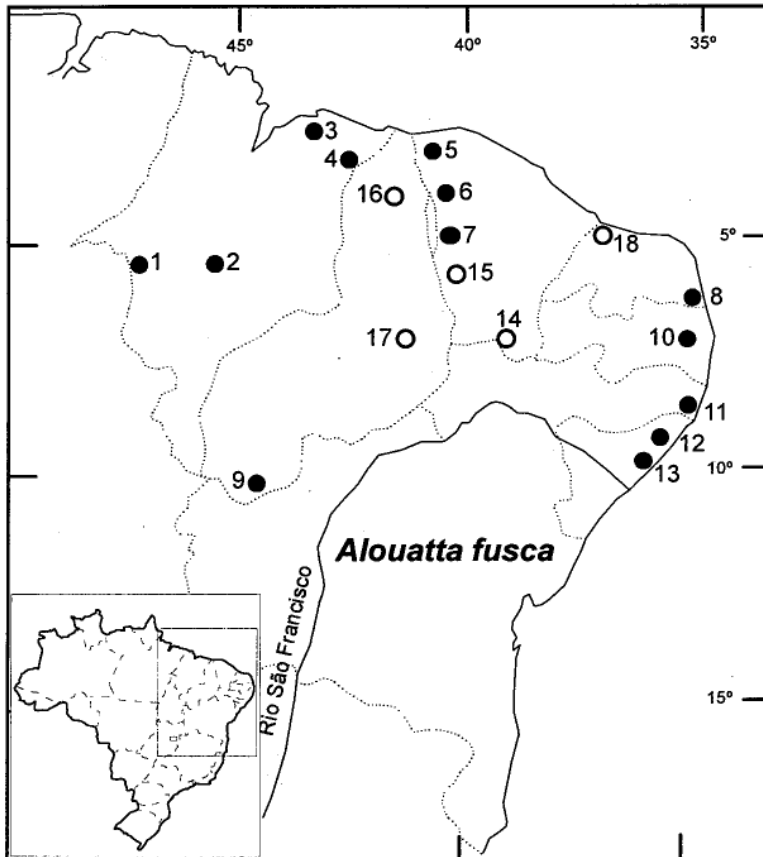


Figure 1. Confirmed (closed circles) or supposed (open circles) localities for *Alouatta belzebul* in the north-east of Brazil. The distribution of *A. fusca* is believed to have included the entire area south of the right margin of the Rio São Francisco. The localities marked with an open circle are those which have the name of "Guariba" or "Guaribas" and which we argue indicate the existence in the past of howler monkeys. *Gazetteer*: 1. Imperatriz, Maranhão (MNRJ); 2. Barra do Corda, Maranhão (MZUSP); 3. Miritiba, Maranhão (MNRJ); 4. Boa Vista, Maranhão (MZUSP); 5. Goiabeira, Granjá, Ceará (MNRJ); 6. Bom Jardim, São Benedito, Ceará (MNRJ); 7. Cinta Sulidon, São Benedito, Ceará (MNRJ) and 8. Mata da Estrela, Baía Formosa, Rio Grande do Norte (M. da F. Arruda, UFRN, unpubl. data); 9. Angico, Parnaguá, Piauí, specimens cited by Neiva and Penna (1916) which have not been located; 10a. Usina São João (Mata do Açude dos Reis, Mata de Jacuípe and Mata do Açude Cafundó), Usina Miriri (Grotta dos Dois Rios) and Usina Santana (Mata da Usina Santana), Santa Rita, Paraíba (Oliveira and Oliveira, 1993); 10b. Fazenda Pacatuba, Sapé, Paraíba (UFPB); 11. Usina Sacramento, Água Preta, Pernambuco (Almeida *et al.*, 1995); 12. Serra Branca, Murici, Alagoas (MNRJ); 13. Usina Sinimbu, Alagoas (MZUSP). Locations 1-7, 10b, 12-13 are cited by Langguth *et al.* (1987), Bonvicino (1989), Bonvicino *et al.* (1989) and Hirsch *et al.* (1991). *Abbreviations*: MNRJ - Museu Nacional, Rio de Janeiro; MZUSP - Museu de Zoologia da Universidade de São Paulo, São Paulo; UFPB - Universidade Federal da Paraíba; UFRN - Universidade Federal do Rio Grande do Norte. *Places with names including "Guariba" or "Guaribas"*: 14. Vila dos Guaribas (Spix and Martius, 1938); 15. Serra dos Guaribas (IBGE, 1972); 16. Olho d'Água dos Guaribas (Coimbra-Filho and Maia, 1979); 17. Rio dos Guaribas (IBGE, 1972); 18. Serra do Apodi ou dos Guaribas (Spix and Martius, 1938).

in suggesting the possibility of *A. caraya* occurring in the Sete Cidades National Park, Piauí. The Brazilian common name for howling monkeys is *guariba*. There are a number of localities around this Park which bear this name and local people informed that howling monkeys occurred there in the past. Coimbra-Filho and Maia (1979) failed to see the monkeys, and the already advanced destruction of the remaining forest, and the widespread hunting and fires, indicated that

A. belzebul, undoubtedly the species in question, was probably already extinct there.

Numerous localities in the north-eastern Brazilian states of Piauí, Ceará and Rio Grande do Norte have the name of Guariba or Guaribas (Vanzolini and Papavero, 1968). It is reasonable, as such, to presume that *A. belzebul* once occurred throughout the north-east, to the left margin of the Rio São Francisco. This coincides with the distribution map presented by Emmons and Feer (1990, p.125). Today, however, *A. belzebul* populations have been eliminated by the decimation of their forests and a long history of hunting, and only a few minute remnant populations in the coastal region remain. In 1979, A. Langguth discovered a small population in a rain forest remnant in the state of Paraíba, at the Fazenda Pacatuba, municipality of Sapé. In 1984, an ornithological expedition organized by the National Museum, Rio de Janeiro, resulted in the collection of specimens by F. M. de Oliveira, from Serra Branca, municipality of Murici, Alagoas (Coimbra-Filho, 1984; Langguth *et al.*, 1987; Bonvicino *et al.*, 1989). Numerous populations probably existed in Alagoas as recently as 1970, up to which time the last forests of the state were being cut down for sugar cane plantations. This included the forest of São Miguel dos Campos, one of the richest remaining forests of the northeastern Atlantic coast in terms of biodiversity, and now destroyed (Coimbra-Filho, 1971).

The discovery of the populations in Paraíba and Alagoas stimulated the search for further sites. Oliveira and

Oliveira (1993) found howling monkeys in five secondary forest patches amongst 17 which were surveyed in the coastal region near to and north of João Pessoa. All are very small, degraded, isolated and privately-owned, and the minute populations resident in them are as such highly vulnerable. With a view to providing for their protection, the Brazilian Environment Institute (Ibama) created the Guaribas Biological Reserve (4321 ha), in the municipalities

of Mamanguape and Rio Tinto. Despite its name, no howling monkeys have survived there, but plans are underway to translocate groups from the other sites where there are no prospects for their future. Surveys in the state of Pernambuco have resulted in the finding of a population in two forest patches at the Usina Sacramento, in the municipality of Água Preta, Pernambuco (Almeida *et al.*, 1995), and also in the Mata da Estrela, municipality of Baía Formosa, Rio Grande do Norte, on the coast near to the state border with Paraíba (M. da F. Arruda, unpubl. data).

Perhaps the most important locality, reinforcing the argument that *A. belzebul* and its forests were until recently widespread throughout the north-east of Brazil, and which has not been included in the literature concerning its range, is in the south of the state of Piauí. During an expedition for medical and natural history purposes carried out in 1912, Neiva and Penna (1916, p.106) observed bands of howling monkeys, described as black with the upper surface of the hands yellowish, in the locality of Angico, municipality of Parnaíba. Specimens collected at the time were identified as *Alouatta belzebul* (Linnaeus, 1766). This locality, along with those mentioned above, and the numerous places which have the name of Guariba, demonstrates that the original distribution of *A. belzebul* extended throughout the north-east of Brazil, and confirms the supposition of Ihering (1914) that it once extended as far south as the Rio São Francisco. Ihering (1914), however, did not extend the range beyond Alagoas, possibly because of the absence of forests resulting from the long history of destructive occupation of the region. The record of Neiva and Penna (1916) indicates that the species occurred throughout Pernambuco, to the west and south as far as at least southernmost Piauí, and, as mentioned, the most precise published description of the range of this species is given by Emmons and Feer (1990, p.125).

Although the expedition carried out by Neiva and Penna (1916) was at the beginning of the century, the vegetation of the north-east of Brazil had already undergone profound alterations. The presence of *A. belzebul* in southern Piauí represents important evidence for the historic existence of a forest continuum between Amazonian and Atlantic forests in the Brazilian North-east (Coimbra-Filho and Câmara, in press).

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AGGRESSION BETWEEN *ALOUATTA CARAYA* MALES IN FOREST PATCHES IN NORTHERN ARGENTINA

The aggressive interactions between primates that live in social groups varies in form and intensity according to the species, social organization, and habitat type. Aggressive behavior can involve fights over food, water, and sites for resting and feeding (Calegario-Marques and Bicca-Marques, 1994). Howler monkeys are considered to be a peaceful species in terms of group interactions as a result of their adaptation to a folivorous diet, where the presence of anti-herbivorous defenses impose selective forces that constrain the use of aggressive behavior (Jones, 1980; Calegario-Marques and Bicca-Marques, 1994).

In *Alouatta*, both sexes obtain benefits through intrasexual aggressive competence, maintaining as such the possibility of entering and remaining in a stable group. This is a prerequisite for reproductive success in this genus (Crockett and Pope, 1988; Calegario-Marques and Bicca-Marques, 1994). Solitary individuals, males or females that leave their

natal groups, are found in *A. caraya* as for other species. The howlers may leave a group because of intense intrasexual competition which can limit group size. Non-stable groups promote dispersal (Neville *et al.*, 1988). Solitary individuals are subadults or young adults that are forced to occupy marginal zones of the habitat, with low availability of resources. They may join an established group or form a new one with other solitary animals, and compete as such for sites with adequate availability of food sources (Zunino *et al.*, 1985).

The arrival of immigrant males in established groups is interpreted as an invasion with fights between males. The encounters can result in: coexistence with the residents, the replacement of the dominant male, or the withdrawal of the invader (Rumiz, 1990). The replacement of the dominant male has been associated with infanticide and the disappearance of infants in several howler species (Clarke, 1983; Zunino *et al.*, 1985; Rumiz, 1990; Galetti, 1994). Howling occurs in a variety of contexts, and is believed to act as a mechanism of communication, spacing, and territory defense (Baldwin and Baldwin, 1976; Jones, 1980; Sekulic, 1982).

Behavioral observations on *A. caraya* were made during of a study of seed dispersal in forest patches in the Province of Corrientes in northeastern Argentina (27° 30' S - 58° 41' W), during August 1994 (Figure 1). One forest fragment (10 ha) was occupied by a group of nine howlers comprised of: one adult male (male A), two subadult males, three adult females, one juvenile female, and two infants. When an adult male (B) strange to the troop appeared, we began to observe aggressive interactions. During the first three days, the strange male B remained 20-30 m from the troop. Subsequently, he began moving closer to the group, and the male A, followed by the other males, chased the male B for about 250 m into low forest. The females did not participate, and remained where they were until the chase finished, about 1-2 hours later, after which they rejoined the males.

When the resident males returned, the male B began to follow the group at a distance of 23-30 m. Each time the male B approached, it resulted in a series of vocalizations, involving all of the group members. On the fourth day, the male B was observed to descend to the ground, and ran for about 25 m, followed by the male A. On day 6 there was a fight between males A and B when the male B again approached the group, coming to within about 1 m of an adult female (about 1 m) and an infant (about 0.5 m). This resulted in vocalizations and chasing, but this time the male B did not retreat, and attacked male A. They hung from