

# New records of *Fredius denticulatus* (H. Milne-Edwards, 1853) and *F. reflexifrons* (Ortmann, 1897), and the eastern limits of the distribution of pseudothelphusid crabs (Crustacea: Decapoda) in Brazil.

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## ABSTRACT

The occurrence of *Fredius reflexifrons* (Ortmann, 1897), a pseudothelphusid crab widely distributed in the Amazon region and the Atlantic Guianas, is recorded from the state of Ceará, northeastern Brazil. Other records of this species and *Fredius denticulatus* (H. Milne-Edwards, 1853) from the Amazon region are also presented. A discussion is made on the eastern limits of the distribution of the family Pseudothelphusidae in Brazil.

## KEY WORDS

Pseudothelphusidae, *Fredius*, taxonomy, geographical distribution, new records

# Novos registros de *Fredius denticulatus* (H. Milne-Edwards, 1853) e *F. reflexifrons* Ortmann, 1897) e o limite oriental da distribuição dos carangueijos da família Pseudothelphusidae (Crustacea: Decapoda) no Brasil.

## RESUMO

É registrada pela primeira vez a ocorrência de *Fredius reflexifrons* (Ortmann, 1897), um caranguejo da família Pseudothelphusidae de ampla distribuição na Amazônia e nas Guianas, no estado do Ceará, Nordeste do Brasil. São feitos registros adicionais de dessa espécie e de *Fredius denticulatus* (H. Milne-Edwards, 1853) para a região amazônica. É feita uma discussão sobre os limites orientais da distribuição da família Pseudothelphusidae no Brasil.

## PALAVRAS-CHAVE

Pseudothelphusidae, *Fredius*, taxonomia, distribuição geográfica, novos registros

## INTRODUCTION

The distributional range of the freshwater crab family Pseudothelphusidae spans from northern Mexico to Peru and Brazil, in South America (Rodríguez, 1982), where it reaches as far as the latitude of approximately 12°S along the Pacific slope of the Andes (Rodríguez & Suárez, 2004), and occurs throughout the Amazon basin (Magalhães, 1986; Magalhães & Rodríguez, 2002). The distributional limits of pseudothelphusid crabs in the Amazon region are not well established. This fauna is still

poorly known in the region, especially in its southern and eastern parts, in spite of recent descriptions of new species from these areas (Magalhães, 2003, 2004).

Three species of *Fredius* Pretzmann, 1965 are known from Brazil. Magalhães (1986) recognized *F. denticulatus* (H. Milne-Edwards, 1853) and *F. reflexifrons* (Ortmann, 1897). Magalhães & Rodríguez (2002) redescribed *F. fittkaui* (Bott, 1967) and *F. reflexifrons*, and discussed their respective ranges and possible explanations for their observed distributions. According to these authors, the former species occupies areas in the upper

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Rio Negro basin, whereas the latter occurs along the main axis of the Amazon river, with an overlap in the Atlantic Guianas. The occurrence of *F. reflexifrons* in the southern Amazon, made by Magalhães (1986), was considered uncertain by Magalhães & Rodríguez (2002), as the few records available are all based on females. Records of *Fredius denticulatus* from Brazil were made by Rathbun (1905) and Magalhães (1986). In this paper, we present new records for *F. denticulatus* and *F. reflexifrons* from the Amazon basin and from northeastern Brazil, and make comments on the eastern limits of the distribution of the family Pseudothelphusidae in Brazil.

## MATERIAL AND METHODS

The specimens are deposited in the crustacean collections of the Instituto Nacional de Pesquisas da Amazônia, Manaus (INPA) and the Museu de Zoologia, Universidade de São Paulo (MZUSP). Measurements, in millimeters, of carapace breadth and carapace length are given in parenthesis (cb:cl, respectively) after the number of specimens examined. Terminology for the description of the gonopod morphology followed Magalhães & Rodríguez (2002).

## RESULTS

### Family Pseudothelphusidae

Tribe Kingsleyini

Genus *Fredius* Pretzmann, 1967

*Fredius denticulatus* (H. Milne-Edwards, 1853)

Material.- Brazil, Amapá: Serra do Navio [00°52'N 51°59'W], serra do Veado, 29.iv.1994, Projeto Diversitas Neotropica, 1 ♂ (65.0:43.4), INPA 582; idem, 30.iv.1994, Projeto Diversitas Neotropica, 1 ♂ (43.5:27.1), MZUSP 16297; idem, 7.v.1994, Projeto Diversitas Neotropica, 1 ♂ (93.8:62.5), MZUSP 16295; idem, Projeto Diversitas Neotropica, 1 ♂ (78.2:53.9), MZUSP 16296; Serra do Navio, sítio São Sebastião, right bank of Rio Amapari, Projeto Diversitas Neotropica - PDN, 30.iv.1999, 1 ♂, MZUSP 16294. – Amazonas: Presidente Figueiredo [02°04'S 60°10'W], road to Balbina, igarapé no sítio "Refúgio do Maroaga", 17.v-6.xii.1986, J.A.S. Zuanon & A.L. Henriques, 2 ♂ (20.6:14.4; 48.1:31.9) 1 ♀ (39.5:26.3), INPA 457.

Remarks.- In Brazil, this species was already recorded from the central Amazon region by Magalhães (1986). Rathbun (1905) recorded it from "Haut Carsevenne" and "Placers, Carsevenne" [respectively, as *Pseudothelphusa denticulata* and *P. angusta* (= *F. denticulatus*)], localities that probably refer to the Rio Calçoene, a coastal Atlantic river in the state of Amapá, Brazil. The present record from the Serra do Navio confirms the occurrence of the species in the eastern Amazon region.

*Fredius reflexifrons* (Ortmann, 1897)

(Fig. 1)

Material.- Brazil, Pará: Santarém [02°24'S 54°44'W], Comunidade

Santa Rosa, 03.iv.1999, Equipe Faculdades Integradas do Tapajós, 1 ♂ (42.4:28.0), INPA 1254. – Ceará: Serra da Ibiapaba, Viçosa do Ceará, Fonte do Caranguejo, 03°33'43.2"S 41°05'09.6"W, 625 m altitude, 13:00 to 15:00 h, 20-24.vi.2004, M. Pereira, 2 ♂ (43.0:28.7), INPA 1382; Serra da Ibiapaba, Ipu [04°19'S 40°11'W], sítio Santa Cruz, vii-x.1999, L.O. Aragão, 4 ♂ (22.3:16.2-56.8:37.1) 5 ♀ (36.8:25.7-53.8:36.5), INPA 1318.

Remarks.- The easternmost records of this species are from the Rio Acará, in Tomé-Açu, state of Pará, and the Rio Gurupi, a coastal Atlantic river that divides the states of Pará and Maranhão (Magalhães, 1986). The latter was considered uncertain by Magalhães & Rodríguez (2002) because it is based on female specimens. The present records from the state of Ceará considerably extend the species distribution towards northeastern Brazil, clearly transcending the limits of the Amazon region.



Figure 1 - *Fredius reflexifrons* (Ortmann, 1897), male, INPA 1318, first left gonopod, mesial view. Scale bar = 6 mm.

When alive, the specimens from the state of Ceará showed a dark reddish-brown carapace, reddish chelipeds and ambulatory legs, with the tip of the chela whitish. The morphology of their first gonopods fits very well in the redescription given by Magalhães & Rodríguez (2002): the cephalic spine is straight, sharp, and short; the auxiliary lobe lays in the caudal side and is slightly shorter than the cephalic lobe, with its distal portion ending subterminally in relation to the cephalic lobe.

The specimens from Ipu were collected in muddy areas near swamp vegetation. They were observed to inhabit small holes. In Viçosa do Ceará, the crabs were found inside holes under stones in the moist terrain of a forest area; they were around a spring close to a rocky wall. The habitat is similar to that where the species is found in the Amazon region, that is, in the moist soil of the forest.

## DISCUSSION

Both *Fredius denticulatus* and *F. reflexifrons* have a wide, sympatric distribution along low elevated areas of the Atlantic Guianas, and the eastern and central Amazon (Holthuis, 1959; Rodríguez, 1982; Magalhães, 1986; Magalhães & Rodríguez, 2002) (Fig. 2). The distribution of the latter seems to be wider, ranging from eastern Peru to the coastal strip of the north and part of northeastern Brazil. Using Brooks (1990) parsimony analysis to compare their cladistic analysis of the genus *Fredius* with geological data, Rodríguez & Campos (1998) postulated that *F. reflexifrons* possibly originated in the Amazon region and then dispersed into the Atlantic Guianas after the marine regression in this area. Following what has already been proposed by Rodríguez & Pereira (1992), they explained the current distribution of *F. denticulatus* as the species having its origin in the Atlantic drainage and later dispersed into the lower Amazon basin.

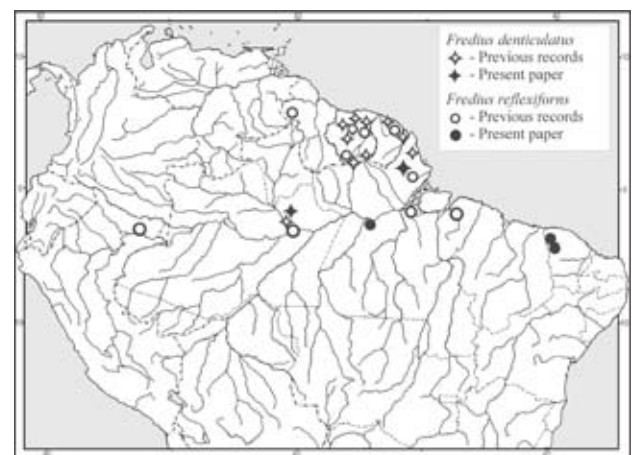
The Rodríguez and collaborators's hypothesis could be corroborated by the current evidences that *F. reflexifrons* has a wider distributional area than *F. denticulatus*, and the latter species does not occur eastward from the mouth of the Amazon river. If *F. denticulatus* had a Guianan origin, their dispersal towards eastern areas could have been prevented by the Amazon river estuary. This species, as well as *F. reflexifrons*, does not inhabit the periodically flooded areas of the Amazon várzea, but live in the "terra firme" forest, near small shadowed streams; in addition, they are not very conspicuous due to their nocturnal and terrestrial habits. The vast flooding environments of the lower Amazon river and its mouth could act, currently or in the past, as a barrier for the dispersion of this species. On the other hand, *F. reflexifrons* having evolved in the Amazon region would have had better conditions for a wider dispersion towards both the western Amazon and northeastern Brazil.

However, taking into account the ecological similarities between the species, whether their different distributional ranges can be explained by the above hypothesis or that it is just a matter of insufficient collecting efforts still remains to be verified by new collections.

Except for a transitional zone in the state of Maranhão, most of the Brazilian Northeast is a very dry, semiarid region, with an unpredictable annual rainfall regime, usually with a short rainy season of three to five months and a pluviometrical average lower than 800 mm. The soil is shallow and rocky, with a typical xerophytic, deciduous and open vegetation called "caatinga" (scrubland) placed in extensive inter-plateau and inter-mountain plains; rivers are usually intermittent (Rodrigues, 2004). The occurrence of *F. reflexifrons* in the Serra da Ibiapaba could be linked to the climatic conditions of the area, which is a high plain plateau with altitudes between 650 to 850 m and extending approximately 200 km in a North-South direction along the northwestern state of Ceará. The crabs were found in its eastern part, which is covered by a tropical pluvial forest, where the climate is hot and humid, with a six month rainy season and pluviometric indexes up to 1,800 mm (Bezerra, 1989; Velloso *et al.*, 2002). Such conditions propitiate a favorable environment for these crabs, similar to where they are usually found in the Amazon region.

In the course of the expansion/retraction process of the humid tropical forest related to the paleoclimatic-vegetational fluctuations, caused by the alternance of glacial and interglacial epochs during the Quaternary (Bigarella & Ferreira, 1985; Haffer, 1996), the distribution of *F. reflexifrons* could have been extended easterward as far as the Serra da Ibiapaba. The humid climate of the Serra da Ibiapaba would have favoured the presence of this population in a place surrounded by the semiarid scrublands of the Brazilian Northeast, and the present punctual occurrence in the area is a relict that probably marks the easternmost boundary of the Pseudothelphusidae distribution in South America.

Rodríguez & Suárez (2004) discussed the southern limits of the family along the Peruvian Andes. They stated that no species is found southwards beyond the latitude of 13°S on the Pacific slope and argued that this could be attributed to



**Figure 2** - Geographical distribution of *Fredius reflexifrons* (Ortmann, 1897) and *Fredius denticulatus* (H. Milne-Edwards, 1853). Previous records based on Holthuis (1959), Rodríguez (1982), Magalhães (1986), and Magalhães & Rodríguez (2002). Some symbols may represent more than one locality.

the arid or semiarid condition found southward from that latitude. The adjacent ecoregions to the north, east and south from the Serra da Ibiapaba are characterized by the typical semiarid landscape, with extensive plains, xerophytic vegetation, prolonged dry season and no permanent rivers (Velloso *et al.*, 2002). Such adverse climatic conditions could account for the likely absence of pseudothelphusids eastwards from Serra da Ibiapaba.

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