

New Fossils (Isoptera: Hodotermitidae), from the Santana Formation (Lower Cretaceous, Araripe Basin, Northeast Brazil), with Descriptions of New Taxa Including a New Subfamily

by

Rafael Gioia Martins-Neto^{1,2}, Cleber Ribeiro-Júnior³ & Fábio Prezoto¹

ABSTRACT

This study describes three new genera and three new species of Isoptera described from the Santana Formation (Lower Cretaceous, northeast Brazil): *Caatingatermes megacephalus* n. gen. et. n. sp., *Araripetermes nativa* n. gen. et n. sp., representing the new subfamily Caatingatermitinae, and *Nordes- tinatermes obesa* n. gen. et. n. sp. (Hodotermitinae). *Meiatermes araripena* Krishna described from the same sediments is transferred to the new genus *Nordes- tinatermes* proposed here, consisting the new combination *Nordes- tinatermes araripena*.

Keywords: Lower Cretaceous, Santana Formation, fossil Isoptera.

INTRODUCTION

The Cretaceous Isoptera fossil record is still extremely scant, with the following named species known: *Cretatermes carpentieri* Emerson, 1967, from the Cenomanian of Labrador, *Valditermes brenanae* Jarzembowski, 1981, from the England Lower Cretaceous and *Valditermes acutipennis* Ponomarenko, 1988 from the Siberian Lower Cretaceous, *Mesotermes incompletus* Dong, 1995, *Mesotermes latus* Dong, 1995, *Asiatermes reticulatus* Dong, 1995, *Huaxiatermes huangi* Dong, 1995 (Termopsidae, Cretatermitinae – data from Emerson 1967; Jarzembowski 1981; Ponomarenko 1988; Dong 1995), *Lutetiatermes prisca* Schlüter, 1989, from the Cenomanian of France (Termopsidae, Lutetiatermitinae, Schlüter, 1989), *Carinatermes nascimbeni* Nel & Engel, 2005, from the Cenomanian of France (Termopsidae, Nel &

¹Programa de Pós-graduação em Ciências Biológicas, Comportamento e Biologia Animal Universidade Federal de Juiz de Fora – UFJF Campus Universitário Martelos - 36036-900-Juiz de Fora, MG Brazil. martinsneto@terra.com.br; fprezoto@icb.ufjf.br

²Sociedade Brasileira de Paleoartropodologia. – SBPr

³Discente do Programa de Pós-graduação em Ciências Biológicas, Comportamento e Biologia Animal Universidade Federal de Juiz de Fora – UFJF, cleberribeirojr@bol.com.br

Engel 2005), *Meiatermes bertrani* Lacasa-Ruiz & Martinez-DelClòs, 1986, from the Lower Cretaceous of the Spain, *Meiatermes araripena* Krishna, 1990, from the Lower Cretaceous of Brazil, *Jitermes tasii* Dong, 1995, *Yanjingtermes giganteus* Dong, 1995, *Yongdingia opiupara* Dong, 1995, from the Lower Cretaceous of China (Hodotermitidae, Hodotermitinae – data from Lacasa-Ruiz & Martinez-DelClos 1986; Krishna 1990; Dong 1995), *Hebeitermes weichangensis* Hong, 1982, from the Lower Cretaceous of China (Kalotermitidae, Hong 1982), aff. *Mastotermes sarthensis* Schlüter, 1989, from the Cenomanian of France (Mastotermitidae, Schlüter 1989), and *Archeorhinotermes rossi* Krishna & Grimaldi, 2003, from the Cretaceous Burmese amber (Krishna & Grimaldi 2003). For the Santana Formation, apart from *Meiatermes araripena* Krishna previously described (Krishna 1990), Martins-Neto & Canello (1989) had made the first mention of the group for the Brazilian sediments. This contribution reveals three new genera, three new species and one new combination of termites of the Family Hodotermitidae, previously pointed (Martins-Neto 2002; Martins-Neto *et al.* 2005), which came from the Lower Cretaceous sediments in northeast Brazil, one of the oldest Isoptera record. A complete listing of all New World fossil termites is given by Fontes & Vulcano (2004).

GEOLOGICAL SETTING

The lowermost part of the Santana Formation (Crato Member) is one of the sedimentary units of the Araripe basin in North-East Brazil. It is situated on top of a variety of sediment types, but largely on top of the Batateira Formation of fluvial origin. It is a sequence of laminated organically rich limestones deposited in a lagoon/lacustrine environment, with important outcrops around the village of Crato and Nova Olinda. The lowermost unit is a sequence of laminate stones, at millimeter scale, mined for the building industry; the sequence bears one of the most impressive arthropod (mainly insects) fossil faunas in the world. Insects, arachnids, crustaceans, myriapods are associated with plants (angiosperms), rare feathers, frogs, crocodiles, turtles, lizards, pterosaurs, dinosaurs, and the little fresh water fish *Dastilbe*, as well as other fish groups.

SYSTEMATIC PALEONTOLOGY

ISOPTERA

Family Hodotermitidae Desneux, 1904

Caatingatermitinae n. subfam.

Diagnosis. Fore wing with costal area notably broad; Humeral suture straight, oblique to the anal margin; Radial sector wide, reaching the posterior part of the apical margin; **M** very short, distally fused to **Cu**, without secondary branches; Cubital area very wide, reaching the apical margin.

Discussion. Caatingatermitinae n. subfam. shares with Hodotermitinae a wide area occupied by the radial sector in the outer fourth and the lower branches reaching the inner margin of the wing and not in Termopsinae, Stolotermitinae, Porotermitinae, or Cretatermitinae. **M** origin very far from the wing base and distally fused to **Cu** is a distinctive characteristic not present in the known Hodotermitidae and Termopsidae subfamilies (apomorphic). The genus *Ulmeriella* Meunier, 1920, distinctively placed into Hodotermitinae or as an *incertae sedis* subfamily within the Termopsidae exhibits a very long **M**, sometimes branched and its origin close to the wing base. Additionally, the humeral suture in this group is curved to sinuous, as also for the Cretatermitinae.

Caatingatermes n. gen.

Type species. *Caatingatermes megacephalus* n. sp., designated here.

Etymology. *Caatinga*, ecological unit that the material came from, and *termes*, common suffix for isopterans.

Diagnosis. Head quite pentagonal, longer than wide and small eyes, not prominent, displaced under the midlength of the head. Pronotum trapezoidal, as wide as the head base, circa 2/3 of the head size. Fore wing with the humeral suture well defined, straight, perpendicular to the costal margin. **R** secondarily branched. Five long, pectinate costal radial branches and five relatively short ventral radial branches, some they with secondary branches.

Discussion. The closest genus to *Caatingatermes* n. gen. is *Yanjingtermes* Dong, 1995, described for the Lower Cretaceous of China, interpreted as Hodotermitinae by Dong (1995), by having a short **M**, possibly distally fused

with **Cu** (judging by Dong's draft, although his interpretation considers the last branch **R** and not **M**, and considers **Cu** as **M**). *Yanjingtermes* Dong could be removed to Caatingatermitinae n. subfam.

***Caatingatermes megacephalus* n. sp.**
(Pl. IB; Fig. 1A-C)

Etymology. Allusive to the big-sized head of the specimen.

Holotype. RGMN-T147, Martins-Neto Collection, belonging to Sociedade Brasileira de Paleoartropodologia - SBPr.

Type locality. Outcrop at Mina Pedra Branca, four Km from the municipality of Nova Olinda, Ceará State, Northeast Brazil. (**latitude/longitude?**)

Type stratum. Upper limestone level of the Crato Member, lower unit of the Santana Formation, Araripe Basin.

Age. Upper Aptian, Lower Cretaceous.

Diagnosis. As for the genus. Body length 9 mm and tegmen length 11 mm.

Description: (Holotype). Body elongated, 9 mm long (Fig. 1C). Elongated head quite pentagonal, 2 mm long and 1.5 mm wide. Eyes small, not protuberant, sitting below of the mid length of the head. Pronotum trapezoidal, 1.5 mm wide. Abdomen a little more robust than the pronotum. Fore wing (Fig. 1A) 11 mm long. Humeral suture well defined at the wing base, straight and perpendicular to the costal margin. Costal area notably wide at the wing base. Five parallel costal branches of **R** and five ventral ones secondarily branched. Radial sector occupying the whole apical area. **M** origin at $\frac{1}{4}$ of the wing base partially fused to the last **Rs** branch and distally fused to **Cu**. Cubital area very wide, reaching the inner part of the apical margin. Hind wing (Fig. 1B) slightly different than the Fore wing shape, more acute.

***Araripetermes* n. gen.**

Type species. *Araripetermes nativa* n. sp., designated here.

Etymology. Araripe, origin from which the material came, and *termes*, common suffix for isopterans.

Diagnosis. Head ellipsoid, 20% wider than long, with rounded anterior,

posterior and lateral margins. Fore wing with **M** sigmoid, distally fused to **Cu**. **M** origin after the mid length of the wing.

Discussion. *Araripetermes* n. gen. shares with *Caatingatermes* n. gen. **M** distally fused to **Cu** (subfamily characteristics) differing however in the **M** origin, after the mid length of the wing in *Araripetermes* n. gen., at $\frac{1}{4}$ of the wing base in *Caatingatermes* n. gen.. Additionally **M** is sigmoid in *Araripetermes* n. gen. (slightly curved in *Caatingatermes* n. gen.) the body is more stunted and the head wider than long, elliptical (body more slender and head longer than wide in *Caatingatermes* n. gen.).

Araripetermes nativa n. sp.

(Pl. IB, C; Fig. 1D-G)

Etymology. Alludes to the fact of this specimen is housed in its native country.

Holotype. RGMN-T148, part and counterpart, Martins-Neto Collection, belonging to the Sociedade Brasileira de Paleontropodologia.

Type locality, stratigraphy and age. (Holotype RGMN-T148). As for *Caatingatermes megacephalus* n. sp.

Diagnosis. As for the genus. Body circa 8 mm and tegmen length 10 mm.

Description (Holotype). Body stunted, robust, 7.76 mm long (Fig. 1G). Head ellipsoidal, 1.7 mm long and 2.1 mm wide, and all margins rounded. Eight antennal segments preserved. Pronotum trapezoidal, little smaller than the head and abdomen ovoid, wider than the thorax. Cerci 4-segmented (Fig. 1F) with the first segment not different than the second. Fore wing 10.2 mm long (Fig. 1D, F). Costal **Rs** branches long and pectinate. **M** origin after the mid length of the wing, sigmoid, distally fused to **Cu**. **Cu** with at least eight secondary branches, oblique to the anal margin, all of them with distal secondary branches.

Subfamily Hodotermitinae Holmgren, 1911

Nordestinatermes n. gen.

Type species. *Nordestinatermes obesa* n. sp., designated here

Etymology. *Nordestina*, a popular Brazilian term for northeastern inhabit-

ants, and *termes*, common suffix for termites.

Diagnosis. Head circular, pronotum quite as long and wide as the head. Fore wing with reduced number of **R** branches. **M** origin close to the wing base, unbranched.

Discussion. *Nordestinatermes* is closely related to *Meiatermes* Lacaza-Ruiz & Martinez-Delclòs, 1986 described from the Spanish Lower Cretaceous in the general appearance (a circular head, pronotum as wide as head) differing however by the reduced number of **R** costal branches and **M** origin. Additionally, *Nordestinatermes* exhibits a narrower costal area.

***Nordestinatermes obesa* n. sp.**

(Pl. IA; Fig. 1H, I)

Etymology. Alludes to the fat body shape.

Holotype. RGMN-T149, Martins-Neto Collection, belonging to the Sociedade Brasileira de Paleoartrópoda.

Type locality, stratigraphy and age. (Holotype RGMN-T149). As for *Caatingatermes megacephalus* n. sp.

Diagnosis. Body circa 6.3 mm and tegmen length 10.5 mm.

Description (Holotype). Body stunted, robust, 6.35 mm long (Fig. 1I). Head spherical, 1.5 mm long and 2.3 mm wide, and all margins rounded. Eight antennal segments preserved. Pronotum quadrangular, quite as long as the head. Abdomen quite rectangular, as wide than the thorax. Fore wing 10.6 mm long (Fig. 1H). Costal area notably narrow. **R** reduced to just one and four costal **Rs**. **M** origin after the mid length of the wing, sigmoid, distally fused to **Cu**. **Cu** with at least eight secondary branches, oblique to the anal margin, all of them with distal secondary branches.

Discussion. Krishna (1990) had described *Meiatermes araripena* of ?**ignored** locality within the Araripe Basin. Several diagnostic characters were based on different specimens. Some of them are identical as for the *Nordestinatermes* n. gen. here proposed. Unfortunately this material is not housed in Brazil, from which it came. Although Krishna (1990) admitted the possibility of a different genus from *Meiatermes*, he preferred to include the Araripe material in that genus. *Nordestinatermes* n. gen. has characteristics enough to exclude it from *Meiatermes*. *Nordestinatermes obesa* n. sp. differs

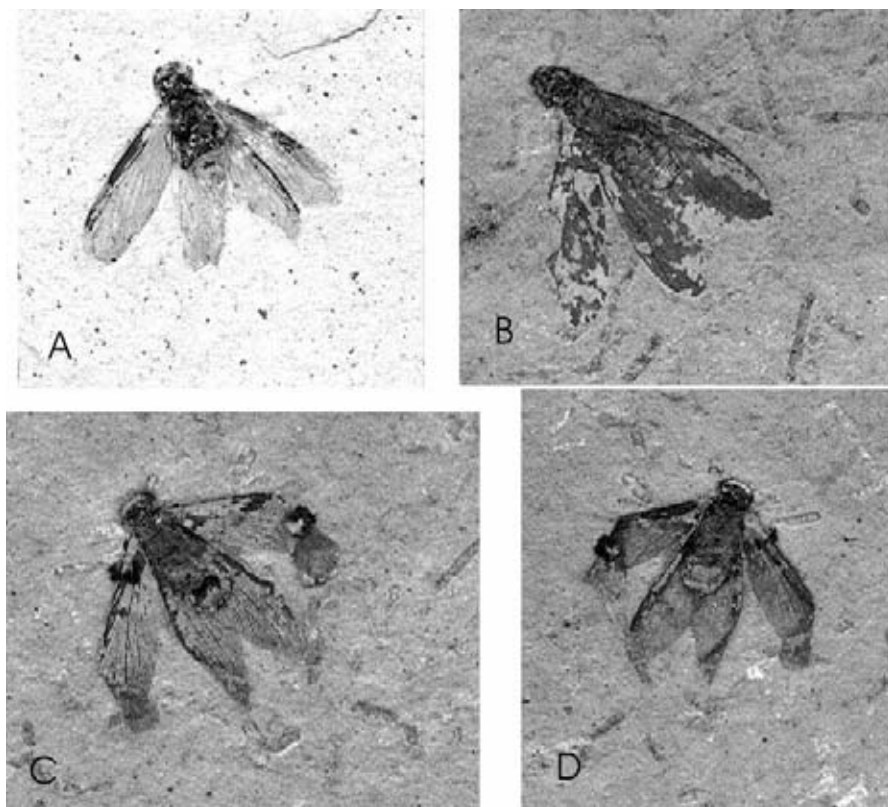


Plate I: A) *Nordestinatermes obesa* n. sp., Holotype.; B) *Caatingatermes megacephala* n. sp., Holotype; C, D) *Aripetermes nativa* n. sp., Holotype, part and counterpart, respectively.

from *Meiatermes araripena* by having just one costal **R** branch, intense cross veins especially at the costal area and a relatively greater head and pronotum. *Meiatermes araripena* is transferred to the new genus here proposed.

FINAL COMMENTS

For the north-eastern Brazilian Cretaceous the climate grades from humid to dry with torrential rainy seasons, grading to dry, in the Aptian and dry until the Cenomanian (Petri 1998). Although the Petri (1998) proposition respects a general tendency, several “microclimates” were detected, furnishing a more specific panorama for the Santana Formation, the most important

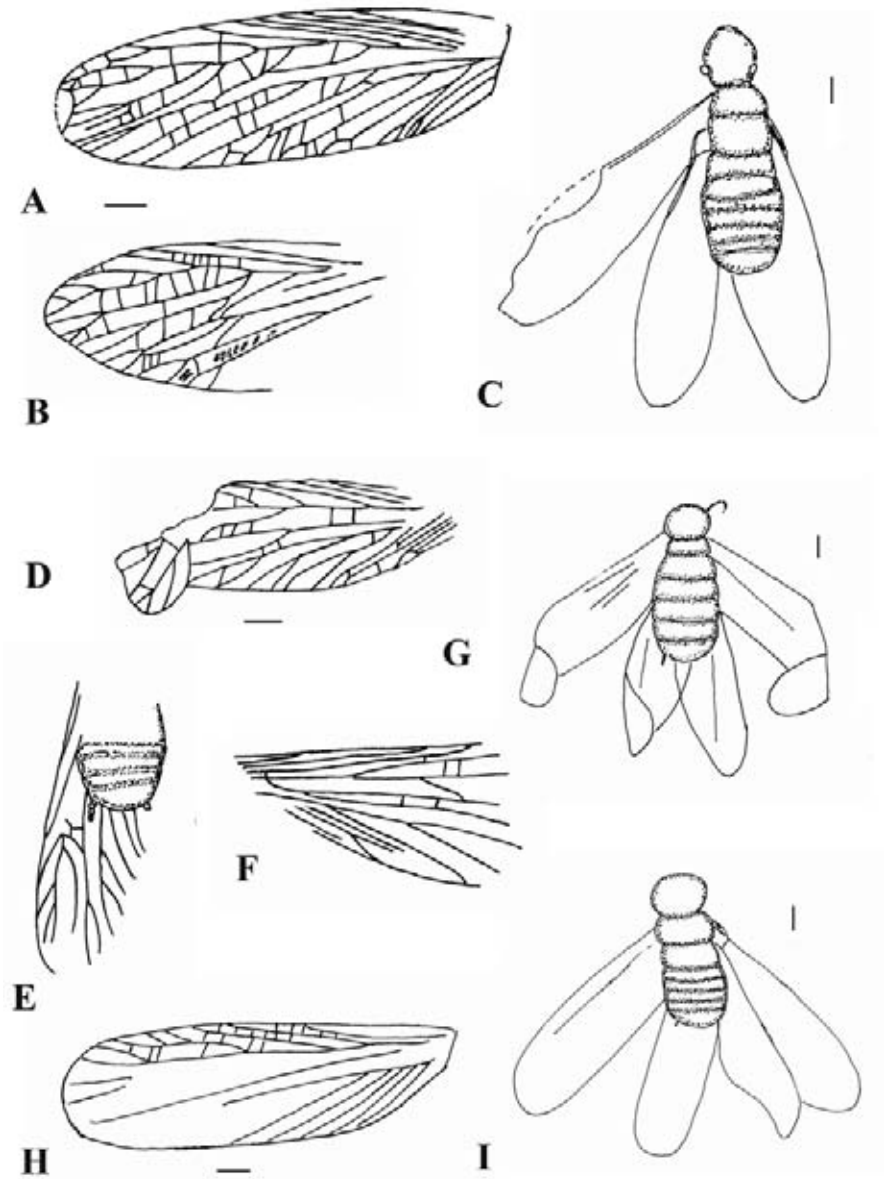


Fig. 1. A-C) *Caatigatermes megacephala* n. sp., fore wing (A), hind wing (B), and general habitus (C) respectively, drawn from the Holotype; D-G) *Araripetermes nativa* n. sp., cerci detail (E), right fore wing (D), left fore wing (F), and general habitus (G), drawn from the Holotype. H-I) *Nordestinatermes obesa* n. sp., costal area detail (fore wing - H), and general habitus (I) drawn from Holotype. Scale bar 1 mm.

Cretaceous site from Gondwana (Martins-Neto 2002).

The isopterans, recorded since the Lower Cretaceous, are indicative of a tropical climate and they are highly dependent on the rainfall in the mating epoch. Any climatic changes (cold, long periods of drought without rainfalls), interfere with its life cycle.

The number of isopteran specimens observed in the Santana Formation is significant (circa 15 collected specimens, not included here), with three known genera of at least two distinct subfamilies. These specimens constitute important data for climatic inferences (tropical humid, compatible with the cricket specimens abundance – Martins-Neto 2002). It is interesting to note that winged forms constitute 90% of the observed specimens, with the wings preserved still adhering to the body.

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