



THE CRETACEOUS PALEOBIOGEOGRAPHY OF TERMITES (INSECTA, ISOPTERA), DIVERSITY AND PALEOCLIMATIC INFERENCES FOR THE NORTHEAST BRAZIL

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INTRODUCTION

The Cretaceous Isoptera record (the oldest known termites record, at least for body remains) remain very rare, just known the following species: from Lower Cretaceous, *Valditermes brenanae* Jarzembowski (England, Hodotermitidae) *Meiatermes bertrani* Lacaza-Ruiz & Martinez-DelClòs, 1986 (Spain, Hodotermitinae), *Valditermes acutipennis* Ponomarenko, 1988 (Mongólia, Hodotermitidae), *Mesotermes incompletus* Dong, 1995, *Mesotermes latus* Dong, 1995, *Asiatermes reticulatus* Dong, 1995, *Huaxiatermes huangi* Dong, 1995 (China, Hodotermitidae), *Jitermes tasii* Dong, 1995, *Yanjingtermes giganteus* Dong, 1995, and *Yongdingia opiupara* Dong, 1995 (China, Hodotermitidae), *Hebeitermes weichangensis* Hong, 1982 (China, Kalotermitidae), and *Carinatermes nascimbeni* Krishna & Grimaldi, 2000 (New Jersey, Hodotermitidae). From the Upper Cretaceous, *Cretatermes carpentieri* Emerson, 1967 (Canada, Hodotermitidae), *Lutetiatermes prisca* Schlüter, 1989 (France, Hodotermitidae), and *Archeorhinotermes rossi* Krishna & Grimaldi, 2003 (Myanmar - formerly Burma - Rhinotermitidae) (updated from Martins-Neto et al., 2005; Martins-Neto & Santos, 2007). For the Brazilian Lower Cretaceous are now the following species: *Caatingatermes megacephalus* Martins-Neto et al., 2005, *Araripetermes nativa* Martins-Neto et al., 2005 (both Hodotermitidae, Caatingatermitinae), *Nordestinatermes araripena* Martins-Neto et al., 2005, and *Nordestinatermes obesa* Martins-Neto et al., 2005 (both Hodotermitidae, Hodotermitinae). The lowermost part of the Santana Formation (Crato Member) is one of the sedimentary units of the Araripe basin in Northeast Brazil; it is situated on top of a variety of sediments type, but largely on top of the Batateira Formation of fluvial origin. It is a sequence of laminated organic 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 laminates stones, at millimetrical scale, mined for the building industry;

the sequence bears one of the most impressive arthropods (mainly insects) fossil fauna in the world. Insects, arachnids, crustaceans, myriapods are associated with plants (angiosperms), rare feathers, frogs, crocodiles, lizards, pterosaurs, dinosaurs, and the little fresh waters fish *Dastilbe*, as well as other fish groups. The Araripe isopterofauna constitutes one of the most diverse with three genera and four species of Isoptera Hodotermitidae distributed in two subfamilies.

OBJETIVES

The present contribution aim to compare the diversity of the Cretaceous isopterofauna and to make inferences on the Hodotermitidae paleobiogeography as well as climatic inferences.

MATERIAL

The material consists of at least 35 slabs of laminated limestone bearing Isoptera specimens, collected by the senior author during several fieldtrip (1989-2000). All the material came from the Crato Member (Santana Formation, Lower Cretaceous, northeast Brazil) and they are housed at the Sociedade Brasileira de Paleontropodologia - SBPr.

RESULT AND DISCUSSION

Apart the described material (Martins-Neto et al, 2005), several specimens remain unpublished with, at least, three new taxa to be described. One of these specimens is revealing be the biggest known Cretaceous Isoptera, bearing more than 40 mm of length and another as the smallest one, a probable immature specimen bearing less than 5 mm of length. Apparently all this material belongs to the Hodotermitidae, however in distinct subfamilies. Hodotermitidae constitutes 90% of all known Cretaceous described species and for the Santana Formation 100 %. Is interesting to note that winged forms constitute 90% of the observed specimens, with the wings preserved still adhered to the body.

The paleobiogeography of the Cretaceous Hodotermitidae is very puzzling: the distribution seems to be restricted rather to the Eurasia (Spain, England, France, Mongolia, Myanmar, and China), but with representatives at North America (Laurasia). The Brazilian specimens constitute the only known record for Cretaceous Isoptera at the South Hemisphere (Gondwana), and very diverse when compared with the North Hemisphere relatives. This very wide distribution suggests an origin for the entire group very before from Cretaceous times (the oldest for Isoptera), possibly at the Triassic ones.

CONCLUSION

For the northeastern Brazilian Cretaceous the climate gradates from humid to dry with torrential raining seasons, gradating to dry, in the Aptian and dry until the Cenomanian (Petri 1998). Although the Petri (1998) proposition says respect to a general tendency, several "microclimates" were detected, furnishing a more specific panorama for the Santana Formation, the most important Cretaceous site from Gondwana (Martins-Neto, 2006). The isopterans, recorded since the Lower Cretaceous, are indicative of a tropical climate and they are highly dependent of the rainfall in the mating epoch. Any climatic change (cold, long periods of drought without rainfalls), interfere in its life cycle. The number of isopteran specimens observed in the Santana Formation is significant (circa 35 collected specimens), with three known genera of at least two distinct subfamilies, and at least three more species, constituting an important data for climatic inferences (tropical humid, compatible with the cricket specimens abundance - Martins-Neto & Cancelo, 1989; Martins-Neto, 2006). The newly founded material extends the Gondwana record for the Cretaceous Isoptera, as well as the paleogeographic distribution.

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