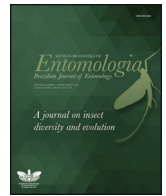




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Short Communication

Giant rhinoceros beetle *Golofa claviger* (Linnaeus) (Coleoptera: Melolonthidae: Dynastini) is damaging North Brazilian oil palm plantations

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ABSTRACT

The oil palm is an economically important crop cultivated in the North of Brazil. Damage caused by insects is one of the main causes of reduced productivity for the oil palm. Before this research, only the beetles of the family Curculionidae were considered to be oil palm pests in Brazil. However, for the first time, we report on the damage caused by a giant rhinoceros beetle to oil palm plantations in Pará, Brazil. The beetle was identified as *Golofa claviger* (Linnaeus, 1771), which has a single record in Brazil (Pará) but is widely distributed in South America. The species occurs in an unprecedentedly high abundance of local specimens. The attacks are concentrated on the central cluster of young palms. Feeding behavior is identified as the main cause of the damage as the beetles use their mouthparts to rip the plant tissues, causing wedge-shaped cuts on young fronds that have not yet unfurled. After an attack, the leaflets of the unfurled fronds are partially destroyed.

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The oil palm *Elais guinensis* Jacq. is an economically important crop across the tropics. Food, oil and chemical industries have been mainly responsible for the current demand for palm oils around the world (Basiron, 2007). Brazil is among the largest producers of oil palm and concentrates the majority of its cultivated area in the Amazonian region (Brazilio et al., 2012). Damage caused by insect pests can reduce the productivity of oil palm crop (Bedford, 1980; Dionisio et al., 2015; Oliveira et al., 2014; Ribeiro et al., 2010). In Brazil, the agricultural sectors lose approximately US\$ 17.7 billion every year due to damage by insects to major crops produced in the country, including oil palm, which represents an economic loss of approximately US\$ 4.73 million (Oliveira et al., 2014). Weevils (Curculionidae) and rhinoceros beetles (Melolonthidae: Dynastinae) are pests of the oil palm, damaging leaf and, consequently, reducing its photosynthetic capacity (Bedford, 1980; Dionisio et al., 2015; Oliveira et al., 2014). The rhinoceros beetles are considered an important pest of the coconut and oil palm in Asian and African

plantations (Bedford, 1976, 1980). Attacks by adult beetles can kill both young and old palms or may provide entry points for lethal secondary attacks from other insects or by pathogens (Bedford, 1980). Although 376 species of rhinoceros beetles are currently known from Brazil (Grossi & Vaz-de-Mello, 2018), they have not been recorded as oil palm pests until now. Only the palm weevils *Rhynchophorus palmarum* (Linnaeus, 1758) and *Metamasius hemipterus* (Linnaeus, 1758) have been considered a severe threat to Brazilian oil palm plantations. Therefore, this present report of rhinoceros beetles attacking an oil palm plantation is the first record in Brazil.

The rhinoceros beetles (Scarabaeoidea: Melolonthidae: Dynastinae) comprises approximately 2000 species distributed worldwide, but reaches its greatest diversity in the New World (Endrödi, 1985; Schoolmeesters, 2018). The genus *Golofa* Hope, 1837 comprises 29 species, of which 14 are found in South America (Arnaud & Joly, 2006; Lachaume, 1985; Ratcliffe, 2003). *Golofa claviger* (Linnaeus, 1771) is one of these South American species in which large males have a long pronotal horn bearing an apex enlarged with three pointed curved projections (Fig. 1C). In Brazil, this species has only been recorded in the state of Pará, but it is widespread across South America with records in Colombia, Venezuela, Peru,

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Fig. 1. *Golofa claviger* on oil palm. A – specimens collected in the infested area; B – dead males of *G. claviger* sheltered on the rachis or stem angles of the young palm; C – adult male lying on a palm leaflet; D – ripped young frond; E and F – wedge-shaped cuts on young, not yet unfurled frond; G – ripped unfurled frond.

Bolivia, Ecuador, French Guiana, and Suriname (Blackwelder, 1944; Céspedes & Ratcliffe, 2010; Dechambre, 1983; Endrödi, 1985; Lachaume, 1985).

Previously, species of *Golofa* had only been suspected of being a crop pest due to incomplete record descriptions in Mexico (Morón, 1995). However, in this research, *Golofa claviger* was observed, for the first time, causing damage to oil palm plants (Figs. 1D–G). The infested area under study was located in the municipality of Acará, Pará State, Brazil. The species occurred in an unusually high abundance there, which resulted in 5000 adults being collected in one day (Fig. 1A). The presence of the species in the area was detected at the beginning of the rainy season in February 2018. The attacks were observed on young palms only, where the beetles were feeding and mating. Males were most frequently found sheltering on the rachis or stem angles (the axil) of the plants (Fig. 1B) but were also found lying under the palm leaflets during the day (Fig. 1C). Feeding behavior was identified as the main cause of the damage as the beetles used their mouthparts to rip the plant tissues, causing wedge-shaped cuts on the central cluster of the palms (Fig. 1E). The central cluster consists of a set of very young, not yet unfurled fronds. After unfurling, the attacked plants exhibited partially ripped fronds (Figs. 1D–G).

The overwhelming majority of specimens collected during this study were adult males of *G. claviger*. In searching for possible breeding sites for Dynastinae species, including those described for *Golofa* by Morón and Pardo-Locarno (1994) and Morón (1995), we found females, eggs, and larvae on decaying palm stumps located in the same area. As part of a sustainable replanting strategy, fallen palm trunks were aligned parallel to the crop lines to improve soil quality for palm seedlings. Therefore, in addition to the feeding resource available for adults, the cultivated area also provided many substrates for female oviposition and development of the beetle's immature stages.

These findings contribute to understanding the unusually high abundance observed for *G. claviger* in the area, suggesting that the

sustainable replanting strategy cited above is very probably the main factor contributing to the arrival of this new pest. This is the most abundant record of the *Golofa* species reported in the literature. Furthermore, it is intriguing that only a few very large males were found among all the specimens, contrasted to the numbers found in other samples we have accessed.

Conflicts of interest

The authors declare no conflicts of interest

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