

First Record of *Xylosandrus Compactus* in Seedlings and Plantations of African Mahogany (*Khaya Senegalensis*) in Northeastern Brazil

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Abstract

The objective of this study was to report the first record of *Xylosandrus compactus* in a *Khaya senegalensis* plantation in the Northeast region of Brazil. The study area comprised 10 hectares of African mahogany (*Khaya senegalensis*) planted under different silvicultural systems and varying in age (4, 10 and 24 months). From May to July 2019, both larvae and adults of *Xylosandrus compactus*, attacked the petiole of adult trees in the field, promoting small holes followed by darkening from the hole to the leaf tip. Furthermore, the stem of the seedlings at the nursery had holes in its stem basis and internal galleries in young and adult individuals. It is estimated that 77% of the *Khaya senegalensis* population in the 24-month trees were attacked. Therefore, the growth of the trees may be compromised, and if there is no proper management, *X. compactus* can cause economic damage in the *K. senegalensis* plantation.

Keywords: Coleoptera, Scolytinae, pest, forest plantation, *Khaya senegalensis*.

The cultivation of forest species, especially in tropical climates, is susceptible to attack by a wide variety of exotic and native insects species (Wingfield et al., 2015). The growth of forest plantation can decline by more than 50% due to pest related damage, as demonstrated in a study on *Eucalyptus* (Souza et al., 2011). This poses a significant threat to high-value cultivation and can render it economically unviable.

Brazilian mahogany (*Swietenia macrophylla*) serves as a classic example of a forest species whose cultivation is constrained in Brazil due to its association with a particularly troublesome native insect, the *Hypsipyla grandella* moth (Krisnawati et al., 2011). In replacement of the Brazilian mahogany, species of the genus *Khaya* have become promising, which have appreciation in the timber market and are not susceptible to attack by this moth (Souza et al., 2020). Planting non-native trees far from their origin site is a strategy to reduce the attack of insect pests (Wingfield et al., 2015). Nevertheless, out of its natural environment, native or adapted

insects could attack the species, like *Trigona spinipes* in *Khaya ivorensis*, causing branch and apical sprouting (Oliveira et al., 2019).

The occurrence of coleoborers has been reported for a long time in tree plantations (Ngoan et al., 1976) and recently in Europe (Gugliuzzo et al., 2019). Specifically, the *Xylosandrus compactus* was reported in Ghana in *Khaya ivorensis* (Browne, 1963), in Nigeria in *Khaya grandifoliola* (Roberts, 1969) and in India in *Khaya* spp (Meshram et al., 1993). Recently, *Xylosandrus crassiusculus* was reported in the southeast of Brazil in a *Khaya senegalensis* plantation (Covre et al., 2021). In Northeastern Brazil, there have been attacks in African mahogany by coleoborers (Coleoptera) of the Scolytinae subfamily, from the seedling phase to the trees growing in the field. In this sense, with the objective of registering the first occurrence of *Xylosandrus compactus* in *Khaya senegalensis* in the northeast region of Brazil, describing its damage and quantifying the percentage of trees killed by the pest, a study was carried out located in the ecosystem called

“Brejo de Altitude Nordestino”, enclaves of the Atlantic Forest, inserted in a matrix dominated by Caatinga vegetation, the study area is located on the São Francisco farm (-8.353455°, -35.597227°), district of Gravatá, Pernambuco State, Brazil. The climate is classified as Aw according to Köppen (Alvares et al., 2013). The average annual temperature is 22.1 °C, varying from 20 to 25.7 °C and with an average annual rainfall of 710 mm (Agritempo, 2020).

The farm has about 10 hectares of *Khaya senegalensis* plantation cultivated in different silvicultural systems and planting ages, with five hectares under homogeneous plantation and five hectares under an agroforestry system regime with a 10-month banana planting (*Musa spp.*). The pure plantation area is divided into three stands of different ages (4, 10 and 24 months old). Soil preparation was carried out by harrowing and 6-month-old seedlings produced in nurseries within the farm were planted in a spacing of 3 x 2 m. Mineral and organic fertilization applied at the planting time and 6 months later for each stand summed about 30, 30 and 60 kg ha⁻¹ of N, P and K, respectively.

In order to survey the attack intensity in mahogany individuals in the field, three plots of 10 x 20 m were set up randomly in each stand, one plot in each topographic environment, and top, middle third and lower third of the hill. We consider this is a sufficient sample as the analysis by a previous work showed a low heterogeneity among plots within the stand (Silva et al., 2023). In each plot, all attacked trees and their attack intensity were counted. In the area where the greatest attack intensity happened, a two-year old plot, leaves were collected from 30 individuals and sent to the laboratory for extraction of petiole insects in the larval and adult stages.

The insects were extracted from the petioles of the leaves with a razor blade knife, with the cuts being made perpendicular to the wood, in regions where the insects caused holes in the plant. After removing the insects from the petioles, the adult individuals were immediately killed in a deadly chamber with cotton soaked in ethyl acetate and subsequently transferred to an oven at 60 °C for 48 hours. Afterwards, they were packaged in Eppendorf-type plastic microtubes and sent for identification by specialists. The identification was performed with a stereoscopic microscope, using methods of Word (1982) and by direct comparison of previously identified specimens at the Federal University of Paraná, Brazil.

From May to July 2019, the presence of insects was observed both in the larval and adult phases of *Xylosandrus compactus* (Eichhoff, 1875), attacking the petiole of adult

plants in the field and the stem of the seedlings in the *Khaya senegalensis* nursery. The *X. compactus* is an insect from the order Coleoptera, family Curculionidae and subfamily Scolytinae. The females of *Xylosandrus compactus* typically measure between 1.6 and 1.8 mm in length and 0.6 to 0.8 mm in width. They are commonly referred to as “petiole borers” or “branch borers.” Additionally, they are sometimes more broadly categorized as “ragweed beetles” due to their tendency to infest live plant wood. These beetles engage in symbiotic relationships with fungi, which are inoculated into the plant during the oviposition process. The fungi then serve as a source of sustenance for both adult individuals and their larvae (Faccoli, 2021). In the case of attacked adult plants, the petioles displayed small holes, which were subsequently accompanied by a blackening that extended from the hole towards the tip of the leaf. other hand, in the mahogany seedlings, the petiole borer attacked the stem, with holes observed mainly in its closest portion, as well as internal galleries with young and adult individuals (Figure 1).

The area where the most attacked *Khaya senegalensis* plants were found was in the 24-months field after planting, with petioles attacked mainly at the leaf base. In each petiole, an average of 10 individuals were found colonizing it internally, considering adults and larvae. No insect attacks happened on the main stem of the adult plant individual; however, seedling attacks were observed in the nursery stage.

Internally, larvae and adults were found in galleries, and portions of the internal plant material with gray spots were observed, probably associated to the fungi with which these insects groups make symbiotic association. Figure 2 shows details of the holes in the petiole caused by the insect, as well as the internal galleries with larvae and adult insects.

In a general scenario, the *X. Compactus* has been recorded in Brazil causing damage to different woody species in the most different regions, such as the native species *Aniba rosaeodora* and *Euterpe oleracea* in the Amazon region (Torrez et al., 2022; Santos, 2021); in exotic cultivated species such as *Coffea canefora* (Túler et al., 2019) and *Eucalyptus grandis* in the South region (Muller & Andreiv, 2004) among other species.

The previous land use involved pasture with *Brachiaria* spp. for cattle ranching. Since we lack a complete historical record of land use, we refrain from speculating on the origin of the insects. It is worth noting that the insects were only detected two years after planting. However, it is evident that these insects are widespread in the area.

In the present study, it was estimated that the pest attacked 77% of the *Khaya senegalensis* population in the 24-month field so it can be inferred that the increased productivity of the attacked individuals may be compromised, and there is still no adequate control, since it is a very new occurrence of this interaction. The physical damage inflicted by *X. compactus* can result in significant economic losses within the *K. senegalensis* plantations in this region, as well as in other regions globally. Pests like *X. compactus* have the potential to cause substantial reductions in productivity, with losses exceeding 50% in severe cases. (Souza et al., 2011). To the best of our knowledge, this is the very first report of this pest in *Khaya senegalensis* plantation in the northeast region in Brazil. Other reports on similar occurrences have been documented in Africa (Browne, 1963; Roberts, 1969). Furthermore, a recent report involving another species within the same genus, *Xylosandrus crassiusculus*, emerged in southeastern Brazil within a *Khaya senegalensis* plantation (Covre et al., 2021). However, the extent and nature of the damage caused by *Xylosandrus crassiusculus* were not provided in the report. Therefore, it is imperative to comprehend the impact of these pests on wood productivity and conduct a more comprehensive investigation into their effects on these tree species. Further research is needed to explore the interaction between native pests and these tree species. Reporting on these interactions will foster increased interest in studying and controlling this potential issue in Brazilian forestry.

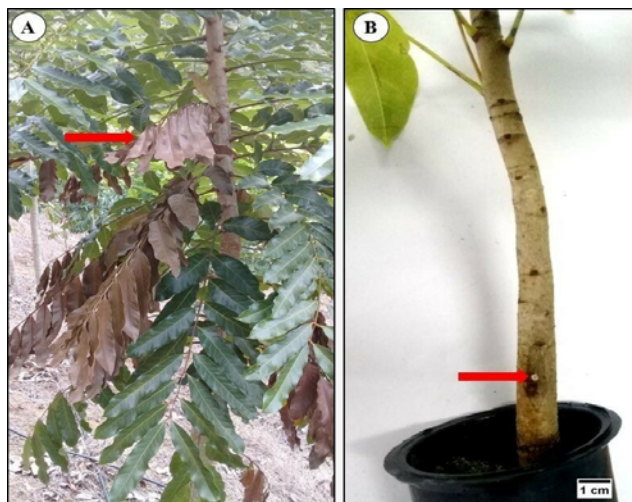


Figure 1. a - *Khaya senegalensis* plant in the field two years after sowing showing dry leaves due to the petiole borer attack; b - 3-month mahogany seedlings with hole detail (red arrow) caused by petiole perforation.

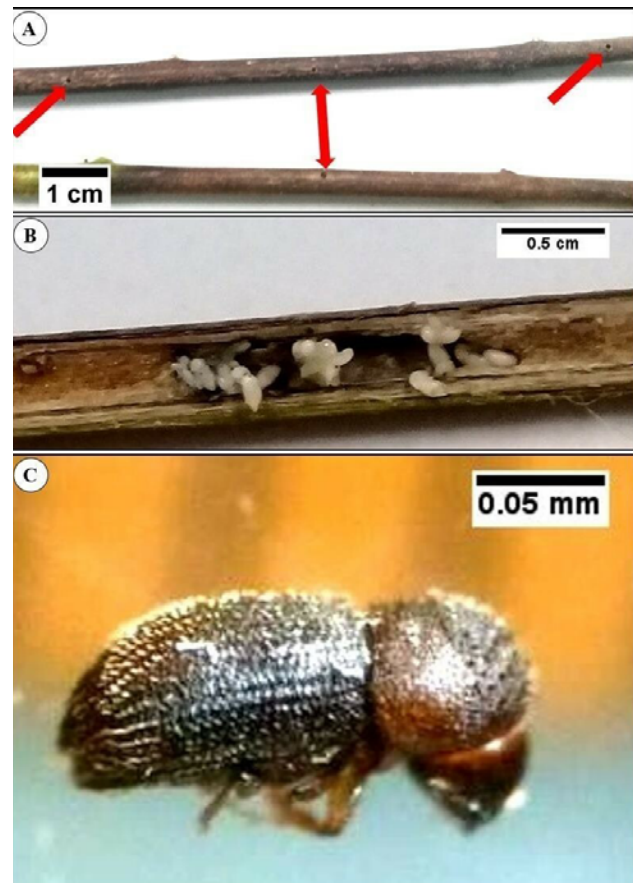


Figure 2. a - External details of the multi-hole petiole (red arrow) and the darkened color; b - Detail of internal galleries in the petiole with petiole borer larvae; c - Adult petiole borer collected from *Khaya senegalensis* plants in Gravatá - PE

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