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First record of *Cadra cautella* (Walker, 1853) (Lepidoptera: Pyralidae) infesting Brazil nut (*Bertholletia excelsa*) in Nova Califórnia, Rondônia, Brazil

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ABSTRACT

This study presents the first record of *Cadra cautella* (Walker, 1853) (Lepidoptera: Pyralidae) infesting Brazil nut kernels (*Bertholletia excelsa* Humboldt & Bonpland) in the Nova Califórnia district, Porto Velho, Rondônia, Brazil. In April 2024, microlepidopterans were found in stored Brazil nuts. A sample of infested nuts was collected and sent to the Entomology Laboratory at Embrapa Acre. From these samples, six adult lepidopterans emerged, which were identified as *C. cautella*, a cosmopolitan pest that infests food products during storage. This polyphagous insect causes significant damage to stored products by creating holes and galleries in the kernels, which favors the development of filamentous fungi and contamination by mycotoxins, rendering the nuts unsuitable for consumption. Identifying pests and understanding their economic impact is essential for developing control strategies and preventing losses. This record represents an initial step toward studies to mitigate infestations in Brazil nuts and preserve the quality of stored products.

Keywords: *Ephestia cautella*, cacao moth, stored product pests.

INTRODUCTION

The Brazil nut tree (*Bertholletia excelsa* Humboldt & Bonpland, Lecythidaceae) is a heliophytic species native to the Amazon region. It is found discontinuously in upland forests from the Guianas to the Amazon Basin, growing in the Brazilian states of Amazonas, Amapá, Maranhão, Roraima, Goiás, Mato Grosso, Rondônia, and Acre.[1] Recognized for its multiple uses, the Brazil nut tree provides a range of valuable products not only for their historical, cultural, and ecological significance but also for their practical applications. The fruit is a kernel typically consumed raw or dried. Additionally, Brazil nut milk and oil are extracted and widely used in the phytocosmetic industry. The byproduct from this extraction can be turned into flour, which is used in the production of bread, cookies, ice cream, and other food items, or used as a protein source in animal feed.[2]

The Brazil nut tree is also considered a promising species for restoring degraded areas due to its strong growth performance in adverse edaphoclimatic conditions and its minimal phytosanitary issues.[3] Although the Brazil nut tree faces few phytosanitary problems, several insect species have been recorded as associated with it, and these pests can impact both field production and the post-harvest stage.

The pest species currently associated with *B. excelsa* in Brazil are: *Lusura chera* (Drury, 1773) (Lepidoptera: Notodontidae),[4,5] *Tropidacris collaris* (Stoll, 1813) (Orthoptera: Romaleidae),[6] *Hybolabus amazonicus* Voss, 1925 (Coleoptera: Attelabidae) and *Hybolabus columbinus* (Erichson, 1848) (Coleoptera: Attelabidae),[7,8] *Coptotermes gestroi* (Wasmann, 1996) and *Heterotermes tenuis* (Hagen, 1858) (Blattodea: Rhinotermitidae),[1,9] *Atta* spp. (Hymenoptera: Formicidae),[1] *Plodia interpunctella* (Hübner, 1813) (Lepidoptera: Pyralidae),[10] *Tribolium castaneum* (Herbst, 1797) (Coleoptera: Tenebrionidae)[11] and *Hypothenemus hampei* (Ferrari, 1867) (Coleoptera: Curculionidae).[12]

Although Brazil nuts are a product of significant socioeconomic relevance for the Amazon region, research aimed at pest monitoring is scarce, both in the field (native or cultivated Brazil nut groves) and under storage conditions. Knowledge of the insect species that cause economic damage to Brazil nut groves or the nuts themselves is essential for developing efficient control and mitigation strategies.[13]

In this sense, the present study aims to document the presence of a lepidopteran borer infesting Brazil nuts in the state of Rondônia, located in the southwestern region of the Brazilian Amazon.

MATERIAL AND METHODS

In April 2024, the presence of microlepidopterans was detected in Brazil nut kernels (*B. excelsa*) stored in a silo (Figure 1) (09°45'28.26"S, 66°36'32.73" W) in the Nova Califórnia district, within the municipality of Porto Velho, Rondônia.

Figure 1. Brazil nut kernels (*Bertholletia excelsa*; Lecythidaceae) in a storage silo in Nova Califórnia, Rondônia, Brazil. Photo: Aline Lima de Melo.

A sample of infested Brazil nuts was collected, placed in a sealed bag, and sent to the Entomology Laboratory at Embrapa Acre in Rio Branco, Acre. In the laboratory, the kernels were placed in a screened cage, awaiting the emergence of adults. Six adult microlepidopteran specimens were captured, mounted on entomological pins, and sent to the taxonomist Dr. Victor Osmar Becker (Uiraçu Institute, Camacan, Bahia, Brazil) for taxonomic identification.

RESULTS AND DISCUSSION

The insects were identified as *Cadra* (*Ephestia*) *cautella* (Walker, 1863) (Lepidoptera: Pyralidae) (Figure 2), commonly known in Brazil as "traça-do-cacau" or "traça-das-flores-do-coqueiro." It is considered a cosmopolitan insect due to its eggs and larvae being transported globally in food products.[14,15]

The moths have a wingspan ranging from 14 mm to 18 mm, with a grayish coloration, yellowish spots, and fringes on the forewings. The hindwings are broad, translucent, and have clearly visible veins. The caterpillars measure 10 mm to 12 mm in length and, when newly hatched, have a dark head capsule and a whitish body. In earlier stages of development, they feature small black dots on their bodies, a characteristic that helps distinguish them from the larvae of *P. interpunctella*. However, in their fully developed stage, they take on a slightly pinkish coloration, with a body covered in fine hairs.[16]

Figure 2. Female of *Cadra cautella* (Lepidoptera: Pyralidae) in dorsal view. Photo: Pekka Malinen.

As reported in the literature, the damage to Brazil nut kernels is similar to that observed in cacao seeds, characterized by holes and internal galleries in the kernels caused by the feeding of the larvae, rendering them unfit for consumption (Figure 3). Additionally, the holes in the kernels caused by the larvae can create conditions conducive to fungal development and contamination by mycotoxins.

Figure 3. Internal appearance of Brazil nut kernels (*Bertholletia excelsa*; Lecythidaceae) after infestation by *Cadra cautella* (Lepidoptera: Pyralidae). Photo: Rodrigo Souza Santos.

As a polyphagous pest, *C. cautella* can infest other stored products, such as cereals and seeds of wheat, corn, rice, and sorghum, as well as dried fruits, flours, peanut pods, and kernels of various palm species.[16] The cacao moth has also been reported to infest stored garlic.[15,17] Additional damage to stored products is caused by the need to remove the abundant webs, which also contain fecal pellets, shed skins, and egg shells. Depending on the level of infestation, losses can exceed 60% of the stored goods.[18]

Pests that occur during storage typically thrive in conditions of inadequate temperature, ventilation, and humidity.[19] According to Sánchez (2011),[16] both the eggs and pupae of *C. cautella* are directly affected by temperature and relative humidity. Temperatures below 15 °C and above 36 °C are harmful to the insect's development, while temperatures between 25 °C and 30 °C, and humidity levels between 70% and 80% are considered optimal. Under favorable climatic conditions, the life cycle of *C. cautella* is completed in an average of 25 days.[17]

There are no products registered with the Brazilian Ministry of Agriculture and Livestock (Mapa) for the control of *C. cautella* in Brazil nut kernels (*B. excelsa*).[20] However, in general, to minimize losses from pests of stored grains and seeds, it is essential to understand the storage conditions of the grains and seeds, the storage unit and seed processing facility, the identification of pest species and populations, their associated damages, and

the cleaning and sanitation of storage facilities.[21] If the products are stored in sealed structures, atmospheres with low oxygen content and enriched with carbon dioxide can be used to control the pest.[22]

Pest identification represents the initial step in addressing any entomological issue in agriculture. Once the species is known, a bibliographic survey can be conducted, providing valuable information related to the pest.[23] In this regard, this work presents the first record of *C. cautella* in Brazil nut kernels (*B. excelsa*) not only for Rondônia but for Brazil.

CONCLUSION

Understanding the species of insects that cause economic damage to Brazil nut trees or their kernels is crucial in developing effective strategies to control them. Given the potential harm caused by the insect in stored Brazil nut kernels, further studies are needed to adapt storage and sanitation conditions at storage sites to mitigate or reduce possible pest infestations and economic losses.

DATA AVAILABILITY STATEMENT

The entire dataset supporting the results of this study is available upon request from the corresponding author, Rodrigo Souza Santos. The dataset is not publicly available as it only consists of the taxonomic identification of the insect species associated with the Brazil nut tree.

AUTHOR CONTRIBUTION

Conceptualization: Rodrigo Souza Santos.

Investigation: Aline Lima de Melo.

Methodology: Rodrigo Souza Santos.

Writing – original draft: Rodrigo Souza Santos.

Writing – review & editing: Rodrigo Souza Santos, Cleisa Brasil da Cunha Cartaxo, Aline Lima de Melo.

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