




# Scolytinae species damaging *Carya illinoensis* trees in southern Brazil<sup>1</sup>

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## ABSTRACT

This study aims to report two species of Scolytinae that have been damaging *Carya illinoensis* trees in southern Brazil. In two Brazilian municipalities, Guarapuava in Paraná State and Pantano Grande in the Rio Grande do Sul State, insects of the Scolytinae family were found damaging pecan trees. Infested tree samples were kept in the laboratory in glass tubes sealed with a voile tissue until the emergence of adults. After the adults' emergence, the specimens were identified by their morphological characteristics and sent to a taxonomist specialized in Scolytinae family for identification. The species *Xyleborus retusus* was identified causing damages to pecan trees from Guarapuava while the species *Xyleborus ferrugineus* was identified in pecan trees from Pantano Grande. Trees injured by these insects displayed similar symptoms in both study areas. In Guarapuava and Pantano Grande, 13 and 10 trees, respectively, died due to stem lesions caused by *Xyleborus* spp. Thus, this study reports for Brazilian pecan growers the occurrence of Scolytinae species *X. retusus* and *X. ferrugineus* damaging *C. illinoensis* plants in southern Brazil. It also emphasizes the importance of constant crop monitoring to minimize the risk of pest damage.

**Keywords:** Forest Entomology; pest management; pecan.

## INTRODUCTION

The species *Carya illinoensis* (Wangenh.) K. Koch is distributed naturally in a continuous area from Mexico to the state of Illinois in the United States (McWilliams, 2013). The cultivation of this species has been growing rapidly in Brazil, with new orchards established mainly in the states of Rio Grande do Sul, Santa Catarina, and Paraná. Besides composing large orchards, pecan crops are also present in numerous small farms due to their use in agroforestry systems, shading of aviaries, wood production, and ornamentation. In 2016, the Brazilian production reached 5.453 tons of nuts (dry fruit), from a total of 3.503 planted hectares (IBGE, 2016). As a consequence of the increase in the area of pecan cultivation in southern Brazil, there has been a significant increase in the incidence of insects, which cause damage to the crop (Boscardin & Costa, 2018).

The pest species *Monellia caryella* (Fitch, 1855) (blackmargined aphid), *Phylloxera devastatrix* Pergande, 1904 and *Phylloxera notabilis* Pergande, 1903 (phylloxera), are highlighted as being of major importance due to their occurrence in Brazil (Rio Grande do Sul) and the United States, causing damage to leaves (Boscardin & Costa, 2018). It should be noted that the phytophagous insect species *Leptoglossus stigma* (Herbst, 1784), *Leptoglossus zonatus* (Dallas, 1852) (Hemiptera: Coreidae) and *Loxa deducta* (Walker, 1867) damage the fruit, implicating in low orchard productivity (Boscardin *et al.*, 2016). Besides these species, coleopteran species (Coleoptera: Curculionidae, Scolytinae) are noteworthy, since these beetles, known as bark beetles and ambrosia beetle, are considered the most harmful in native and planted forests (Raffa *et al.*, 2015).

The bark beetles build galleries initially on the phloem, or sometimes on the sapwood, from where they feed and

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are characterized by high host specificity (Wood, 1982; Rassati *et al.*, 2016). Ambrosia beetles establish breeding galleries in wood and feed of symbiotic fungi rather than directly on plant tissues. In addition, they are less specific regarding their hosts (Wood, 1982; Raffa *et al.*, 2015) and are considered as the dominant group in Brazil, especially the species from the Xyleborini tribe (Flechtmann *et al.*, 1995). In the Rio Grande do Sul State, two species of the genus *Corthylus* and one species of the genus *Xyleborinus* have been reported to harm *C. illinoensis* trees (Boscardin, 2016). The identification and monitoring of pecan pests are fundamental to the adoption of Integrated Pest Management strategies. Thus, this study aims to report the occurrence and damages caused by two species of Scolytinae in pecan trees in southern Brazil.

## MATERIAL AND METHODS

From December 2016 to January 2017, injuries caused by insects on four-year-old pecan trees were observed in an area of two hectares in the town of Guarapuava (25°23'27" S and 51°27'4" W), state of Paraná, Brazil. The climate of this region is classified as subtropical humid oceanic, without a dry season and with temperate summer (Cfb) (Alvares *et al.*, 2017). The symptoms were observed on the outer parts of the trees, such as the presence of sawdust, circular entrance and exit holes, senescent leaves, and complete dryness of the canopy.

In the town of Pantano Grande (30°11'24" S and 52°22'24" W), state of Rio Grande do Sul, symptoms similar to those observed in Guarapuava were observed in a 55 ha pecan farm with five-year-old trees during November, December 2017 and January 2018. In this region, the climate is classified as subtropical humid oceanic, without a dry season and with hot summer (Cfa) (Alvares *et al.*, 2017). In an area of four hectares, trees displayed 'wilted' canopies, several of them having yellowish leaves. The presence of perforations and insect larvae were observed after removing a piece of bark from the stem.

Fragments of the stems with insect damage of four dead trees from both locations (from Guarapuava in December 2016 and from Pantano Grande in November 2017) were collected and sent to the Forest Entomology Laboratory of the Universidade Federal de Santa Maria, RS. The material was stored in glass containers (60 cm high x 30 cm in diameter), separated by sampling sites and covered with a mesh until the emergence of adult insects, which initiated in January 2017 to samples from Guarapuava and in December 2017 to samples from Pantano Grande.

Afterward, the Scolytinae specimens were collected and stored in 1.5 mL tubes containing 70% alcohol. The

specimens emerged from stems (113 females and 8 males from Guarapuava; and 138 females and 11 males from Pantano Grande) were sent to a specialist for identification. Then, the specimens were identified by a taxonomist based on the morphological characteristics of Scolytinae species. In addition, fragments of stems were sectioned in the longitudinal and transverse directions to allow visualizing the presence of galleries and insects inside the wood.

## RESULTS AND DISCUSSION

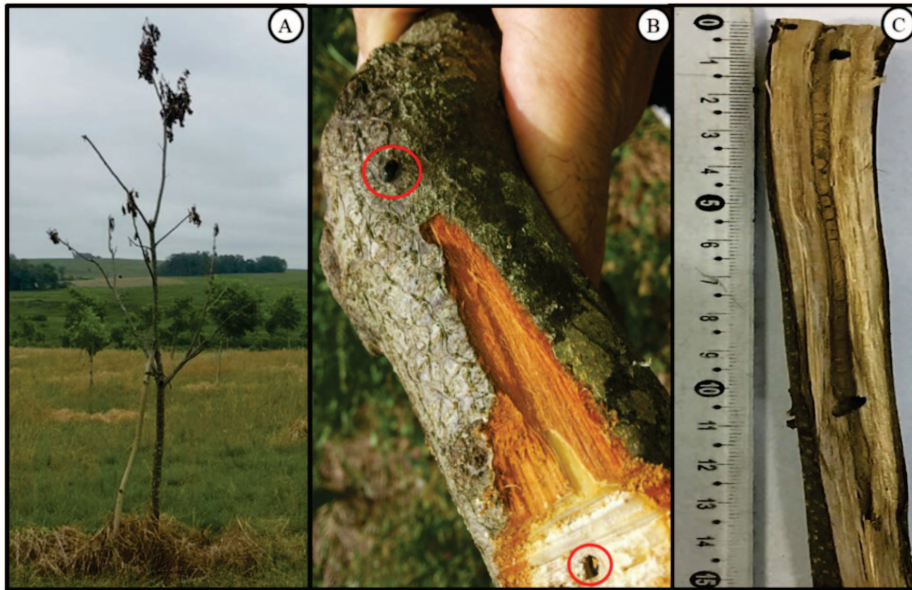
In Guarapuava, 13 dead trees were recorded due to injuries caused by insects identified as *Xyleborus retusus* (Eichhoff, 1868) (Figure 1). Some trees were removed from the plantation and sectioned (Figure 2A), revealing the presence of adults in the external and internal parts of the wood (Figure 2B). From the longitudinal and transversal cuts in the trunk and branches, it was possible to visualize internal galleries and black staining in the cambial layers (mainly in galleries) (Figure 2C).

A total of 30 injured trees were found in Pantano Grande, from which 10 died due to the occurrence of one species of Scolytinae identified as *Xyleborus ferrugineus* Fabricius, 1801 (Figure 3). Some injured trees presented perforations in the trunk (Figure 4A) and were cut into smaller parts to facilitate the visualization of the damage caused by larvae and adults of *X. ferrugineus* (Figure 4B). From the longitudinal section of some trees, internal symptoms similar to those found in Guarapuava were observed, such as the presence of dark stains in the wood (Figure 4C).

Pecan cultivation can be economically important in family farming properties not only due to low implantation costs but also because it allows the implantation of an integrated system with pastures. In addition, both the wood (considered noble and useful in the formation of legal reserve in properties) and the walnut are marketable



Figure 1: Adult individual of *Xyleborus retusus*.



**Figure 2:** Pecan's plantation in Guarapuava, PR, Brazil. Young pecan tree dead as a result of *Xyleborus retusus* infestation (A); adult individual and its bore in the wood (B); galleries caused by *Xyleborus retusus* (C).

products (Divinut, 2016). In this sense, the occurrence of pests such as Scolytinae (that may lead to the death of plants in an orchard) may harm the production of fruits and noble wood even before the crops become profitable.

The species found in Guarapuava and Pantano Grande belong to the Xyloborini tribe. This tribe is considered as one of the most important from Scolytinae due to the species causing significant damages to different types of monocultures, including the black wattle (Machado *et al.* 2014). Species from the Scolytinae and Platypodinae (Coleoptera: Curculionidae) subfamilies initially feed on stressed or damaged trees. However, when reaching high population levels, they may injure healthy plants (Carrano-Moreira, 2014).

The damage caused by *Xyleborus* spp. is characterized by the opening of galleries by adult insects through the bark directly into the sapwood, leaving grained sawdust on the outside of the entrance opening (Solomon & Payne, 1986; Boscardin & Costa, 2018). When galleries are active, they have a light coloration and no sawdust, whereas the unoccupied galleries have a dark color due to the symbiotic fungi (Solomon & Payne, 1986). These fungi reduce plant defenses and deteriorate wood, making it more nutritious for larvae and adults (Gullan & Cranston, 2014). In addition, the insect damage weakens the plant, leaving it vulnerable to disease, which may render it unfeasible for commercial purposes and even kill the host tree (Solomon & Payne, 1986).

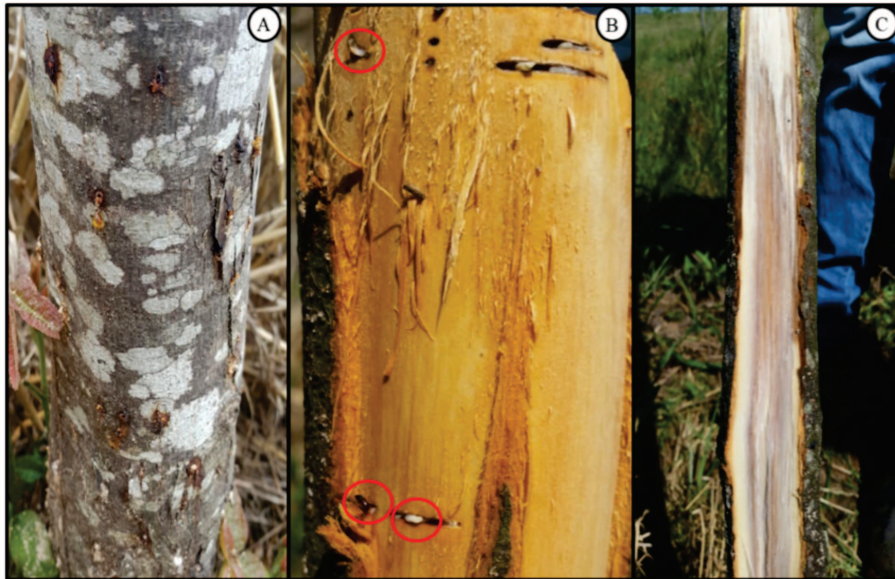
Climatic factors comprising temperature and humidity are extremely important for *Xyleborus* species development and its symbiotic fungi because they are dependent on ideal conditions for the fungal development

in the galleries (Wood, 1982). Climate change and anthropic action are under intensification in recent years and are increasingly influencing the biology and behavior of insects and also expanding their hosts. Homogeneous cultivations are an easier alternative to insect adaptation, feeding and increasing its population density.

Boscardin (2016) carried out a study in the Rio Grande do Sul State on the symptomatology of the damage caused by Scolytinae (*Corthylus* sp.1, *Corthylus* sp.2, and *Xyleborinus* sp.) in pecan trees. This author considered water stress as a central aspect of conditioning the trees for the emission of phenolic compounds that attract these insects (Boscardin, 2016). The symptoms reported by the author were the presence of holes and sawdust in the trunk, senescent leaves and death of trees after 2-4 weeks as external symptoms, and wood stains and insect entry/emergence holes as internal symptoms. These symptoms are similar to those caused by *X. retusus* and *X. ferrugineus*.



**Figure 3:** Adult individual of *Xyleborus ferrugineus*



**Figure 4:** Pecan's plantation in Pantano Grande. Injured tree presenting perforations in the trunk by *Xyleborus ferrugineus* (A); larvae and adult specimen of *Xyleborus ferrugineus* inside the trunk (B); and wood staining by fungus (C).

The species *X. ferrugineus* along with *X. affinis* are considered the most destructive species in eucalyptus plantations in Brazil (Flechtmann, 2000). *X. ferrugineus* is considered as the primary vector of the pathogenic fungus *Ceratocystis fimbriata* (Ciesla, 2011; Wollmann *et al.*, 2017) and may leave injuries in woody plants with more than 10 cm in diameter (Wood, 1982; Wollmann *et al.*, 2017). In a survey of scolytidae in plantations of *Eucalyptus* spp. in Cuiabá, state of Mato Grosso, Brazil, the species *Xyleborus spinosulus* (Schedl, 1934), *X. retusus* and *X. ferrugineus* were quantitatively the most important (Dorval *et al.*, 2004). Therefore, *X. retusus* and *X. ferrugineus* are potential pests in pecan plantations.

The wide occupation of monocultures intensifies the emergence of entomological problems, which must be constantly monitored to recognize the pests and their damages, which can reduce the growth and yield of pecan trees. Although there is no Integrated Pest Management (IPM) program for pecan trees, the basic IPM strategies, as identification, monitoring, and evaluation of yield loss per unit of injury, should be used and investigated in orchards to reduce and to avoid economic losses. Scolytinae insects in pecan should be monitored with ethanolic traps distributed in the orchard for the capture and later identification of the species. Studies on the biology and ecology of these insects and on their natural enemies are important.

## CONCLUSIONS

Damages identified on the stem of pecan trees in Guarapuava (Paraná State) and Pantano Grande (Rio Grande do Sul State) were caused by two species of *Xyleborus*

(Scolytinae). The potential risk of insect pests, as well as the quantification of their damages in *C. illinoensis* crops, are extremely important to the proper management of the species. The constant monitoring of pecan cultivation is a practical and rapid action to be taken, assisting in the early detection of entomological problems. It is important to highlight that this is the first report of occurrence of the scolytinae species *X. retusus* and *X. ferrugineus*, causing damage to stem and mortality of *C. illinoensis* plants in Brazil.

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