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Research Article

EMERGING PEST THREATS TO *LITSEADECCANENSIS* GAMBLE: IMPLICATIONS FOR CONSERVATION AND MANAGEMENT IN THE WESTERN GHATS, INDIA

Praveena S and P A Jose

Tree Physiology Department, Sustainable Forest Management Division, KSCSTE-Kerala Forest Research Institute, Peechi, Thrissur, Kerala-680653

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ABSTRACT

Litsea deccanensis Gamble, a vital wet-season blooming tree in the Lauraceae family, faces a dual threat from the Redbay ambrosia beetle (*Xyleborus glabratus*) and the Molytinae weevil (*Alcidodes porrectirostris*). This study, conducted in the Western Ghats, India, explores the impact of these pests on *L. deccanensis*, a commercially significant species used in agarbatti production. Stem bark exploitation, coupled with laurel wilt disease, contributes to the tree's declining population. These stem borers cause considerable damage to both seedlings and young saplings, and their influence extends to infestations in mature trees. The Molytinae weevils primarily target seeds, posing a significant challenge for the storage and production of planting stock. This dual pest threat jeopardizes the natural regeneration of *L. deccanensis*, contributing to population decline in the wild. Recognizing the urgent need for conservation, this study marks a crucial step in developing proactive strategies to manage *L. deccanensis* effectively within its natural habitat, safeguarding this commercially valuable species from further decline.

Keywords: *Litsea deccanensis*, Ambrosia beetle, Molytinae weevil, Pest incidences, Conservation.

INTRODUCTION

Litsea deccanensis Gamble is a tree that blossoms during the wet season and belongs to the Lauraceae family. This dioecious species is found in the moist deciduous forests of South India and Sri Lanka, typically at altitudes above 500 meters. It holds commercial significance in India, particularly in the production of agarbatti incense sticks, where its stem bark serves as a crucial binding matrix (Jayaraj *et al*., 2022). The leaves are esteemed in traditional medicine, particularly among tribal communities in Andhra Pradesh, India, where they are used for treating chest pain (Kumar *et al*., 2011).Unfortunately, the populations of *L. deccanensis* are declining as a result of both unscientific practices and the excessive harvesting of its bark. This decline is exacerbated by biological constraints (Mishra and Naidu, 2013).

Laurel wilt is a recently identified disease affecting various trees, such as redbay (*Persea borbonia*), swampbay (*Persea palustris*), and other members of the Lauraceae family, including *Sassafras albidum* and commercial avocado (*Persea americana* Mill.), particularly in the southeastern USA (Fraedrich *et al*., 2008). The cause of mortality in these trees is attributed to the laurel wilt disease, which is triggered by *Raffaelea lauricola*, a fungal symbiont providing sustenance for the redbay ambrosia beetle, *Xyleborus glabratus* Eichhoff (Coleóptera: Curculionidae, Scolytinae) (Fraedrich *et al*., 2008; Harrington *et al*., 2010, 2008).The laurel wilt pathogen was introduced to the southeastern USA when the beetle brought it from its home range in Asia.

First detected near Savannah, GA, in 2002, the red bay ambrosia beetle quickly led to redbait mortality in Hilton Head, SC (Fraedrich *et al*., 2008).While *X. glabratus* is not considered an economic pest in its native regions (India, Japan, Myanmar, and Taiwan), limited research has been conducted on the species due to its relatively benign status in its home range.

*Corresponding Author: P A Jose, Tree Physiology Department, Sustainable Forest Management Division, KSCSTE-Kerala Forest Research Institute, Peechi, Thrissur, Kerala-680653 Email: pajosekfri@gmail.com

The walnut weevil, scientifically known as *Alcidodes porrectirostris* Marshall, has emerged as a significant threat to walnut trees, with no prior reports of its damage to seeds within the Lauraceae family. Notably, this marks the first documented instance of the walnut weevil targeting the seeds of *L. deccanensis*, both within India and globally. The recorded attacks on *L. deccanensis* seeds represent a novel observation, shedding light on the expanding range of this pest's impact beyond its traditionally reported targets in the walnut tree population. The species population under investigation was identified within the Nelliampathy forests of Palakkad District, situated in the southern region of the Western Ghats, Kerala state, India, at coordinates 10.539°N latitude and 76.673°E longitude, with an altitude of 765m asl. The host plant's identity was verified through the Digital flora of flowering plants of Kerala (Sasidharan, 2011) and cross-confirmed using the Plants of the World Online database (https://powo.science.kew.org/). In December 2021, ripened fruits and infected stems were systematically collected.

MATERIAL AND METHODS

Xyleborus glabratus Eichoff

The redbay ambrosia beetle, *Xyleborus glabratus* Eichoff (Coleoptera: Curculionidae, Scolytinae), was first detected in the US, in a survey trap near Port Wentworth, Georgia in 2002 (Rabaglia *et al*., 2005) and by 2004 beetle with females its association with laurel wilt disease had been recognized (Fraedrich *et al*., 2008). *X. glabratus* is a minute Wood boring beetle with 2.1-2.4 mm in length, 3 times as long as wide, and dark brown to black. Males are rare, flightless, 1.8 mm in length, and 2.5 times as long as wide (Rabaglia *et al*., 2006).

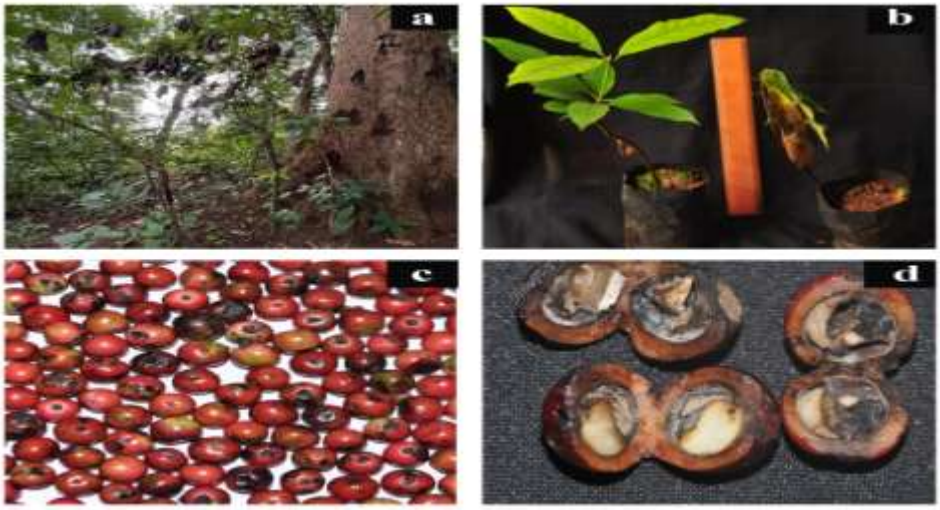

Figure 1. Laurel wilt *in situ***b.**Infested seedling vs normal seedling *ex-situ* **c**&**d.** View of infested fruits.

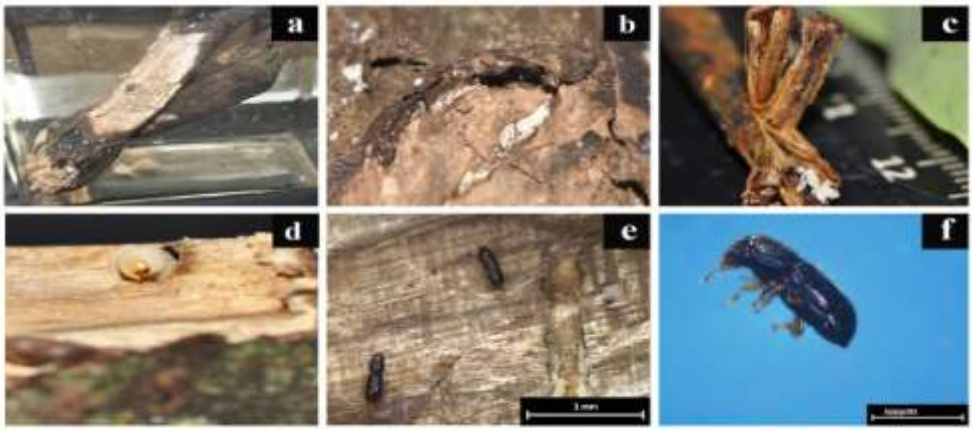

Figure 2. *Xyleborus glabratus* Eichoffa. Powdered bark indicates the infestation of an ambrosia beetle **b.**A string of compacted sawdust protruding from the bark at the point of attack **c.** Early stages of larval development **d.** Larvae emerge from the short hole.**e**. Adult ambrosia beetles near the gallery **f.** Lateral view of an adult ambrosia beetle. Scale bars e. 1mm &f. 500µm.

The trunks of infested trees were cut at the base and sectioned into 20–25 cm logs. Logs were transferred immediately to the laboratory and 4–6 logs were placed in a glass container where the mouth of the container was covered by a cotton cloth. Throughout the developmental study outlined above, specimens of *X. glabratus* in the egg, larval, and pupal stages were collected and preserved in 70% ethyl alcohol. Photo documentation and morphological descriptions were taken for each stage. The collected specimens have been deposited in the collection room of the Forest Entomology department at KFRI, Peechi. Trees freshly attacked by *X. glabratus* exhibit few external symptoms initially. Small strings of compacted sawdust protrude from the bark at the point of attack, but these strings disintegrate easily and are not always readily apparent. Removal of bark at the point of attack reveals, shot holes from which a dark stain extends into the surrounding xylem. Eggs were first observed at 10 days, larvae at 19, pupae at 25, and teneral adults at 30 days after gallery initiation. *X. glabratus* is a small, elongate, cylindrical beetle about 2.2 mm in length. The larva of *X. glabratus* is similar to other scolytid beetles. It is a white, c-shaped, legless grub with an amber-coloured head capsule. The adult was blackish, nearly glabrous on the upper surface, V-shaped and pointed abdominal tip, and had abrupt apical declivity (Figure 2).

***Alcidodes porrectirostris* Marshall**

Alcidodes porrectirostris Marshall, commonly known as the walnut weevil, has established itself as a significant threat to walnut trees (*Juglans regia*) over the years. It has particularly become a major concern in the Jammu region of Jammu and Kashmir, where it has caused substantial yield losses (Guroo *et al*., 2021). Subsequently, the developing seeds' endosperm consumed completely by the grub inside. The expected incubation period for the weevil is relatively short, lasting between 10 to 15 days. The infested fruits of varying maturities were collected from the natural population of the species. The infected fruits were kept in a glass bottle where the mouth of the bottle was replaced with a cotton cloth. Photographs of various life stages of the insect were taken to facilitate monitoring and identification. The herbarium specimens have been placed in the Insect collection room of the Forest Entomology department at KFRI, Peechi. The percentage of weevil infestation was calculated using the formula:

$$\text{Percent Infestation (PI)} = \frac{\text{Number of larvae – infested seeds}}{\text{Total sample seeds observed}} \times 100$$

The larval stage of *A. porrectirostris* is quite extended, lasting for approximately 35 to 38 days. During this phase, the larvae feed on the seeds. Once the larvae are full-grown, they pupate for a period of 14 to 15 days before emerging into adults. The adult walnut weevil is characterized by its physical features. It has a body size measuring between 12.1 to 12.6 mm. The head is blackish, moderately flat, and smooth. The antennae are blackish red and the scape is long, situated very near to the middle of the eyes. The elytra (wing covers) are blackish and exhibit sparsely squamous characteristics with white hair (Figure 3). As a part of the study on developing plantation technology of *L. deccanensis*, the authors came across stem wilting and seed damage of >80% among the planting stock (Figure 1) and the seeds under storage. Since the species exhibited abnormal fall of flowers and immature fruits, the incidence of insect pests accelerates and remarks a major cause for the poor natural regeneration and subsequent decline of the populations of the species.

RESULTS AND DISCUSSION

The study estimated that approximately 84% of the seeds were destroyed due to weevil infestation during the fruiting year of the tree. This high level of damage poses a significant threat to the regeneration of the species in its natural habitats. Even minor damages to vital seed parts like the radicle or hypocotyls can quickly lead to the death of the seed (Fraedrich *et al*., 2008). The weevil's life cycle, particularly its larval stage, poses a substantial threat to seed viability and, consequently, the regeneration of the species. Failure to address this issue may lead to further yield losses and hinder the natural regeneration of the species in the affected areas.

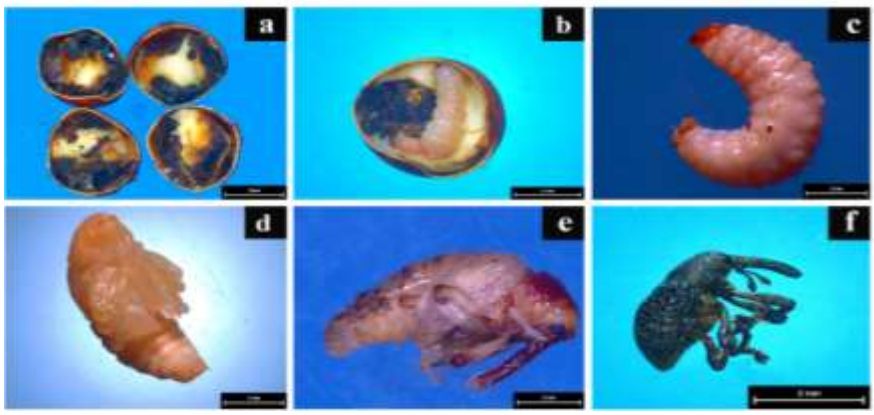

Figure 3. ***Alcidodes porrectirostris* Marshalla.** Infested seeds **b.** Larval infestation **c.** 'C' shaped larvae **d.** Early stages of pupal development **e.** Pupa late-stage **f.** Adult weevil Scale bars a. 5mm & b-f. 2mm.

CONCLUSION

The present study reveals the detrimental impact of two key pests, *Xyleborus glabratus* and *Alcidodes porrectirostris*, on *Litsea deccanensis*. Addressing the threats posed by these pests and implementing sustainable harvesting practices are essential steps towards ensuring the long-term survival and resource-based utilization of the species in its natural habitats. This study underscores proactive conservation efforts to safeguard not only the tree species but also the biodiversity of the Western Ghats region where it resides.

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