

Bark Beetle *Cryphalus lipingensis* Tsai & Li, 1963, (Insecta: Coleoptera: Curculionidae: Scolytinae)¹

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The Featured Creatures collection provides in-depth profiles of insects, nematodes, arachnids and other organisms relevant to Florida. These profiles are intended for the use of interested laypersons with some knowledge of biology as well as academic audiences.

Introduction

Cryphalus lipingensis Tsai & Li, 1963 belongs to the bark beetle genus *Cryphalus* that contains more than 200 species. Five species of *Cryphalus* are distributed throughout the USA, mostly in northern latitudes (Wood 1982; Johnson et al. 2020). All species native to North America live in dead twigs of conifers, and none of these species is considered an important pest. *Cryphalus lipingensis* does not occur in North America, but it is widespread in China. The reason for its importance is that it has been reported to colonize and kill American pine species planted in China, namely slash pine, *Pinus elliottii*, and as such poses a threat to US forests and forestry as a potential invasive pest. As in other bark beetles, most of the life cycle of *Cryphalus lipingensis* is spent under the bark of infested trees, and their main nutrient resource is the inner bark and phloem. Taxonomically, *Cryphalus lipingensis* and *Cryphalus kesiyae*, Browne, 1975 have been recognized as two different species, but molecular phylogeny has shown that *Cryphalus lipingensis* and *Cryphalus kesiyae* are the same species (Johnson et al. 2020).

Synonymy

Cryphalus kesiyae, Browne, 1975 (Johnson et al. 2020)

Distribution

China (Guizhou, Sichuan, Chongqing, Shaanxi, Yunnan) and Thailand (Beaver and Browne 1975, Chen and Tang 2014, Tian 2018, Johnson et al. 2020, Yang 2020).

Description

Female. The adult females (Figure 1A) are 1.50 mm to 1.90 mm long and approximately 2.25 times as long as wide. They are brown in color, and there are no scales, but there are abundant hairs all over the body. The beetle forehead (frons) has a densely “scratched” surface (the expert term is aciculate). The antennal club has three lines (marked with hairs) curved downwards. The dorsal and lateral surfaces of the beetle thorax (called pronotum) are visible with abundant tiny projections in the shape of flat teeth. Where most bark beetles have a scutellum—the little triangle in the middle of the wing covers (elytra) where they meet the thorax—the scutellum in *Cryphalus lipingensis* is mostly hidden and poorly visible. The front legs have hair-like setae.

Male. The adult males (Figure 1B) are 1.50 mm to 1.70 mm long and approximately 2.30 times as long as wide. The

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male is similar to the female, except it is smaller and the bottom of its head has less hair-like setae. Compared to the adult females, the last segment of the abdomen in males, at the bottom of the body, is smaller and narrower than the body width.

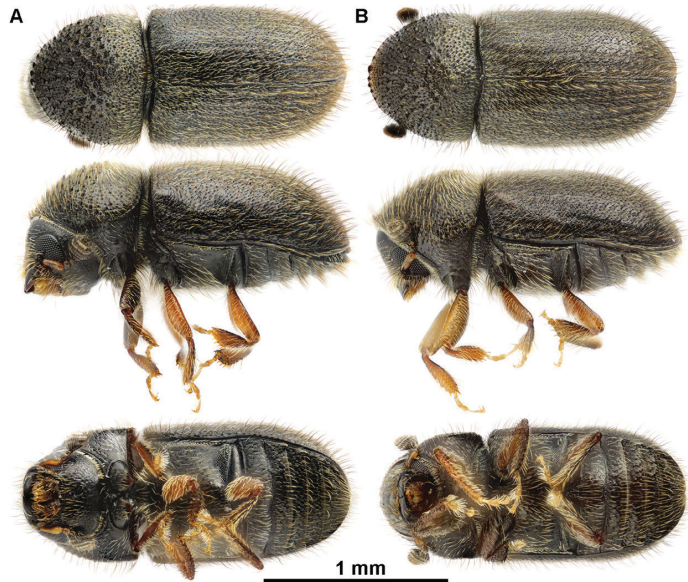


Figure 1. The dorsal, lateral, and ventral surfaces of the adult *Cryphalus lipingensis*. A) the female individual; B) the male individual. Credits: Johnson et al. (2020)

Diagnosis

There are two species of *Cryphalus* present in Florida: *C. itinerans*, and *C. mangiferae*. The most important difference in these species from *C. lipingensis* is that *C. itinerans*, and *C. mangiferae* colonize broadleaved hosts, not pines (figs and paper mulberry, or mango, respectively). The American *Cryphalus* species that colonize Pinaceae (*C. rubentis*, *C. pubescens*, and *C. striatulus*) do not occur in Florida.

Morphologically, *Cryphalus lipingensis* can be distinguished from the other *Cryphalus* species by the combination of the setae status and the “scratched” (aciculate) forehead. Almost the entire body is covered with hair-like setae and the male forehead does not have a transverse ridge (Johnson et al. 2020). The adults of all other American *Cryphalus* species have scale-like setae on the surface of their bodies. Several more details distinguish *Cryphalus lipingensis*: Compared with *Cryphalus striatulus*, *Cryphalus rubentis*, and *Cryphalus itinerans*, *Cryphalus lipingensis* has more broadly rounded eyes, it is more shiny, its body is covered with the hair-like setae, and it has lots of asperities on the declivity (Figure 2). *Cryphalus itinerans* is much smaller than *Cryphalus lipingensis*. *Cryphalus mangiferae* and *Cryphalus itinerans* have a pronotum (dorsal surface and the first segment of the beetle thorax) with a more rounded top.

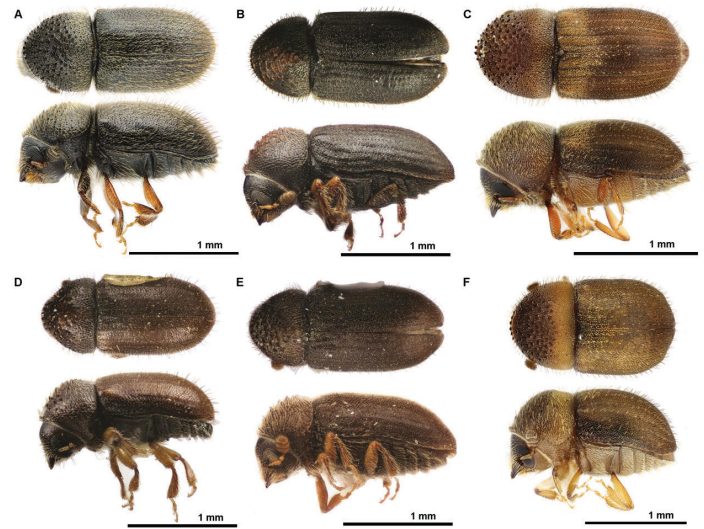


Figure 2. The dorsal and lateral photographs of the *Cryphalus* species. A) The Asian *Cryphalus lipingensis*; the remaining species are American: B) *Cryphalus striatulus*; C) *Cryphalus mangiferae*; D) *Cryphalus pubescens*; E) *Cryphalus rubentis*; F) *Cryphalus itinerans*. Credits: Andrew J. Johnson, UF/IFAS

Another group of bark beetles common in Florida that can be confused with *Cryphalus lipingensis* is the genus *Hypothenemus*. *Hypothenemus* previously belonged in the same group (Cryphalini) but were recently placed in a different tribe (Trypophloeini) based on DNA sequence evidence. Although the male and female of *Hypothenemus* have a similar forehead to *Cryphalus lipingensis*, the two sexes are distinctly different from one another, which is key for this genus distinction. *Hypothenemus* has weakly emarginated (concave at the margin) eyes, the side of the thorax has a raised line, there are abundant hair-like scales on the body (vestiture), and the antennae have a tiny internal black patch (septum, some species, Figure 3). *Cryphalus* have emarginated third tarsal segments, their body size and antennae (paired sensors on the head, like aerials) are larger, and the hair-like setae on the body are long and dense.

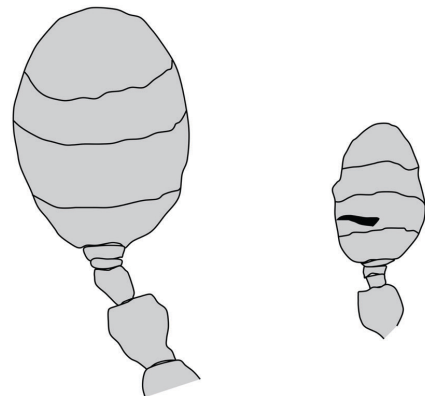


Figure 3. Anterior face diagram showing the antennal difference between *Cryphalus lipingensis* (left) and *Hypothenemus eruditus* (right) with septum (black patch). Credits: Sketch is redrawn by Yiyi Dong, University of Florida according to the figures from Wood (1982) and Johnson et al. (2020)

Hosts

The host plants of *Cryphalus lipingensis* are only Pinaceae trees in China. It has been collected in *Pinus kesiya*, *Pinus armandii*, *Pinus yunnanensis* (Chen and Tang 2014, Johnson et al. 2020), and in the American slash pine *Pinus elliottii* (unpublished Sentinel Garden experiment data).

Importance

Cryphalus lipingensis were reported to attack the upper trunk and branches of stressed pine trees in China (e.g. infected with a pathogen, stressed by drought, or freshly dead trees) (Chen and Tang 2014). Our observations in China showed that *Cryphalus lipingensis* also colonizes the branches of living *Pinus yunnanensis* (A. S. Ernstsons, Y. Li, J. Hulcr, unpublished data). Most importantly, these bark beetles were detected in living *Pinus elliottii* (slash pine, Figure 4), experimentally injured but otherwise healthy, planted in an experimental garden in China, which means that if *Cryphalus lipingensis* establishes in the USA, it may become a pest of economically important pines.

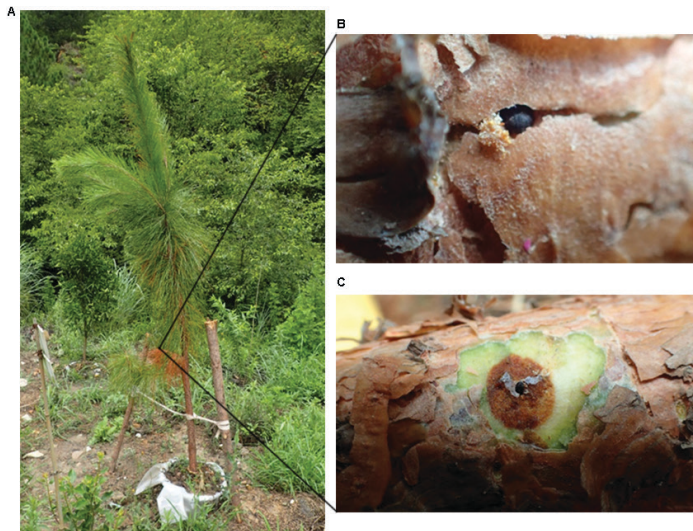


Figure 4. A) Slash pine attacked by *Cryphalus lipingensis*; B) the damage area with the frass; C) the entrance hole in a green tissue exposed by removal of the bark.

Credits: A. Simon Ernstsons, UF/IFAS

Sentinel plant gardens

The Sentinel plant garden concept uses trees planted overseas to detect potential invasive pests, and to report new potential associations between the host plants and insects. The purpose is to detect and study the pests before they are accidentally transported through international trade. The University of Florida's Forest Entomology Laboratory has already established several sentinel gardens of American trees in China's tropical, subtropical, and temperate natural regions, matching the latitudes in the

USA (Popkin 2020). The trees are stressed (but kept alive) in each garden by flooding or girdling to test which of the local wood-boring beetles attack the treatment trees. The wood borers that attack trees with high health scores (not dead or stressed) are judged as having a high-risk of being potentially invasive pests. The occurrences of *Cryphalus lipingensis* on living, stressed *Pinus elliottii* planted in the sentinel garden in China contribute to assessing this beetle's invasive risk in the USA.

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