A mysterious wing spine in male coffee berry borers (Coleoptera: Curculionidae: Scolytinae)

Fernando E. Vega[1], Ann Simpkins[1], Gary Bauchan[2], Jorge M. Valdéz-Carrasco[3], Alfredo Castillo[4] and Francisco Infante[4]*

The coffee berry borer, *Hypothenemus hampei* (Ferrari) (Coleoptera: Curculionidae: Scolytinae), is the most important insect pest of coffee worldwide (Vega et al. 2015). As part of a series of studies using low temperature-scanning electron microscopy (LT-SEM) aimed at further expanding our knowledge on the basic morphology of the insect, we noticed a remarkable reduction in the number of facets in the compound eyes of male vs female coffee berry borers (Vega et al. 2014), and in this paper we report on an unusual structure in the hind wings of males. The structure is a spine in the basal part of the hind wing (Figs. 1, 2), which unexpectedly, is not present in all male wings, and is completely absent in female wings. To our knowledge, this article constitutes the first report of such a structure in an insect wing.

The hind wings of 40 male and female adult coffee berry borers reared in the laboratory (as described in Vega et al. 2011) were excised and examined under a stereoscope. The spine was photographed using a stereoscope (Fig. 1) as well as LT-SEM (Fig. 2) as described in Vega et al. (2014). Four males had the spine in both hind wings, seven had it in the left wing, 10 had it in the right wing, and 19 did not have the spine. None of the 40 adult females examined exhibited the spine.

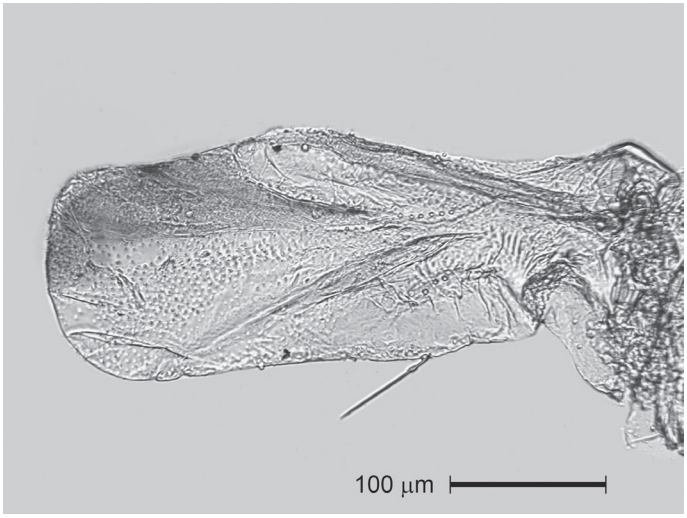

Fig. 1. Male coffee berry borer wing showing spine.

We hypothesize that the spine might at some point have been used for stridulation and acoustical communication, and that during the evolution of the insect, it has been disappearing, thus explaining why it is not present in all males. It could be hypothesized that the disappearance of the spine is perhaps due to the basic biology of the insect inside the coffee berry. Males are the offspring of a colonizing female that bores into a coffee berry and deposits her eggs within galleries in the endosperm. The offspring exhibits a skewed sex ratio favoring females, and males are smaller than females (Vega et al. 2015), have reduced compound eyes (Vega et al. 2014), have vestigial wings (size in mm: ♂ 0.29 ± 0.009 (*n* = 9); ♀ 2.18 ± 0.42 (*n* = 9); also see Corbett 1933) and in contrast to females, never leave the berry (Vega et al. 2015). Due to the close proximity of males and females within the confines of the coffee berry, use of the spine for stridulation and for revealing the position of the scarce males, might have become unnecessary. It has not escaped our notice that the origin of the spine might have been a wing vein and in order to better understand how the spine evolved, it will be necessary to compare male coffee berry borer wings to other *Hypothenemus* species as well as to other Cryphalini. Another possibility is that the spine serves as a mechanosensor, but based on it not being present in all males it must not be essential for this function. We are presently conducting acoustic experiments to determine if sounds are produced by male and/or female coffee berry borers.

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Summary

A spine was observed in the hind wings of male coffee berry borers, *Hypothenemus hampei* (Ferrari) (Coleoptera: Curculionidae: Scolytinae), although it was not present in all males. Females do not exhibit the spine. The function of the spine remains unknown although one possibility is that it might have had a stridulatory role in acoustic communication.

Key Words: *Hypothenemus hampei*, broca del café, stridulation, acoustics

[1]Sustainable Perennial Crops Laboratory, U.S. Department of Agriculture, Agricultural Research Service, Bldg. 001, Beltsville, Maryland, USA 20705
[2]Electron and Confocal Microscopy Unit, U.S. Department of Agriculture, Agricultural Research Service, Bldg. 012, Beltsville, Maryland, USA 20705
[3]Colegio de Postgraduados, Campus Montecillo, Apartado Postal 56230, Km. 36.5, Carretera México-Texcoco, Montecillo, Texcoco, Edo. de México, México
[4]El Colegio de la Frontera Sur (ECOSUR), Carretera Antiguo Aeropuerto Km. 2.5, Tapachula, 30700 Chiapas, México
*Corresponding author, Email: Fernando.Vega@ars.usda.gov

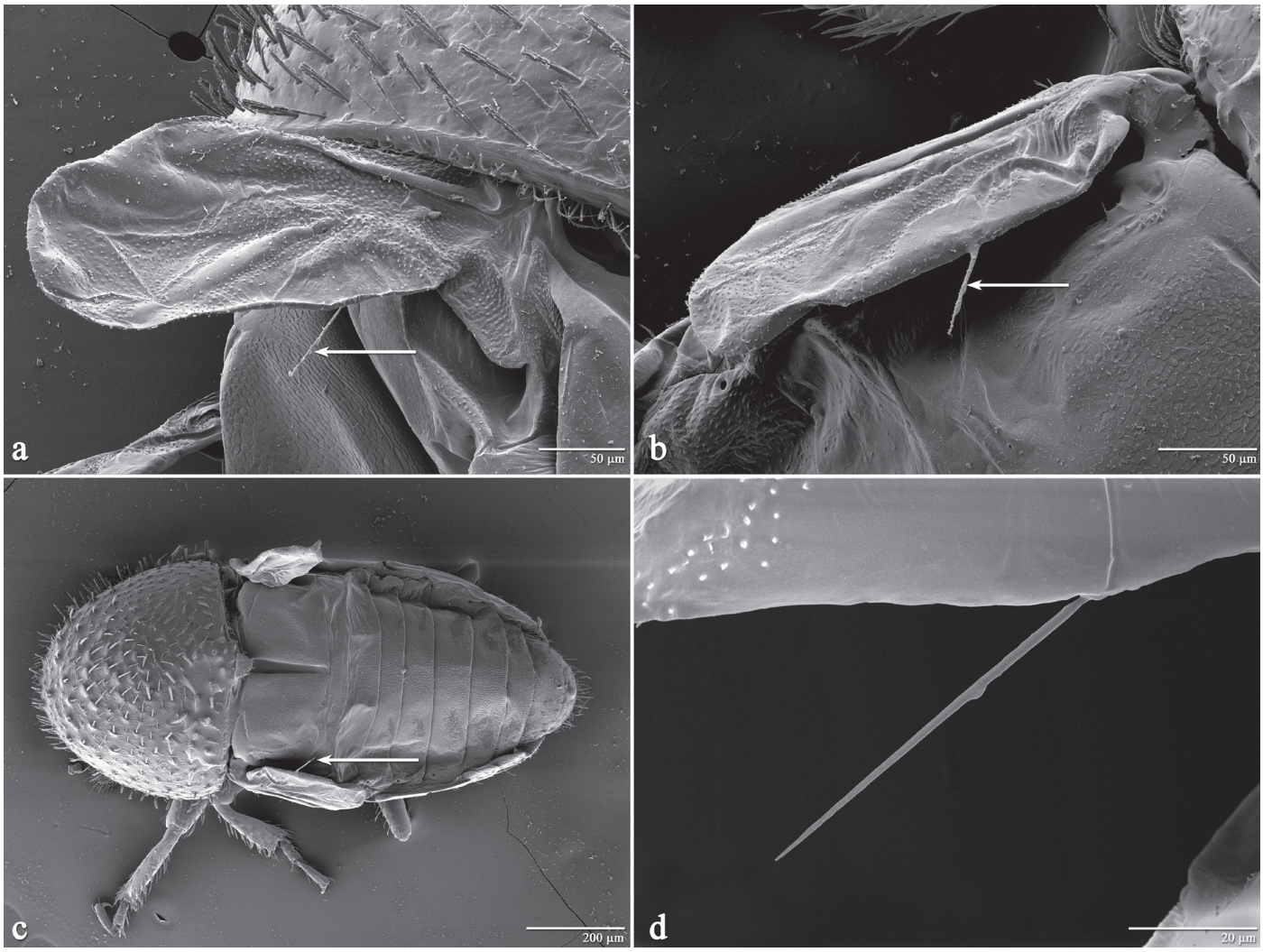

Fig. 2. Low temperature-scanning electron microscope photographs showing the wing spine in three left wings (a, b, c), and a detail of the spine (d).

Sumario

La presencia de una espina fue observada en las alas posteriores de machos de la broca del café, *Hypothenemus hampei* (Ferrari) (Coleoptera: Curculionidae: Scolytinae), pero no todos los machos la tienen. Las hembras no poseen la espina en el ala. La función de la espina es desconocida, pero es posible que haya tenido un rol en estridulación y comunicación acústica en esta especie.

Palabras Clave: *Hypothenemus hampei*, broca del café, estridulación, acústica

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