Pagiocerus frontalis (Fabricius) (Coleoptera: Curculionidae: Scolytinae) Associated with Avocado Persea americana Miller (Lauraceae) Fruit in Nayarit, Mexico

Authors: Dios Avila, Ndahita De, Velasco, Claudio Rios, Campos, Jhonathan Cambero, Solorio, Armando Burgos, Domínguez Miranda, Jesús Leonel, et al.

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Scientific Notes

Pagiocerus frontalis (Fabricius) (Coleoptera: Curculionidae: Scolytinae) associated with avocado *Persea americana* Miller (Lauraceae) fruit in Nayarit, Mexico

Ndahita De Dios Avila[1], *Claudio Rios Velasco*[2], *Jhonathan Cambero Campos*[1], *Armando Burgos Solorio*[3], *Jesús Leonel Domínguez Miranda*[1], *and Mario Orlando Estrada Virgen*[1,*]

Avocado, *Persea americana* Miller (Lauraceae), is one of the most economically important crops in Mexico. Mexico is the world's largest avocado producer with an established area of 234,270 ha and a production of 2,300,888 tons in 2019; the state of Nayarit produced 67,058 tons (SIAP 2019). It is estimated that more than 54% of the avocados produced in Mexico are exported to the USA, Canada, and Japan; the rest is destined for the local market for fresh consumption and processing (SAGARPA 2017). Avocado seeds are an unconventional alternative source of flour and starch with potential for the agri-food industry (Gomez et al. 2014). Seeds represent approximately 16% of the fruit fresh weight with a starch content up to 29% (Builders et al. 2010; Chel et al. 2016). Nayarit producers use avocado seeds as rootstocks and the demand for seeds has increased considerably.

In the present study, *Pagiocerus frontalis* (Fabricius) (Coleoptera: Curculionidae) is reported for the first time from fallen avocado fruits of the cultivars Hass and "Criollo" in Nayarit. This insect is not considered a pest in Mexico and it does not restrict the export of avocado fruits to the countries mentioned above. But it limits the procurement of rootstocks used for the production of avocado seedlings in the region. This borer was recently reported from seeds of tropical and subtropical Lauraceae (*Persea*, *Nectandra*, *Ocotea*) trees in Argentina and Chile (Córdoba & Atkinson 2018; Lawrence 2018). This species also has been associated with stored grains, causing losses greater than 44% in corn (*Zea mays* L.; Poaceae) (Eidt-Wendt & Schulz 1990).

In Feb 2019, avocado fruit at physiological maturity with hard skin, fresh and ripened pulp, and without damage by pathogens (Fig. 1A–C) were collected from soil in an experimental orchard of the Academic Unit of Agriculture (21.4127778°N, 104.9263889°W; 1,129 masl), located in Xalisco, Nayarit, Mexico. Avocado trees were in the full flowering phenological stage; hence, the fruit corresponded to the previous cycle. External holes (Fig. 1A) were observed in avocado seeds. The holes led to internal galleries (about 1.5 mm in diam) con-

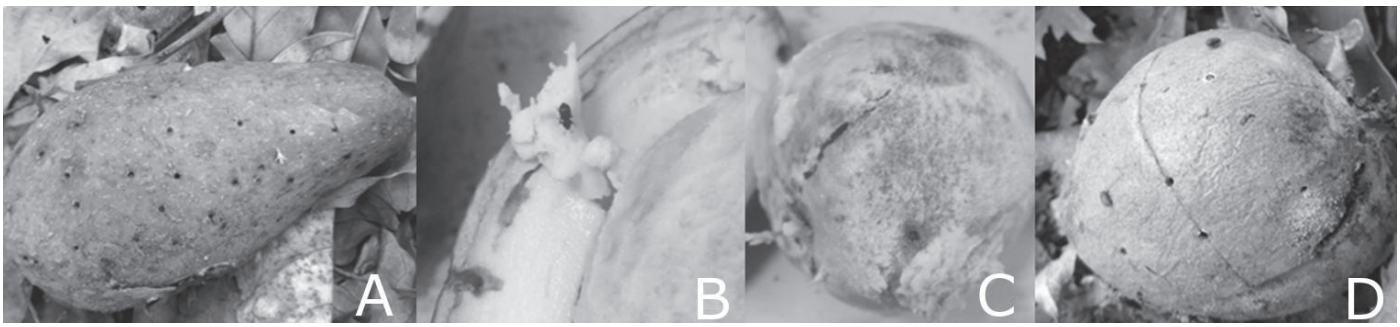

Fig. 1. *Pagiocerus frontalis* in avocado fruit. (A) Holes caused by *P. frontalis*, (B) adult of *P. frontalis*, (C) presence of seed (embryo) damage indicators, (D) dehydrated seed with external evidence of sawdust.

[1]Unidad Académica de Agricultura, Universidad Autónoma de Nayarit, Carretera Tepic-Compostela Km. 9, Xalisco, Nayarit, Mexico;
E-mail: ndahitadedios@gmail.com (N. D. D. A.), jhony695@gmail.com (J. C. C.), leonfire74@hotmail.com (J. L. D. M.), estra0288@gmail.com (M. O. E. V.)
[2]Centro de Investigación en Alimentación y Desarrollo A. C., Unidad Cuauhtémoc, Av. Río Conchos S/N, Parque Industrial. C.P. 31570, Chihuahua, Mexico;
E-mail: claudio.rios@ciad.mx (C. R. V.)
[3]Laboratorio de Parasitología Vegetal, Centro de Investigaciones Biológicas de la Universidad Autónoma del Estado de Morelos, Av. Universidad 1001, C.P. 62210 Col. Chamilpa, Cuernavaca, Morelos, Mexico; E-mail: burgos@uaem.mx (A. B. S.)
*Corresponding author; E-mail: estra0288@gmail.com

taining *P. frontalis* larvae and adults. The galleries led to the seeds (Fig. 1B, C) and each seed contained about 30 adults. The weevils continued feeding until completely degrading the seeds in about 18 d (Fig. 1D). The adult specimens were preserved in 70% ethanol for identification, which was confirmed by Armando Burgos Solorio (woodborer specialist, Autonomous University of the State of Morelos, Cuernavaca, Morelos, Mexico). Specimens were deposited in the insect collection of the Agricultural Parasitology Laboratory of the Autonomous University of Nayarit, Xalisco, Nayarit, Mexico. Genomic DNA (gDNA) was extracted using the Pure Link Genomic DNA Mini Kit (Invitrogen, Carlsbad, California, USA) following the manufacturer's protocol. Genomic DNA was used to amplify the cytochrome C oxidase (COI) subunit gene by Polymerase chain reaction (PCR) using the following primers, LCO (5'-GGTCAACAAATCATAAAGATATTGG-3') and HCO (5'-TAAACTTCAGGGTGACCAAAAAATCA-3') (Folmer et al. 1994). Polymerase chain reaction products were visualized by electrophoresis on a 1.0% agarose gel, then sequenced by Macrogen USA (Rockville, Maryland, USA). The sequence data of *P. frontalis* was submitted to GenBank (accession number MN419152.1).

Pagiocerus frontalis was reported previously as an occasional insect in avocado orchards in other states of Mexico such as Chiapas, Federal District, Guanajuato, Guerrero, State of Mexico, Morelos, Nayarit, Nuevo León, Oaxaca, Puebla, San Luis Potosí, Tamaulipas, and Veracruz (Atkinson & Riley 2013; Soto et al. 2013; Atkinson 2019), but not associated with fallen avocado fruit (Fig. 1A). High populations of this coleopteran are uncommon in avocado orchards (Atkinson et al. 1986). Therefore, both occurrences of extraordinarily abundant *P. frontalis* in avocado orchards and feeding on freshly fallen fruit are reported for the first time in Nayarit, Mexico.

These findings could be the starting point for a better understanding of the behavior and potential damage caused by this insect in fallen avocado seeds. For this reason, we suggest performing studies related to their thermal requirements, host plants, natural enemies, and determine their abundance, distribution, and potential economic impact on avocado regions of Mexico.

Summary

Pagiocerus frontalis (Fabricius) (Coleoptera: Curculionidae) is known to feed on stored grains, especially corn *Zea mays* L. (Poaceae). No reports are available of this borer feeding on avocado seeds (*Persea americana* Mill.; Lauraceae), which is one of the most economically important crops exported by Mexico. In 2019, this coleopteran was extraordinarily abundant (about 30 adults per avocado seed) in an avocado orchard located in Nayarit, Mexico. We found that this insect feeds on mature fallen avocados. Biological and behavioral aspects of *P. frontalis* still are largely unknown on avocado fruits. This study documented the natural occurrence of this species on avocado seeds in Nayarit, Mexico.

Key Words: borer; Xalisco; insect; spermophagy; bark beetle

Sumario

Pagiocerus frontalis (Fabricius) (Coleoptera: Curculionidae) se alimenta de granos almacenados, especialmente maíz *Zea mays* L. (Poaceae). Sin embargo, no hay informes sobre la alimentación de este barrenador en semillas de aguacate (*Persea americana* Mill.; Lauraceae), uno de los cultivos más importantes desde el punto de vista económico en México. En 2019, la población de este coleóptero era extraordinariamente abundante (acerca de 30 adultos por semilla de aguacate) en un huerto de aguacate ubicado en Nayarit, México. Este insecto fue encontrado alimentándose de aguacates maduros recién caídos de los árboles. Los aspectos biológicos y conductuales de *P. frontalis* son desconocidos en los frutos de aguacate. Tomando esto en cuenta, el objetivo del estudio fue documentar la natural ocurrencia de esta especie en semillas de aguacate en Nayarit, México.

Palabras Clave: barrenador; Xalisco; insecto; espermatófago; escarabajo descortezador

References Cited

Atkinson TH, Riley EG. 2013. Atlas and checklist of the bark and ambrosia beetles of Texas and Oklahoma (Curculionidae: Scolytinae and Platypodinae). Insecta Mundi 292: 1–46.

Atkinson TH. 2019. Bark and Ambrosia Beetles. http://www.barkbeetles.info/regional_chklist_target_species.php?lookUp=695 (last accessed 24 Aug 2021).

Atkinson TH, Martínez FE, Saucedo CE, Burgos SA. 1986. Scolytidae y Platypodidae (Coleoptera) asociados a selva baja y comunidades derivadas en el estado de Morelos, México. Folia Entomológica Mexicana 69: 41–82.

Builders PF, Nnurum A, Mbah CC, Attama AA, Manek R. 2010. The physicochemical and binder properties of starch from *Persea americana* Miller (Lauraceae). Starch-Stärke 62: 309–320.

Chel GL, Barbosa ME, Martínez AA, González ME, Betancur AD. 2016. Some physicochemical and rheological properties of starch isolated from avocado seeds. International Journal of Biological Macromolecules 86: 302–308.

Córdoba SP, Atkinson TH. 2018. New records of Scolytinae (Coleoptera: Curculionidae) from Argentina. The Coleopterists Bulletin 72: 376–380.

Eidt-Wendt J, Schulz FA. 1990. Studies on the biology and ecology of *Pagiocerus frontalis* (Fabricius) (Coleoptera: Scolytidae) infesting stored maize in Ecuador, pp. 61–69 *In* Fleurat-Lessard F, Ducom P [eds.], Proceedings of the 5th International Working Conference on Stored-Product Protection, Bordeaux, France, 9–14 Sep 1990.

Folmer O, Black M, Hoeh W, Lutz R, Vrijenhoek R. 1994. DNA primers for amplification of mitochondrial cytochrome c oxidase subunit I from diverse metazoan invertebrates. Molecular Marine Biology and Biotechnology 3: 294–299.

Gómez FS, Sánchez SP, Iradi MGG, Azman NAM, Almajano MP. 2014. Avocado seeds: extraction optimization and possible use as antioxidant in food. Antioxidants 3: 439–454.

Lawrence K. 2018. Invasive bark beetles (Coleoptera, Curculionidae, Scolytinae) in Chile and Argentina, including two species new for South America, and the correct identity of the *Orthotomicus* species in Chile and Argentina. Diversity 10: 1–20.

SAGARPA 2017. Secretaria de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación. Planeación Agricola Nacional 2017–2030, Aguacate mexicano. https://www.gob.mx/cms/uploads/attachment/file/257067/Potencial-Aguacate.pdf (last accessed 24 Aug 2021).

SIAP. 2019. Servicio de Información Agroalimentaria y Pesquera. https://nube.siap.gob.mx/cierreagricola/ (last accessed 24 Aug 2021).

Soto HM, Martínez OG, Carbajal CC. 2013. Fauna de Curculionidae (Coleoptera) en huertas de aguacate Hass (*Persea americana* Mill) en Xalisco, Nayarit. Dugesiana 20: 93–98.