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Authors: Hernández-Cruz, Julián, Guzmán-Vásquez, Héctor Miguel, Pablo, Elia Jirón, and Sánchez-García, José Antonio

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Phytophagous Scarab Beetles[1] Associated with Fruit Trees at Oaxaca, Mexico

Julián Hernández-Cruz[2], Héctor Miguel Guzmán-Vásquez[3], Elia Jirón Pablo[4]*, and José Antonio Sánchez-García[3]

Knowledge of the diversity and distribution of phytophagous scarab beetles (Coleoptera: Scarabaeidae "Pleurosticti") in Mexico has increased significantly, but documented information about feeding habits is scarce, generalized, and sometimes imprecise. Morón (1996) studied the habits, abundance, and phenology of 15 species of Melolonthinae and Rutelinae associated with tulip flowers (*Hibiscus rosa-sinensis*, Malvaceae), which is one of the most specifically studied cases in Mexico.

Subsequently, Morón et al. (1997) established that, generally, most adult phytophagous Scarabaeidae feed on the floral structure and sugar content of various plants, while others also include foliage in their diet. They also documented that larvae and adults of the genus *Phyllophaga* Harris are associated with 57 plant families, native or introduced in Mexico and Central America, which include Lauraceae and Rosaceae. Some species of *Anomala* and *Phyllophaga* mainly in the larval stage are of agricultural importance, although adults usually also cause damage. The species are part of the white grub complex associated with various crops, among the main ones are maize (*Zea mays* L.), beans (Fabaceae), sugarcane (*Saccharum officinarum* L.), and sorghum (*Sorghum bicolor* (L.) Moench).

Some studies on association of *Phyllophaga* spp. with avocado (*Persea americana* Mill.) are: Zapata et al. (2018) pointed out that *P. obsoleta* damaged leaves, flowers, and fruits. Londoño et al. (2014) documented that *P. obsoleta* and *P. menetriesi* were mainly responsible for serious damage to fruit. Hernández-Cruz et al (2016) documented female *P. lenis* after copulation defoliating shoots of huizache (*Acacia farnesiana*, Fabaceae). However, until now association of *P. lenis* with avocado has not been documented. Little information exists on preference for *Anomala* spp. host plants; Londoño et al. (2014) reported *A. cincta* and *A. undulata* damaging fruit and causing losses in avocado production; Sisne et al. (2013) reported *A. calceata* in papaya (*Carica papaya* L.). *A. inconstans* has not been documented associated with loquat (*Eriobotrya japonica* (Thunb.) Lindl.

Persea americana Mill. (Lauraceae) whose fruit is commonly known as avocado, is a plant native to Mexico and Central America, fully adapted and cultivated in mountain areas over 1,000 m above sea level, whose economic importance increased significantly in recent years (CEDRSSA 2017). Loquat is a Rosaceae of Asian origin (South China), cultivated mostly in Japan. In tropical regions it is cultivated over 1,000 m above sea level (León 2000). The objective of this document was to report two unpublished cases of two scarab beetle species (Scarabaeidae:

[1]Coleoptera: Scarabaeidae

[2]Universidad Tecnológica de la Sierra Sur de Oaxaca, Villa Sola de Vega, Oaxaca, México. C.P. 71410
[3]Instituto Politécnico Nacional. CIIDIR Unidad Oaxaca. Santa Cruz Xoxocotlán, Oaxaca, México. C.P. 71230
[4]Universidad para el Bienestar, Benito Juárez, Villa de Zaachila, Oaxaca, México. C.P. 71313
*Corresponding author email: eliajiron@hotmail.com

Melolonthinae and Rutelinae) associated with damage to avocado and loquat at Ocotlán de Morelos, Central Valleys of Oaxaca, Mexico.

In May 2019, approximately 120 specimens of two species of beetles were observed damaging avocado plants and loquat shrubs in an orchard in the municipality of Ocotlán de Morelos, Oaxaca, Mexico, between coordinates 16° 47′ 29″ N and 96° 40′ 30″ W, at an altitude of 1,518 m above sea level. A representative sample of eight specimens of each species was collected, which were preserved in 70% alcohol. Later, the genitalia were removed and mounted on entomological pins (Morón and Terrón 1988). Beetles were identified taxonomically with keys and descriptions by Bates (1888), Morón (1986), and Morón et al. (1997). The images of the males and their genitalia were taken with a Canon Rebel T-6 camera mounted on a Zeiss Stemi 508 stereo-microscope. Images were arranged by Adobe Photoshop CC 2017. The specimens were deposited in the private collections of the first and second authors.

The collected beetles correspond to two species of Scarabaeidae "Pleurosticti": *Anomala inconstans* (Burmeister, 1844) (Fig. 1a, b, c) and *Phyllophaga lenis* (Horn, 1887) (Fig. 1 e, f, g). The specimens of *A. inconstans* were observed feeding on loquat flowers (Fig. 1d). *P. lenis* was observed feeding on avocado leaves (Fig. 1h).

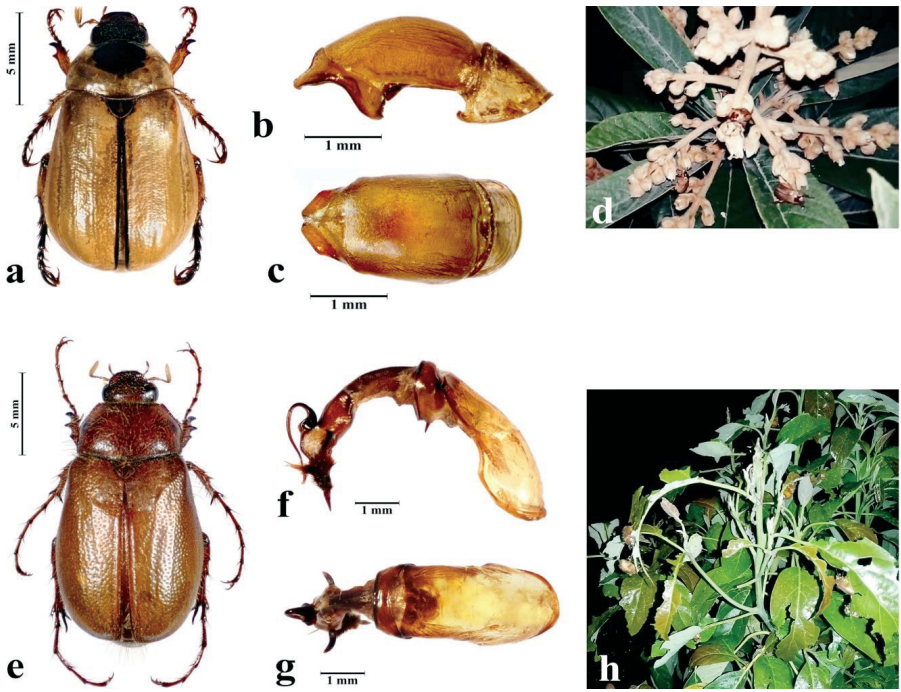

Fig. 1. Adult scarab beetles and host plants at Ocotlan, Oaxaca, Mexico. a) Dorsal habitus of *Anomala inconstans* (Burmeister, 1844) ♂. b and c) Aedeagus in lateral and dorsal views. d) Specimens of *A. inconstans* damaging a loquat inflorescence. e) Dorsal habitus of *Phyllophaga lenis* (Horn, 1887) ♂. f and g) Aedeagus in lateral and dorsal views. h) Specimens of *P. lenis* damaging avocado leaves.

According to what was observed in this research and reported by Pathania et al. (2016), beetles exhibit a different preference for a host plant in a particular locality and select a plant for food according to availability. Oliveira and Frizzas (2019) suggested the preference of beetles for areas with tall plants (trees and shrubs) was due not only to a strategy for a better dispersal of pheromones to locate a mate, but also to increase survival of their offspring, because the presence of vegetation implies roots that signify a source of feeding for rhizophagous species.

Both *Anomala inconstans* and *Phyllophaga lenis* can become important pests in crops such as maize, to cite an example (Saunders et al. 1998, Cano 2007). Therefore, it is important to continue monitoring activity of the beetles in cultivation of loquat and avocado at Ocotlán, Oaxaca, to assess and estimate the damage threshold, and determine if the beetles are causing significant loss in production of fruit trees in the area. In addition, prevention and/or control can be proposed, if necessary. However, it is suggested to continue documenting the beetle-host plant association and food preferences of the adult because accumulation of information will enable establishing behavior patterns of rhizophytophagous Scarabaeidae that can ultimately be used to propose integrated pest management strategies as suggested in Oliviera and Frizzas (2017), for example.

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