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Phytophagous invertebrates that damage orchids in gardens of western Tabasco, Mexico

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ABSTRACT

Objective: To record six species of invertebrates that damage orchids in gardens in the western area of the state of Tabasco, Mexico.

Methodology: As part of the project "Fauna associated with plants cultivated in the south-southeast region of Mexico", non-systematic collections of invertebrates that were observed damaging orchids were made in three gardens in the western part of the state of Tabasco. The invertebrates were identified through descriptions and taxonomic keys.

Results: Four species of insects of the order Coleoptera and two species of mollusks of the class Gastropoda are recorded. The insects are: (1) *Diabrotica adelpha* Harold (Chrysomelidae), (2) *Stethobaris* sp. (Curculionidae), (3) *Cyclocephala guttata* Bates (Scarabaeidae), these three damaging flowers of *Brassavola nodosa* (L.) Lindley; and (4) *Stethobaroides nudiventris* Champion (Curculionidae) damaging flowers of *Catasetum integerrimum* Hook. The mollusks are (1) *Subulina octona* (Bruguière) (Subulinidae) scraping leaves of *Gongora leucochila* Lem., *Phalaenopsis* sp. and *C. integerrimum*, and (2) *Sarasinula plebeia* (P. Fischer) (Veronicellidae) damaging leaves of *C. integerrimum*.

Study limitations: It was not possible to specifically identify one of the insect species (*Stethobaris* sp.) and one of the damaged orchid species (*Phalaenopsis* sp).

Conclusions: This study contributes to the knowledge of invertebrates that damage orchids in Mexico, and is a basis for future studies to determine the impact and importance of these organisms in the conservation and cultivation of orchids in this area of Tabasco.

Keywords: Orchidaceae, Insecta, Mollusca, southeastern Mexico.

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INTRODUCTION

Orchids constitute a diverse group of plants popularly valued by the beauty of their flowers, although presently they face a series of problems that threaten their conservation, among which overexploitation, loss of habitat, and impacts from climate change stand out (Swarts and Dixon, 2009). In addition to these factors, which combined can lead to the loss of species, there are others that make difficult the conservation and production of these plants, among them bad cultural management and phytosanitary problems (Rivera and Corrales, 2007). The latter include the damage caused by insects and other invertebrates, which should be identified in order to implement control measures (Kawate and Sewake 2014). These organisms, in addition to affecting the plants' health, affect their aesthetic

value (Ramos *et al.*, 2008), and could alter the expectations of conservation in orchids that are relocated outside of their natural habitat (Light and MacConaill, 2011).

In general, the invertebrates that are found causing damages in orchids are insects from the orders Coleoptera, Diptera, Hemiptera, Hymenoptera, Lepidoptera, Orthoptera and Thysanoptera, as well as springtails (Collembola), mites (Acari), millipedes (Diplopoda), and slugs and snails (Gastropoda) (Rivera and Corrales, 2007; Light and MacConaill, 2011; González et al., 2012; Kawate and Sewake, 2014). In Mexico few studies have been published about invertebrates that damage orchids. For the state of Jalisco, the species reported as harmful are *Aphis spiraecola* Patch., *Macrosiphum luteum* (Buckton), *Toxoptera aurantii* (B. de F.), and *Diaspis* sp. (González *et al.*, 2012), and in Veracruz and Tamaulipas the beetle *Stethobaroides nudiventris* Champion has been recorded (Morales *et al.*, 2016; Rosas *et al.*, 2020). The objective of this study is to record six species of invertebrates that damage orchids in gardens in the western area of the state of Tabasco.

MATERIALS AND METHODS

Sites of registry

The registry was carried out in three sites: (1) in a garden of a rural household located in Ejido Chicozapote 1st Section of the municipality of Cárdenas (18° 13' 0.15" N, 93° 51' 3.44" W), (2) in a garden of an urban household located in the city Heroica Cárdenas of the same municipality (17° 59' 45.44" N, 93° 22' 54.61" W), and (3) in a garden of the enclosure of Colegio de Postgraduados, Campus Tabasco, belonging to the municipality of Huimanguillo, although located next to that city as part of that urban zone (17° 58' 36.45" N, 93° 23' 8.40" W). In sites 1 and 3 orchids were located on the trunk of trees (1.5 to 3 m height), while in site 2 they were found in pots (Figure 1). In addition to orchids, in the three sites there were other ornamental plant species. In Chicozapote 1st Section, the vegetation is made up mainly of mangroves and grasses with disperse trees and palm trees. In the city Heroica Cárdenas the vegetation consists mainly of various ornamental plants and fruit trees located in gardens and throughout the streets and avenues; in the surrounding area there are mainly cacao plantations (*Theobroma cacao* L.), pasturelands with disperse trees, and ruderal vegetation. The physiography of the zone corresponds to Tabasco plains. The climate is warm humid with abundant summer rains, isothermal variation of 26 to 28 °C, and rainfall variation from 2,000 to 2,500 mm (INEGI, 2017).

Collection and identification

The adult insects that were observed causing damage were caught manually and placed in glass containers with ethylic alcohol at 70%. The larvae of Coleoptera that were found damaging flowers were placed together with these in cages until the adults emerged. Each cage consisted of a plastic container of 300 ml capacity, inside of which there was a layer of moist soil 2 cm thick. The cap had small holes to allow the circulation of air inside. For the collection, preparation and preservation of mollusks the recommendations from Naranjo and Gómez (2011) were followed. The identification of insects was done by consulting studies by Jacoby (1880-1892), Bates (1886-1890), Champion (1906-1909), Davis (2009), Prena and O'Brien (2011), Derunkov and Konstantino (2013), and Prena (2017), and

Figure 1. Partial view of the three gardens with orchid plants. A) Chicozapote 1st Section. B) Enclosure of Colegio de Postgraduados, Campus Tabasco. C) City of Heroica Cárdenas.

of the mollusks by consulting studies by Auffenberg and Stange (1988), Caballero *et al.* (1991), Araújo and Bessa (1993), Herbert (2010) and Velázquez *et al.* (2014). The specimens were deposited in the collection of invertebrates associated to cultivated plants at Colegio de Postgraduados, Campus Tabasco. The species of orchids were identified *in situ* by consulting studies by Beutelspacher (2013) and Campos *et al.* (2019).

RESULTS AND DISCUSSION

The invertebrates that are registered next are four species of insects of the order Coleoptera and two species of mollusks of the class Gastropoda. For each species, the locality, date, individuals, development stage, and species of host orchid were recorded.

Information about their distribution and a comment about where their importance is reported in the literature are also presented.

***Diabrotica adelpha* Harold, 1875 (Insecta: Coleoptera: Chrysomelidae)**

Registry. Ejido Chicozapote 1st Section: December 29, 2021; one adult (♀) feeding and damaging flowers of a *Brassavola nodosa* (L.) Lindley plant, on the trunk of an *Annona muricata* L. tree (Figure 2A).

Distribution. North America: United States and Mexico (Chiapas, Coahuila, Colima, Durango, Guerrero, Hidalgo, Jalisco, México, Michoacán, Morelos, Nayarit, Nuevo León, Oaxaca, Tabasco, Tamaulipas and Veracruz). Central America: Costa Rica, Guatemala, Honduras, Nicaragua and Panama. South America: Colombia (Jacoby, 1880-1892; Raigosa *et al*., 1978; Derunkov and Konstantino, 2013; Torres *et al*., 2021; GBIF, 2022).

Commentary. Polyphagous species. In Central America it is considered a pest of low importance in various agricultural crops (Saunders *et al*., 1998); however, it is capable of mechanically transmitting different viruses when the adults feed off fodder of the bean, *Phaseolus vulgaris* L. (Hallman, 1985). In Tabasco, adults were recorded feeding off flowers of *Caesalpinia pulcherrima* (L.) Swartz (Hernández and Sánchez, 2017), and in Tamaulipas the adults attacked the fodder of a crop of *Portulaca oleracea* L. (Torres *et al*., 2021).

***Stethobaris* sp. (Insecta: Coleoptera: Curculionidae)**

Registry. Ejido Chicozapote 1st Section: December 25, 2021, two adults damaging a flower button of a *B. nodosa* plant on the trunk of a *Pachira aquatica* Aubl. tree (Figure 2B). January 2, 2022, two adults damaging a flower of a *B. nodosa* plant on the trunk of

Figure 2. A) Adult of *Diabrotica adelpha* damaging a flower of *Brassavola nodosa* in Chicozapote 1st Section. B) Adult of *Stethobaris* sp. damaging a flower bud of *B. nodosa* in the same locality.

a *Tabebuia rosea* (Bertol.) DC tree. January 30, 2022, one adult damaging a flower of a *B. nodosa* plant on the trunk of a *P. aquatica* tree.

Distribution. The genus *Stethobaris* is distributed from Canada to Argentina and Uruguay, including the Caribbean islands (Prena, 2017).

Commentary. More than 100 species of the genus *Stethobaris* are known (Prena, 2017). Their hosts are mainly orchids (Prena and O'Brien, 2011; Prena, 2017). Approximately 50 species of *Stethobaris* have been found in 33 genera of orchids (Prena, 2017). In Costa Rica, *Stethobaris* sp. is registered in orchids of different genera, including *Brassavola* and *Catasetum* (Rivera and Corrales, 2007). Some species of *Stethobaris* cause much worry among producers and several species are disseminated outside of their natural environment through trade of ornamental plants (Prena, 2017). The damage caused by adults of the species found (*Stethobaris* sp.) consisted in small perforations on the flower organ.

***Stethobaroides nudiventris* Champion, 1907 (Insecta: Coleoptera: Curculionidae)**

Registry. Enclosure of Colegio de Postgraduados, Campus Tabasco: November 1, 2018, larvae damaging flowers of a *Catasetum integerrimum* Hook plant on the trunk of a *T. rosea* tree (Figure 3A); through larvae breeding, 34 adults were obtained (19 ♀, 15 ♂); 24 larvae obtained from a flower were preserved in ethylic alcohol at 70%. November 2, 2018; five adults (2 ♀, 3 ♂) collected in flowers of a *C. integerrimum* plant on the trunk of a *T. rosea* tree (Figures 3B and 3C).

Distribution. Mexico (Veracruz and Tamaulipas), Belize, Costa Rica, Panama and Colombia (Champion, 1906-1909; O'Brien and Wibmer, 1982; Rosas *et al.*, 2020; GBIF, 2022).

Commentary. In Mexico, Belize, Costa Rica and Panama it is associated to *Catasetum* sp. (Prena and O'Brien, 2011). In Veracruz and Tamaulipas it is found damaging flowers of *C. integerrimum* (Morales *et al.*, 2016; Rosas *et al.*, 2020). The larvae cause withering of the petals (Figure 3), and the flower dies within a period of three days, which is why it can become a potential pest (Morales *et al.*, 2016).

***Cyclocephala guttata* Bates, 1888 (Insecta: Coleoptera: Scarabaeidae)**

Registry. Ejido Chicozapote 1st Section: October 10, 2021, two adults (♀♂) damaging flowers from a *B. nodosa* plant on the trunk of a *T. rosea* tree (Figure 4A). January 30, 2022, one adult (♂) feeding from a flower of *B. nodosa* on the trunk of a *P. aquatica* tree (Figure 4B).

Distribution. Mexico (Chiapas, Hidalgo, Morelos, Oaxaca, Puebla, San Luis Potosí, Tabasco and Veracruz) and Central America: El Salvador, Guatemala, Honduras and Nicaragua (Bates, 1886-1890; Maes and Ratcliffe, 1996; Morón *et al.*, 1997; Sánchez, 1997; Pacheco *et al.*, 2008;; Morón and Rojas, 2011; Maes, 2021; GBIF, 2022).

Commentary. Similar to other species of *Cyclocephala*, the habits and biology of this species are unknown (Morón *et al.*, 1997).

***Subulina octona* (Bruguière, 1792) (Mollusca: Gastropoda: Subulinidae)**

Registry. Heroica Cárdenas, Pueblo Nuevo neighborhood: November 17, 2021, and January 12, 2022, one individual scraping the foliage of a plant of *Gongora leucochila* Lem.

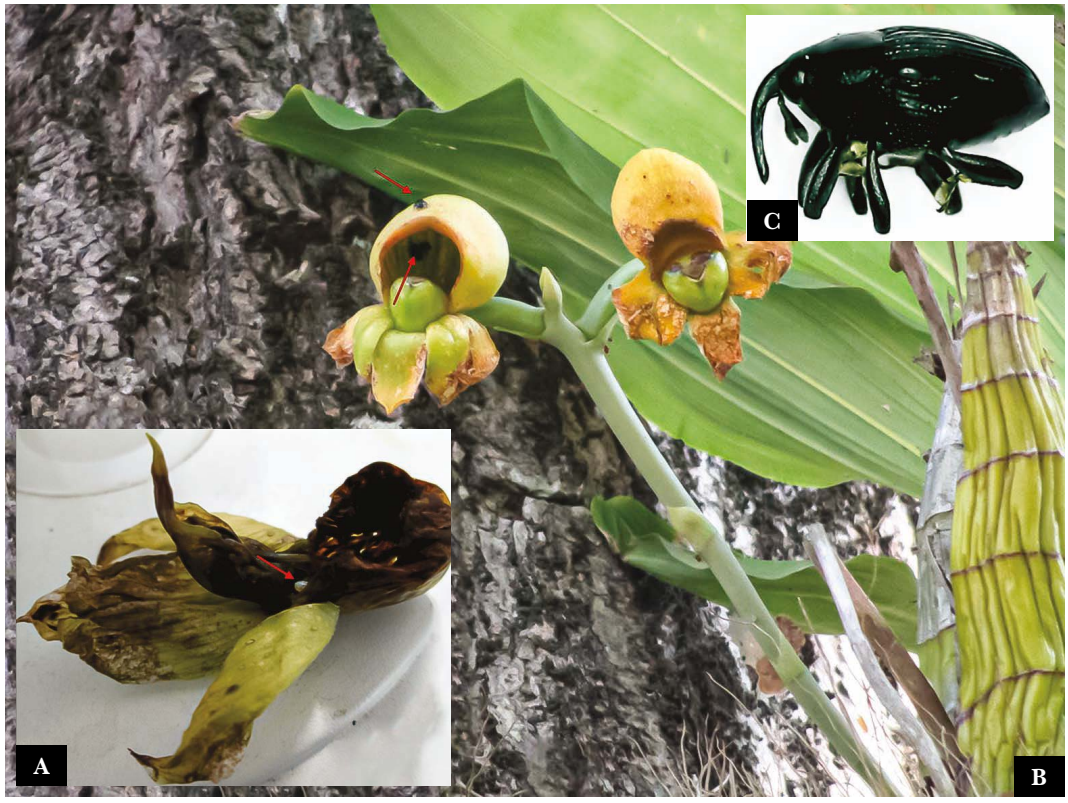

Figure 3. A) Flower of *Catasetum integerrimum* damaged by larvae of *Stethobaroides nudiventris* (the arrow points to a body part of the larvae). B) Flowers of *C. integerrimum* with damaged petals, and adults of *S. nudiventris* in a flower (signaled with the arrows). C) Female of *S. nudiventris* in lateral left view. Enclosure of Colegio de Postgraduados, Campus Tabasco.

(Figure 4C). November 17, 2021, one individual damaging the foliage of a *Phalaenopsis* sp. plant. January 27, 2022, two individuals scraping the foliage of a *C. integerrimum* plant.

Distribution. In different countries around the world, where it was introduced through vegetable and agricultural imports. Its geographical origin is unknown, although it is suggested that it is Neotropical (Auffenberg and Stange, 1988; Herbert, 2010; GBIF, 2022). In Mexico, it is found in the states of Chiapas, Campeche, Distrito Federal, Guerrero, Jalisco, Michoacán, Morelos, Nuevo León, Quintana Roo, San Luis Potosí, Sinaloa, Tabasco, Tamaulipas, Veracruz and Yucatán (GBIF, 2022).

Commentary. In Cuba it constitutes a phytosanitary risk for agriculture, since it causes damages in various crops, including orchids (Herrera *et al.*, 2013; Matamoros, 2014). In the north of Australia it is considered a garden pest (Solem, 1998). Since it is a species with quarantine importance, in Costa Rica it has caused substantial economic losses due to the interception of shipping of ornamental plants with presence of the species (Monje, 1996). It also has medical and veterinary importance, because it is an intermediary host of parasites that affect human beings and domestic animals (De Faria, 1980; Armiñana *et al.*, 2020).

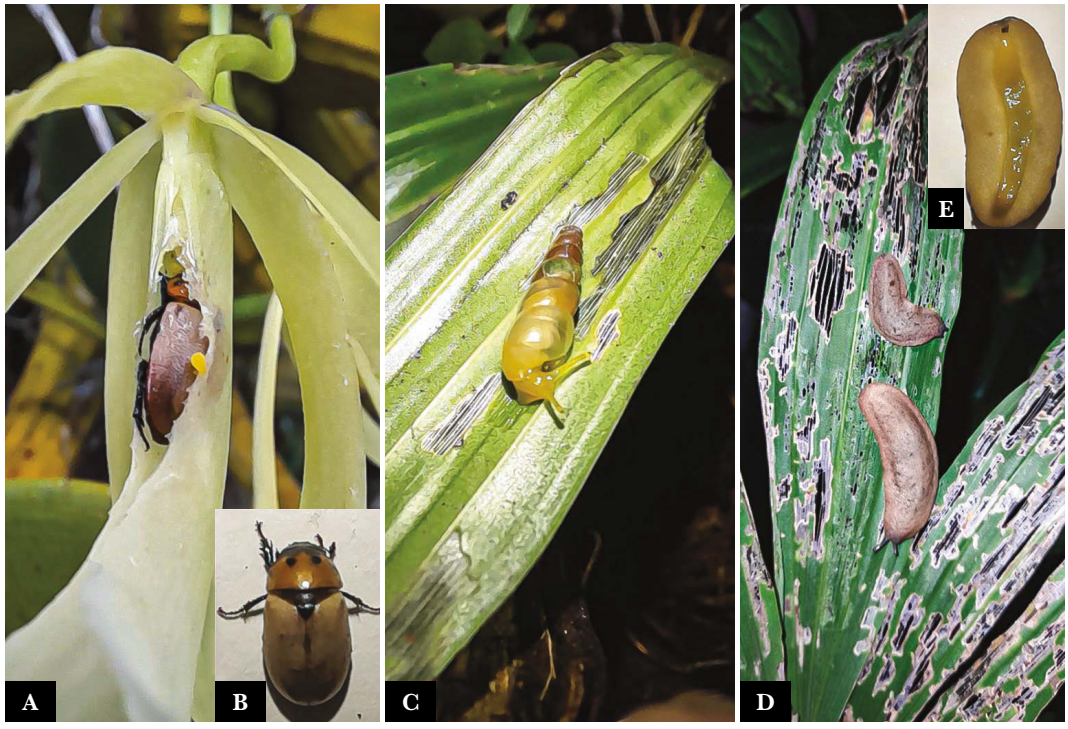

Figure 4. A) Adult of *Cyclocephala guttata* damaging a flower of *Brassavola nodosa* in Chicozapote 1st Section. B) Another adult of *C. guttata* in dorsal view. C) Adult of *Subulina octona* scraping the foliage of a *Gongora leucochila* plant in the city Heroica Cárdenas. D) Adults of *Sarasinula plebeia* scraping the foliage of a *Catasetum integerrimum* plant in that city. E) Adult of *S. plebeia* in ventral view.

***Sarasinula plebeia* (P. Fischer, 1868) (Mollusca: Gastropoda: Veronicellidae)**

Registry. Heroica Cárdenas, Pueblo Nuevo neighborhood: January 27, 2022; four adults and one juvenile damaging the foliage of a *C. integerrimum* plant (Figures 4D and 4E).

Distribution. It is considered non-native of Mexico (Naranjo *et al*., 2007). Presently it is distributed in the north, center and south of America, Caribbean islands, southeast of Asia, north and northeast of Australia, and islands of the Pacific (GBIF, 2022). In Mexico it is found in the states of Chiapas, Puebla, San Luis Potosí, Tamaulipas, Veracruz and Yucatán (Naranjo *et al*., 2007; Velázquez *et al*., 2014; GBIF, 2022). It lives in altered environments such as gardens. The horticultural industry, as part of global trade, is probably the most important dispersion vector of this and other species of gastropods (Cowie *et al*., 2008).

Commentary. In Central America it is one of the main pests of the bean crop (Sobrado and Andrews, 1985). It can cause losses of 100% (Rodríguez *et al*., 1987), has limited the harvests and motivated the abandonment of this crop (Sobrado *et al*., 1987; del Río *et al*., 1990). In Los Tuxtlas, Veracruz, it has caused bean producers to change the crop (Naranjo *et al*., 2007). In Veracruz and Puebla it has caused important reductions in the production of vanilla, *Vanilla planifolia* Jackson, a species of orchid (Velázquez *et al*., 2014). In Colombia it has caused the mortality of coffee plants, *Coffea arabica* L., in nursery and newly sown in the field (Constantino *et al*., 2010). In Hawaii, it causes severe damages to various ornamental plants, being one of the main pests of orchids from genus *Dendrobium*.

It has also been cause for quarantine rejections in export shipments (Kawate and Sewake, 2014). It has medical importance, since it is an intermediate host of nematodes of the genus *Angiostrongylus* which are pathogenic for human beings (Caballero *et al.*, 1991; Araya *et al.*, 2015).

CONCLUSIONS

This study contributes to the knowledge of invertebrates that damage orchids in Mexico. *Diabrotica adelpha*, *Stethobaris* sp., *Cyclocephala guttata* and *Subulina octona* are registered for the first time damaging orchids in the countries. Likewise, this study constitutes a basis for future studies that allow defining the impact and importance of these organisms in conservation and cultivation of orchids in this zone of Tabasco.

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