Annona liebmanniana and *A. cherimola* x *A. reticulata* (Magnoliales: Annonaceae): Two New Host Plant Species of *Anastrepha ludens* (Diptera: Tephritidae) in Mexico

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ANNONA LIEBMANNIANA AND *A. CHERIMOLA* X *A. RETICULATA* (MAGNOLIALES: ANNONACEAE): TWO NEW HOST PLANT SPECIES OF *ANASTREPHA LUDENS* (DIPTERA: TEPHRITIDAE) IN MEXICO

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Fruit flies (Diptera: Tephritidae) from the genus *Anastrepha* are endemic to subtropical and tropical areas in the Americas (Stone 1942; Aluja 1994), and collectively infest a wide variety of economically important hosts (Hernández-Ortiz 1992; Norrbom 2004). In Mexico and northern Central America, *Anastrepha ludens* Loew, the Mexican fruit fly, is the most common and most damaging insect pest of perennial fruit crops such as citrus (Rutaceae) and mango (Anacardiaceae). This polyphagous species also attacks fruit species belonging to the plant families Myrtaceae, Fabaceae, Rosaceae, and Sapotaceae, among others (Baker et al. 1944; Bush 1962; Aluja & Martínez 1984; Aluja et al 1987; Aluja 1993, 1994).

Several species of *Anastrepha* have been reported to infest *Annona* spp. For example, in Mexico several authors have reported *A. ludens* feeding in *Annona cherimola* Mill., *A. reticulata* L., *A. squamosa* L., and *A. muricata* L. (Baker et al 1944; Aluja et al 1987; Hernández-Ortiz 1992; White & Elson-Harris 1992; Vidal 1994). In the state of Veracruz, Piedra-Rodríguez & Zuniga-Anell (1993) reported *A. ludens* infesting *A. cherimola* fruits in the locality of Llano Grande, Municipality of Teocelo. Here, we provide the first report of *A. ludens* feeding in two new host plants: *Annona liebmanniana* Baill. (= *A. scleroderma* S., USDA 2007) and *A. cherimola* x *A. reticulata,* a plant that is presumed to be a natural hybrid (R.V. Ortega-Ortiz, pers. comm.), from Chiapas and Veracruz, Mexico, respectively. Also we confirm previous reports indicating that *A. ludens* infests fruits of *A. reticulata.*

Fruits were collected in 2010 and 2012 in different agro-ecosystems in the communities of Francisco Sarabia, Municipality of Tuzantan, Chiapas, Mexico (N 15°09' 6" W 92°28'08", 513 m asl, and N 15°11'13"W 92°21'41", 1074 m asl); Tejería (N 19°22' 24" W 96°54'90", 938 m asl) and Llano Grande (N 19°22'05"W 96°52'79", 851 m asl) Municipality of Teocelo, Veracruz, Mexico. Three fruit collections were made for each *Annona* species at each locality. In all, 23.1 kg of *A. liebmanniana* fruits were collected (15 kg in Feb 2010 and 8.1 kg in Feb 2012); 3.2 kg of *A. reticulata* fruits were collected in Apr 2010; and 1.6 kg of *A. cherimola* × *A. reticulata* fruits were sampled in Oct 2010. Collections focused on fruit that appeared to be physiologically mature. After sampling, all fruit was labeled and transported to the laboratory. The collected fruit were placed in individual trays labeled with the name of the host species and covered with mesh netting to prevent the emerging insects from escaping (Borror & White 1970; Peña et al 2002). Pupae were collected and kept in plastic containers with moist (50-70%) vermiculite until the emergence of the adult insects. Emerged fruit flies were collected and placed in vials containing 70% alcohol. Keys provided by Hernández-Ortiz (1992) were used for insect taxonomic identification. Voucher specimens of *A. ludens* were deposited at the Instituto de Investigaciones Forestales, Universidad Veracruzana, in Xalapa, Veracruz, Mexico. Voucher specimens of *A. liebmanniana* and *A. cherimola* × *A. reticulata* were deposited in the herbarium XALU of Faculty of Biology of Universidad Veracruzana (Xalapa, Mexico).

Overall, 55 *A. ludens* individuals emerged from *A. liebmanniana* (5 adults, 9.1% of the total recovered), *A. reticulata* (48 adults, 87.3% of the total) and *A. cherimola* × *A. reticulata* (2 adults, 3.6% of the total) fruits (Table 1). This is the first report documenting the emergence of *A. ludens* from *A. liebmanniana* (Tuzantan, Chiapas) and *A. cherimola* × *A. reticulata* (Llano Grande-Veracruz). This fly species also was found infesting *A. reticulata* fruits (Tejería-Veracruz) thus confirming previous reports from Hernández-Ortiz (1992) and White & Elson-Harris (1992), who indicated that *A. cherimola*, *A. reticulata* and *A. squamosa* serve as hosts to *A. ludens* in México; however, they provided no specific information as to the location of the infestations.

TABLE 1. NUMBER OF *ANASTREPHA LUDENS* INDIVIDUALS RECOVERED FROM FRUITS FROM 3 SPECIES OF *ANNONA* COLLECTED IN THE STATES OF VERACRUZ AND CHIAPAS, MEXICO (2010, 2012).

Host Species	State	Municipality	Town	Total	♀	♂
Annona cherimola × *A. reticulata*	Veracruz	Teocelo	Llano Grande	2	0	2
Annona liebmanniana	Chiapas	Tuzantan	Francisco Sarabia	3	0	3
Annona liebmanniana	Chiapas	Tuzantan	Francisco Sarabia	2	0	2
Annona reticulata	Veracruz	Teocelo	Tejería	48	21	27
Total				55	21	34

This report increases to 22 the number of plant species serving as hosts of *A. ludens* (Eskafi & Cunningham 1987; Norrbom & Kim 1988; Hernández-Ortiz 2007). We emphasize the importance of the presence of *A. ludens* in *A. liebmanniana* (Fig. 1b) in particular because fruits of this host plant, a type of custard fruit cultivated from Southern Mexico down through western Guatemala to Honduras, possesses a hard and leathery peel on the fruit, previously thought to be resistant to pests (EAC 2010).

Annona cherimola × *A. reticulata* has particular morphological features not found in any other kind of *Annona* previously identified. For instance, its fruits are similar to those of *A. cherimola,* but the axillary shoot and leaf shape is similar to that of *A. reticulata* (see Fig. 1c.). Furthermore, flowering and fruiting periods of this species are synchronous with those of *A. cherimola* and *A. reticulata* in the study site in Llano Grande, Veracruz. Owing to these characteristics, it is presumed that this plant is a natural hybrid between *A. cherimola* and *A. reticulata* (R.V. Ortega-Ortiz, pers. comm.).

Overall, our results highlight the need to continue assessing other *Annona* species potentially

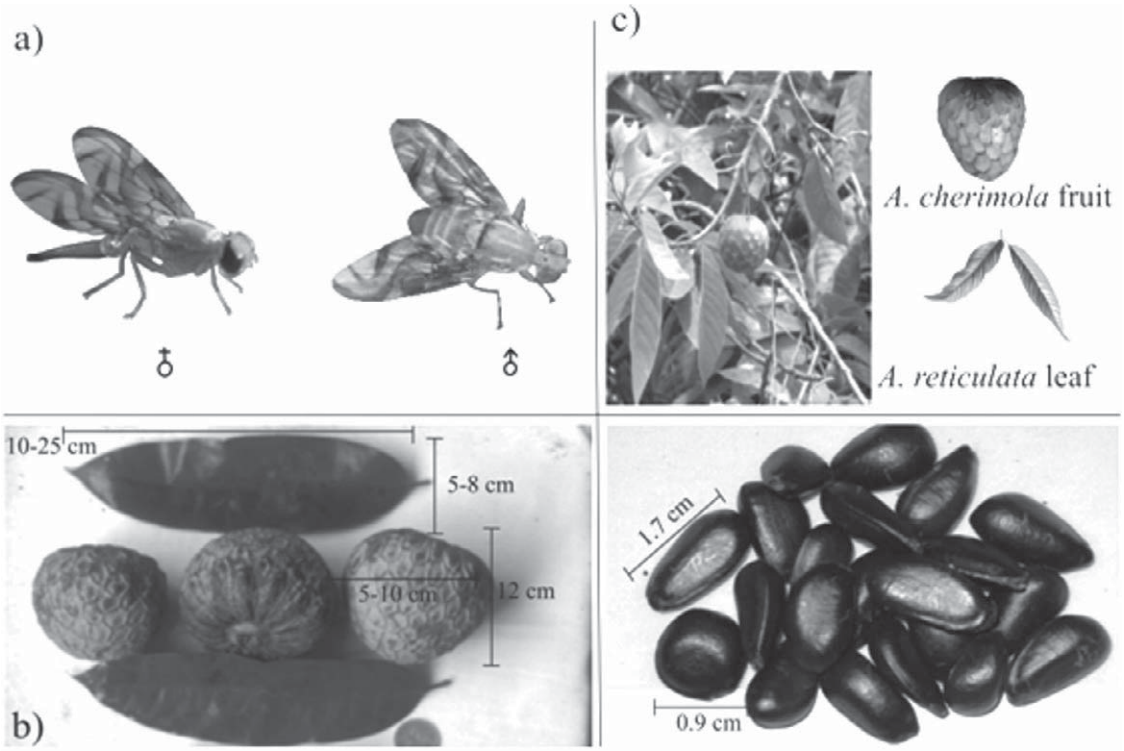

Fig. 1. (a) Side and aerial view of *Anastrepha ludens*, both male and female, recovered from fruits of *Annona liebmanniana*, *A. reticulata* and *A. cherimola* × *reticulata*, collected in the localities of Francisco Sarabia, Tuzantan Chiapas, and Llano Grande and Tejería, Municipality of Teocelo, Veracruz, Mexico, (b) Morphometry of leaves, fruits, and seeds of *A. liebmanniana* collected in Tuzantan, Chiapas, Mexico, (c) *Annona cherimola* × *reticulata* fruits collected in the community of Llano Grande, Municipality of Teocelo, Veracruz, Mexico. A fruit of *A. cherimola* and leaves of *A. reticulata* are shown for comparative purposes.

serving as alternate host plants for *A. ludens,* because populations building in *Annona* fruits may represent a potential reservoir for populations of this pest that can in turn attack citrus, mango and other commercial fruits within and outside Mexico.

Summary

The presence of Mexican fruit fly, *Anastrepha ludens* Loew, (Diptera: Tephritidae) in fruits of *Annona liebmanniana* (= *A. scleroderma)* and *A. cherimola* × *A. reticulata* (Magnoliales: Annonaceae) is reported for the first time in Central Veracruz and Southern Chiapas, Mexico, respectively. This report provides evidence of an increasing number of *Annona* species acting as hosts for this pestiferous fruit fly.

Resumen

La presencia de la mosca Mexicana de la fruta, *Anastrepha ludens* Loew, (Diptera: Tephritidae) infestando frutos de *Annona liebmanniana* (= *A. scleroderma)* and *A. cherimola* × *A. reticulata* (Magnoliales: Annonaceae) es reportada por primera vez en la zona central de Veracruz y en la zona sur de Chiapas, Mexico. Este reporte proporciona evidencia de un incremento en el número de árboles del género *Annona* sirviendo como hospederos de esta especie plaga.

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