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Systematic Review

Mites Associated to the Cultivation of Soursop (*Annona Muricata* L.) in the Municipality of Compostela, Nayarit, Mexico

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The presence of *Amblyseius aerialis* (Muma), *Euseius ho* (De Leon), *Pronematus ubiquitus* (McGregor), *Agistemus floridanus* Gonzáles, *Tetranychus mexicanus* (McGregor), *Brevipalpus phoenicis* (Geijskes) associated with the cultivation of soursop in municipality of Compostela, Nayarit, Mexico is reported for the first time. Is registered for the first time in the country *Tarsonemus confusus* Ewing.

Keywords: *Amblyseius*, *Euseius*, *Agistemus*, *Tetranychus*, *Pronematus*, *Brevipalpus*, *Tarsonemus.*

INTRODUCTION

For the state of Nayarit, about 165 species of mites have been reported, most of which are parasitic species of mammals, found in soil, litter, caves, aquatic species and in natural ecosystem plants, leaving aside those associated with plants of economic interest, of which its diversity is little known (Hoffmann and López-Campos, 2000). Recently in the state has been reported the presence of *Aceria annonae* Keifer, which produces erineos on the underside of leaves (Flores-Canales et al., *in press*), and of which it is not known if it is affecting in a negative way the production of fruit; a situation that applies to most of the mites associated with plants of economic interest; since they are only studied if the species has an impact on the crop (Acuña-Soto and Estrada-Venegas, 2009).

The obtained mites were collected from a total of 100 leaves from *Annona muricata* L. in El Divisadero and Altavista locations, of the municipality of Compostela in the state of Nayarit, collected in February 2017. These were collected and assembled from according to the proposed by Walter and Krantz (2009), changing the liquid of Hoyer by modified Berlese like means of assembly (Amrine and Manson, 1996). The generic determination was carried out using specialized keys and specified specifying the original descriptions or redescriptions. The specimens are deposited in the acarological collection of the Colegio de Postgraduados, Campus Montecillo.

A total of 357 individuals were distributed in seven families, eight genera, and eight species; two genera with two species for the family Phytoseiidae, whereas for the families, Eriophyidae, Iolinidae, Tarsonemidae,

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Tenuipalpidae, Tetranychidae and Stigmaeidae, only one genus and one species each are reported; the commented list is presented below.

Family Phytoseiidae Berlese
Subfamily Amblyseiinae Muma
Genus *Amblyseius* Berlese
Amblyseius aerialis (Muma, 1955)

Material examined. Nayarit, Compostela, location El Divisadero 21° 08' 46.7'' N 105° 13' 09.4'' W, 21 meters above sea level (masl), 23-II-2017, ex *Annona muricata* L. 8 ♀. Location Altavista 21° 05' 57.1'' N 105° 10' 16.2 'W. 21 masl, 23-II-2017, ex *Annona muricata* L. 6 ♀. Comments. Considered as a general predator that feeds on other mites of families Tetranychidae and Tenuipalpidae (Muma, 1971). Previously associated with "frijolillo" ex *Rynchosia mínima* (L.) DC, ex *Theobroma cacao* L. in Tabasco (Garman, 1958; Estebanes-González and Rodríguez-Navarro, 1998; de Moraes et al., 1991). First record in Nayarit and associated with soursop in México.

Genus *Euseius* Wainstein
Euseius ho (De Leon, 1965)

Material examined. Nayarit, Compostela, location El Divisadero 21° 08' 46.7'' N 105° 13' 09.4'' W, 21 masl, 23-II-2017, ex *Annona muricata* L. 5 ♀. Location Altavista 21° 05' 57.1'' N 105° 10' 16.2 'W. 21 masl, 23-II-2017, ex *Annona muricata* L. 4 ♀. Comments. This species has been studied as a possible biological controller of *Mononychellus tanajoa* (Bondar), *Manihot esculenta* Crantz, 1766 in Brazil, although it is considered generalist. There are previous reports in ex *Psidium guajava* L. of Yucatán; ex *Citrus* spp. in the states of Nuevo León and Tamaulipas: ex *Baccharis glutinosa* Pers. in Sonora (Chant, 1959; Badii and Flores, 1990; de Moraes et al., 1991). Firts record in Nayarit associated with soursop in México.

Family Iolinidae Pritchard
Subfamily Pronematinae André
Genus *Pronematus* Baker
Pronematus ubiquitus (McGregor, 1932)

Material examined. Nayarit, Compostela, location El Divisadero 21° 08' 46.7'' N 105° 13' 09.4'' W, 21 masl, 23-II-2017, ex *Annona muricata* L. 7 ♀. Location Altavista 21° 05' 57.1'' N 105° 10' 16.2 'W. 21 masl, 23-II-2017, ex *Annona muricata* L. 9 ♀. Comments. It is considered the most abundant mite and the lergest predator in fig cultivation (Abou-Awad et al., 1999). Previous studies cite it associated with mosses in the states of Morelos and Sonora (Hoffmann and López-Campos, 2000). Firts record in Nayarit associated with soursop in México.

Family Eriophyidae Nalepa
Subfamily Eriophyinae Nalepa
Genus *Aceria* Keifer
Aceria annonae Keifer 1973

Material examined. Nayarit, Compostela, location El Divisadero 21° 08' 46.7'' N 105° 13' 09.4'' W, 21 masl, 23-II-2017, ex *Annona muricata* L. 20 ♀. Location Altavista 21° 05' 57.1'' N 105° 10' 16.2 'W. 21 masl, 23-II-2017, ex *Annona muricata* L. 20 ♀. Comments. A strictly phytophagous species, due to its feeding produces an abnormal growth of trichomes on the underside of the leaves, damage that is denominated erineo (Keifer, 1973). In Costa Rica are the most important pest in soursop (Ochoa et al., 1997). It is reported for the states of Jalisco, Nayarit, Oaxaca and Veracruz in *Annona muricata* L. (Acuña-Soto and Estrada-Venegas, 2009; Flores-Canales *et al*., *in press*).

Family Stigmaeidae Oudemans
Genus *Agistemus* Summers
Agistemus floridanus González, 1965

Material examined. Nayarit, Compostela, location El Divisadero 21° 08' 46.7'' N 105° 13' 09.4'' W, 21 masl, 23-II-2017, ex *Annona muricata* L. 5 ♀. Location Altavista 21° 05' 57.1'' N 105° 10' 16.2 'W. 21 masl, 23-II-2017, ex *Annona muricata* L. 3 ♀. Comments. Species generally known as active predator of tetranychid mite eggs (Gerson and Smiley, 1990). Hoffmann and López-Campos (2000) report it associated with *Pithecellobium* sp. in Nayarit. Firts record in Nayarit associated with soursop in México.

Family Tetranychidae Donnadieu
Subfamily Tetranychinae Berlese
Genus *Tetranychus* Dufour
Tetranychus mexicanus (McGregor, 1950)

Material examined. Nayarit, Compostela, location El Divisadero 21° 08' 46.7'' N 105° 13' 09.4'' W, 21 masl, 23-II-2017, ex *Annona muricata* L. 6 ♀, 3 ♂. Location Altavista 21° 05' 57.1'' N 105° 10' 16.2 'W. 21 masl, 23-II-2017, ex *Annona muricata* L. 5 ♀, 4 ♂. Comments. A phytophagous species associated with numerous host plants, it is considered a secondary species with no negative effects on crops such as citrus or soursop (Gerson, 2003; de Souza et al., 2010). Other reports in México. ex *Annona purpurea* Moc. & Sessé ex Dunal, ex *Cedrela odorata* L., ex *Musa* sp., ex *Cocos nucifera* L., ex *Citrus* spp., in the States of Chiapas, México, San Luis Potosí and Veracruz (Beer and Lang, 1958; Hoffmann and López-Campos, 2000). Firts record in Nayarit associated with soursop in México.

Family Tenuipalpidae Berlese
Subfamily Brevipalpinae Reck
Genus *Brevipalpus* Donnadieu
Brevipalpus phoenicis (Geijskes, 1939)

Material examined. Nayarit, Compostela, location El Divisadero 21° 08' 46.7'' N 105° 13' 09.4'' W, 21 masl, 23-II-2017, ex *Annona muricata* L. 3 ♀. Location Altavista 21° 05' 57.1'' N 105° 10' 16.2 'W. 21 masl, 23-II-2017, ex *Annona muricata* L. 5 ♀. Comments. Phytophagous species reported as a vector of citrus leprosis and of economic importance (Childers et al., 2001). Also reported in ex *Citrus* spp., ex *Cordia* sp., ex *Fraxinus* sp., ex *Musa x paradisiaca* L. Chiapas; ex *Citrus* spp. Querétaro; ex *Anthurium* sp., ex *Brysonima* sp., ex *Psidium* sp. in Nayarit; *Heterotheca* sp. in Oaxaca; ex *Guazuma* sp., ex *Verbena* sp. in San Luis Potosí; *Cissus sisvoides* L., *Plumeria* sp. in Sinaloa; ex *Citrus* spp. Tabasco; ex *Citrus* spp., ex *Coffea* sp., *Cocos nucifera* L., ex *Curatella* sp., Veracruz (De León, 1961; Baker and Tuttle, 1987; SENASICA, 2016). First record associated with soursop in Mexico.

Family Tarsonemidae Canestrini and Fanzago
Subfamily Tarsoneminae Kramer
Genus *Tarsonemus* Canestrini and Fanzago
Tarsonemus confusus Ewing, 1939

Material examined. Nayarit, Compostela, location El Divisadero 21° 08' 46.7'' N 105° 13' 09.4'' W, 21 masl, 23-II-2017, ex *Annona muricata* L. 6 ♀, 2 ♂. Location Altavista 21° 05' 57.1'' N 105° 10' 16.2 'W. 21 masl, 23-II-2017, ex *Annona muricata* L. 3 ♀ 1 ♂. Comments. It has been found in many plant species, in soil and trash, in house dust and in bird nests. It is a fungivora species and is also known as a minor pest of some ornamental plants and in greenhouses. No registration for the country. First record in Mexico, Nayarit and associated with soursop in Mexico.

In this work, there is little diversity of mite species associated with soursop (eight species), nor was there a high population (357 organisms), compared to a study carried out in Brazil, where 32 species and 1011 organisms (de Sousa et al., 2015); these results may be due mainly to the management of the orchards, where the constant application of insecticides for pest management is affecting the diversity of these organisms, since in Brazil, the orchards sampled is limited the application of insecticides with which we conclude that the present diversity is greater (de Sousa et al., 2015).

CONCLUSIONS

In Mexico, there are few studies on the diversity of acarofauna present in a specific crop and the damages caused by these species; these species have generally been registered in faunal studies in other states and plants generally in natural ecosystems; eight species are recorded for the first time in the state; seven are new records associated with soursop as host, and is first recorded to *Tarsonemus confusus* Ewing, in the country.

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