

Scientific Notes

***Tenuipalpus uvae* (Acari: Tenuipalpidae) and *Calophya spondiadis* (Hemiptera: Psyllidae), pests of *Spondias* in Florida, USA**

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Spondias purpurea L. (Anacardiaceae), which originated in Mexico and Panama, is now widely cultivated in tropical America and tropical West Africa and Asia; it is 1 of the 4 *Spondias* species that are important economically (Mitchell & Daly 2015). *Spondias purpurea* (purple mombin or Spanish plum) and *Spondias dulcis* L. (Anacardiaceae) (ambarella, golden apple, hog plum; native from Melanesia through Polynesia [Morton 1987]) are grown in south Florida. Two main arthropods were found attacking *S. purpurea* in Homestead, Florida, USA. The first is the flat mite, *Tenuipalpus uvae* De Leon (Acari: Tenuipalpidae), that first was recorded in Florida damaging the leaves of spondias on 5 Oct 2010. It was described originally from Mexico (De Leon 1962), and also has been reported in Costa Rica (Salas & Ochoa 1986), Puerto Rico, Trinidad (Welbourn 2010) and Brazil (de Carvalho Mineiro et al. 2014). The second pest is the spondias psyllid, *Calophya spondiadis* Burkhardt & Mendez (Hemiptera: Psyllidae), which was found feeding on the flowers, fruitlets, and tender expanding leaves in Jan 2020. The spondias psyllid has been collected twice (2007, 2013) from traps in Miami-Dade County, Florida, but had not been found on plants in the USA (Burckhardt & Halbert 2020; Halbert 2020). The psyllid was recorded in Mexico collected from *S. purpurea* in 2014 (Mendez et al. 2016).

Both arthropods were collected from *S. purpurea* trees at 2 sites: 1 at the University of Florida, Tropical Research and Education Center, Homestead, Florida, USA, and the other at a private property within a quarter-mile from the center. Developmental times and oviposition rates of *T. uvae* were studied in the laboratory (26 ± 2 °C, 65 to 80% RH, 12:12 h [L:D] photoperiod). Mite arenas consisted of a moist broadcloth rectangle (10 × 8 cm) with a hole in the middle (2 × 1 cm) exposing the surface of a clean *S. purpurea* leaf. The leaf was placed on top of a moist cotton square (18 cm), with a moist sponge (10 × 10 × 2) on a Petri dish (13.5 cm diam). The arenas were watered daily (including the cloth barrier on top of the leaf that kept the mites contained). Leaves were replaced daily when mites oviposited, otherwise within 3 to 5 d. Arenas were maintained at 26 ± 2 °C, 65 to 80% RH, with a 12:12 h (L:D) photoperiod.

Tenuipalpus uvae adults are red and orange with brown markings. Females are 242.0 ± 4.8 µm in length by 158.5 ± 1.6 µm in width ($n = 9$) and males are 221.7 ± 2.0 by 130.7 ± 4.1 µm ($n = 3$) (mean ± SEM)

(Fig. 1a). Populations of *T. uvae* were composed principally of females, with only 4 males observed out of several hundred individuals. As with other flat mites, reproduction could be by thelytokous parthenogenesis (Weeks et al. 2001; Groot et al. 2005; Groot & Breeuwer 2006). Female longevity was 13.1 ± 2.0 d on average (range of 7 to 25 d; $n = 10$). Unmated females oviposited 5.0 ± 1.0 eggs in their lifetime (range 3 to 10; $n = 8$). The preoviposition period averaged 7.4 ± 1.6 d ($n = 8$) and ranged between 3 to 17 d.

Eggs are reddish-orange, ovoid with longitudinal white fringes, 102.4 ± 0.7 µm in length, and 62.3 ± 0.7 µm in diam ($n = 10$) (Fig. 1b, c). Eggs from field-collected females on average eclosed in 10.0 ± 0.1 d (range 9 to 12 d; $n = 29$). Eclosure time for eggs from laboratory-reared unmated females (F_1) was similar, on average 10.2 ± 0.1 d (range 9 to 11 d; $n = 22$).

Developmental times for the larva averaged 6.6 ± 0.4 d (range 5 to 9 d; $n = 10$) (Fig. 1d). The protonymph stage lasted 5.7 ± 0.2 d (range 4 to 8 d; $n = 17$) (Fig. 1e). The deutonymph stage lasted 6.8 ± 0.7 d (range 4 to 11 d; $n = 13$) (Fig. 1f). Their life span and oviposition rates are likely greater under field conditions. For instance, 1 female survived for 52 d under south Florida winter conditions (average 20.2 °C).

Tenuipalpus uvae were found feeding on the leaves of *S. purpurea* and *S. dulcis* causing bronzing damage. The upper surface had a significantly higher number of nymph and adult mites (6.43 ± 0.60) than the lower surface (2.29 ± 0.35) (Kruskal-Wallis tests: $\chi^2 = 43.35$; $P < 0.001$; SAS Institute). The number of eggs on the upper surface also was significantly higher than on the lower surface (0.91 ± 0.15 and 0.61 ± 0.12, respectively) (Kruskal-Wallis test: $\chi^2 = 6.35$; $P < 0.0117$). A significantly higher number of eggs, nymphs, adults, and exuviae combined were found on the proximal (base) (9.4 ± 1.3) and medial (9.8 ± 1.3) portions of the leaf compared to the distal (apex) end (3.2 ± 0.5), rachis (2.2 ± 0.3), and petiole (1.3 ± 0.2) (Kruskal-Wallis test: $\chi^2 = 63.1452$; $df = 2$; $P < 0.0001$). Only 1 egg and 2 nymphs were found on stems, which on average were 9.4 cm long, and 0.79 cm diam ($n = 17$). The leaves containing mites were mature and soon to senesce. The newer shoots that grew after the defoliation period did not have mites by the middle of Apr, when this study ended. Fruits were checked intermittently throughout the study period. No mites

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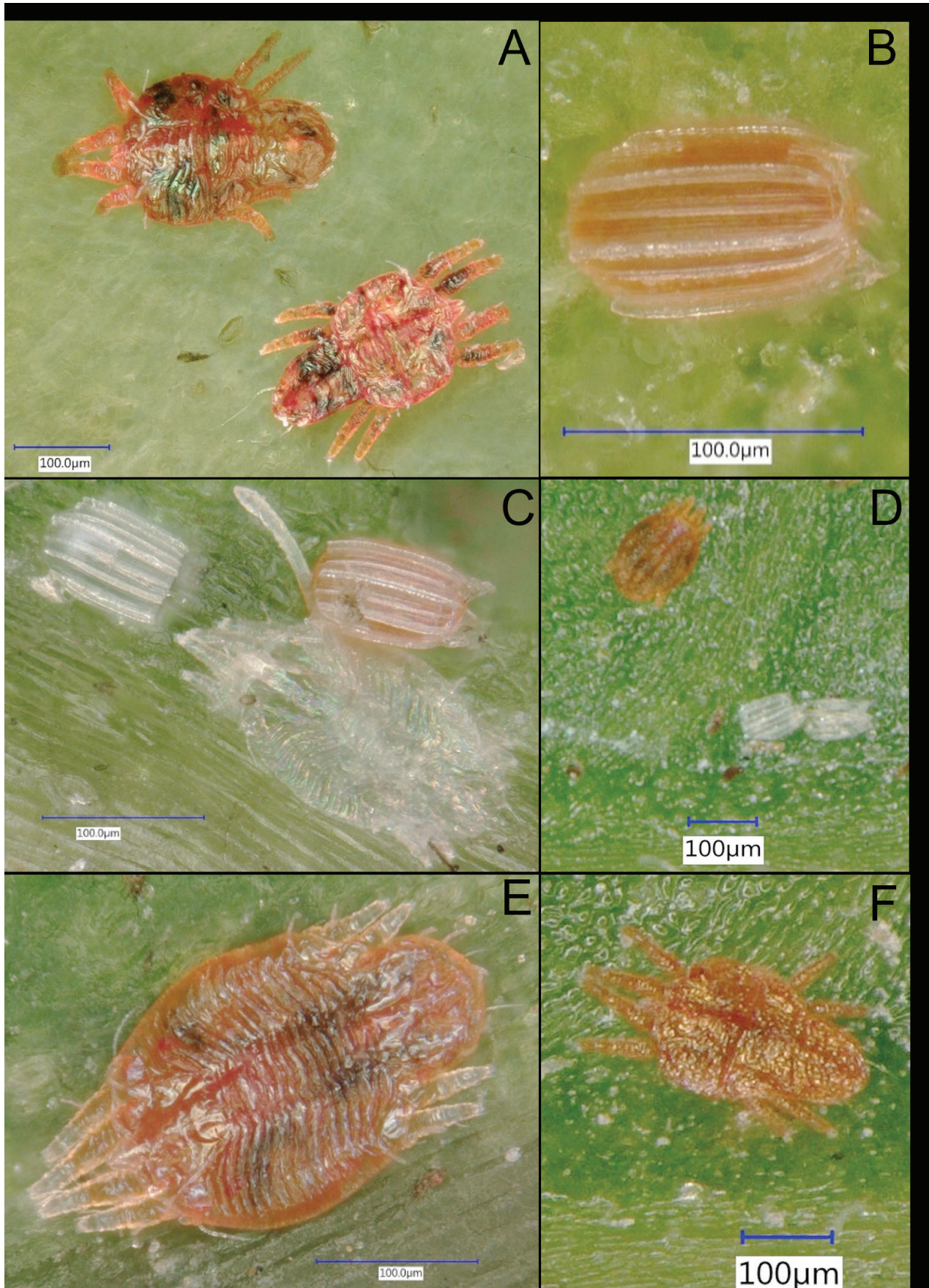


Fig. 1. *Tenuipalpus uvae* on *Spondias purpurea* leaves: (a) adults, female (top) and male (bottom); (b) egg; (c) an egg, a translucent chorion, and the exuviae of a nymph that molted; (d) larva (3 d old) with the translucent egg chorions; (e) protonymph; and (f) deutonymph.

were found on the fruit at the University of Florida, Tropical Research and Education Center, even when the trees lost all of their old leaves before blooming. One mite was found on 1 fruit at the private property site where trees retained a few old infested leaves by the time the first fruits appeared.

The second pest found feeding on the flowers, fruitlets, and tender expanding leaves was the spondias psyllid, *Calophya spondiadis*. Adults are around 2.1 mm in length and 0.8 mm in width. They are predominantly black and brown, with some yellow and orange (Fig. 2a); these colors appear to darken as adults mature. Spondias psyllids first laid their eggs on flowers, because these were the first to sprout in Jan. The

eggs are oblong, black, glossy, and 0.23 mm long by 0.11 mm wide (Fig. 2b, c). Nymphs display a range of colors, from dark green to yellow, orange and dark reddish-brown; they secrete waxy droplets that give the leaves a frothy white appearance when the population levels are high (Fig. 2d). Newly hatched nymphs are around 0.16 mm long and 0.10 mm wide, and grow to 0.95 mm in length and 1.1 mm in width as they mature (Fig. 2e). Flowers were heavily infested by the end of Mar, with an average of 10.9 ± 1.5 eggs and 9.6 ± 1.1 nymphs ($n = 13$) per flower.

Few eggs or nymphs (0.17 ± 0.17 and 0.08 ± 0.08 , respectively) were found per small fruit (average size of fruit 20×14 mm; $n = 12$); nonetheless the fruit did have multiple punctures or necrotic spots

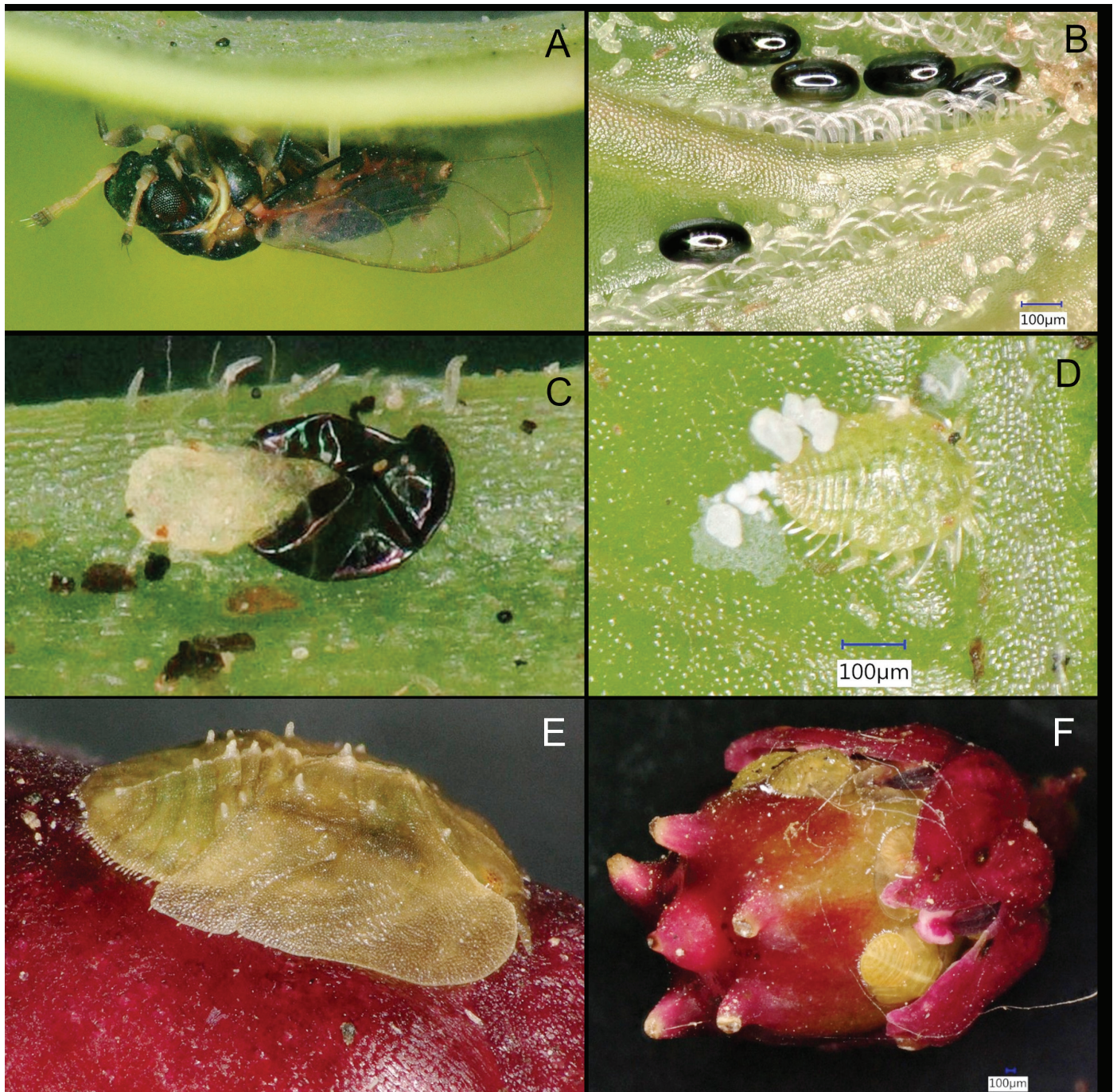


Fig. 2. Spondias psyllid, *Calophya spondiadis*, on *Spondias purpurea*: (a) adult on a leaf; (b) eggs on a leaf; (c) a nymph hatching from an egg; (d) a 2 d old nymph with waxy secretions; (e) older nymph on a flower petal; (f) flower with small fruitlet and spondias psyllid immatures feeding on the flower ovary as it becomes a fruit.

(16.7 ± 4.3 per fruit). These likely were acquired as nymphs fed on the flowers and their ovaries just as they started to form a fruitlet (Fig. 2f).

There was a high population of spondias psyllids on the flowers and small fruitlets by the time leaves emerged, and they readily infested the young leaves. Significantly more eggs were found on the upper surface of the leaves (6.97 ± 1.19) and the petiole portion adjacent to each leaflet (3.44 ± 0.56) than the underside of the leaves (0.20 ± 0.08) (Kruskal-Wallis tests: $\chi^2 = 38.09$; $df = 2$; $P < 0.0001$). Nymphs were found on the upper surface of the leaves (0.77 ± 0.24) and the petioles (0.28 ± 0.12), but significantly more nymphs were found on the underside of the leaves (1.80 ± 0.50) (Kruskal-Wallis tests: $\chi^2 = 12.21$; $df = 2$; $P < 0.0022$). The feeding damage resulted in black, necrotic spots that became brown pits as the leaves matured and hardened.

The spondias psyllid caused most of the damage observed on fruits. Chilli thrips, *Scirtothrips dorsalis* Hood (Thysanoptera: Thripidae), and damage likely caused by them was observed. In addition, aphids (*Aphis spiraeicola* Patch [Hemiptera: Aphididae]) were observed feeding on the flowers and fruitlets and 1 leaf was infested with the whitefly *Aleurodicus* Douglas sp. (Hemiptera: Aleyrodidae). An unidentified predatory thrips and a fly larva, *Leucopis* Meigen sp. (Diptera: Chamaemyiidae), were observed feeding on psyllid eggs and immatures, respectively. Most of the flat mite damage was observed on the leaves. Two predatory mites, *Amblyseius largoensis* (Muma) (Acari: Phytoseiidae) and an unidentified Stigmatidae, were observed associated with *T. uvae*.

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Summary

Two main pests were found attacking purple mombin or Spanish plum, *Spondias purpurea* (Sapindales: Anacardiaceae) in Homestead, Florida, USA: *Tenuipalpus uvae* De Leon (Acari: Tenuipalpidae), a flat mite damaging the leaves, and the spondias psyllid, *Calophya spondiadis* Burckhardt & Mendez (Hemiptera: Psyllidae) feeding on the flowers, fruitlets, and tender expanding leaves. *Tenuipalpus uvae* populations are composed principally of females. Female longevity was 13.1 ± 2.0 d and unmated females oviposited 5.0 ± 1.0 eggs in their lifetime. On average, eclosure time for eggs from laboratory-reared unmated females was 10.2 ± 0.1 d, and developmental times for the larva, protonymph, and deutonymph were 6.6 ± 0.4 d, 5.7 ± 0.2 d, and 6.8 ± 0.7 d, respectively. In a survey of *S. purpurea* leaflets, the upper surface had a significantly higher number of nymph and adult mites (6.43 ± 0.60) than the lower surface (2.29 ± 0.35). *Calophya spondiadis* laid their eggs on flowers at first, because these were the first to sprout in Jan, and they were heavily infested by the end of Mar with an average of 10.9 ± 1.5 eggs and 9.6 ± 1.1 nymphs per flower. Few eggs or nymphs (0.17 ± 0.17 and 0.08 ± 0.08, respectively) were found per fruit; nonetheless, the fruit did have multiple punctures or necrotic spots (16.7 ± 4.3 per fruit), likely acquired as nymphs fed on the flowers and their ovaries. Significantly more eggs were found on the upper surface of the leaves and the petiole portion adjacent to each leaflet than the underside of the leaves, and most nymphs migrated to the undersides. The feeding damage resulted in black, necrotic spots that became brown pits as the leaves matured and hardened.

Key Words: spondias psyllid; flat mite; purple mombin; Spanish plum

Sumario

Se encontraron dos plagas atacando ciruela purpura, jocote o mombin purpura, *Spondias purpurea* (Sapindales: Anacardiaceae) en Homestead, Florida, USA. El ácaro plano *Tenuipalpus uvae* De Leon (Acari: Tenuipalpidae) se encontró alimentándose en las hojas y el psílido *Calophya spondiadis* Burckhardt & Mendes (Hemiptera: Psyllidae) en flores, fruitillas y hojas tiernas poco desarrolladas. Las poblaciones de *T. uvae* estuvieron compuestas primordialmente de hembras. La longevidad de las hembras fue de 13.1 ± 2.0 días, y hembras vírgenes depositaron 5.0 ± 1.0 huevos durante su estado adulto. En promedio, el tiempo de eclosión de huevos fue de 10.2 ± 0.1 días, el desarrollo de la larva fue de 6.6 ± 0.4 días, 5.7 ± 0.2 días para la protoninfa y 6.8 ± 0.7 días para la deutoinfa. En un muestreo se encontró que el haz de las hojas secundarias de *S. purpurea* tenía un número significativamente mayor de ninfas y adultos (6.43 ± 0.6) comparado con el envés de estas (2.29 ± 0.35). *Calophya spondiadis* deposita sus huevos en las flores que aparecen por vez primera en Enero, observándose un pico de infestación a finales de Marzo, con un promedio de 10.9 ± 1.5 huevos y 9.6 ± 1.1 ninfas por flor. Se encontró pocos huevos y ninfas (0.7 ± 0.17 y 0.08 ± 0.08, respectivamente) en frutos. Los frutos presentan manchas necróticas (16.7 ± 4.3) (16.7 ± 4.3 por fruto), que parecen ser el resultado de la alimentación del psílido cuando estos atacan el ovario floral. Un número significativamente mayor de huevos fue encontrado en el haz y peciolo de las hojas secundarias comparado con un número menor observado en el envés. La mayoría de las ninfas fueron observadas en el envés. El resultado de la alimentación del psílido en las hojuelas se manifiesta como manchas negras, las cuales al paso del tiempo y cuando las hojas están maduras, se convierten en depresiones cóncavas de color marrón.

Palabras Clave: spondias psílido; jocote; ciruela purpura; mombin morado; ácaro plano

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