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'SOLO' SUNRISE PAPAYA AS A HOST OF THE CARIBBEAN FRUIT FLY, *ANASTREPHA SUSPENSA* (LOEW), UNDER FIELD AND LABORATORY CONDITIONS

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Abstract. **The suitability of 'Solo' Sunrise papaya as host of *Anastrepha suspensa* (Loew) was studied under field and laboratory conditions. Several pupae of *A. suspensa* were reared from fully ripened 'Solo' Sunrise papaya in the laboratory. However, no larvae were produced from field tests conducted in Clermont, FL., on half-, quarter-, and color break-fruit.**

Papaya, *Carica papaya* L. (Caricaceae), is believed to have originated in tropical America, perhaps southern Mexico or Central America (Morton, 1986). Papaya is a very popular fruit in nearly all tropical regions including the Pacific Islands. In the United States, papaya is grown commercially in Hawaii and south Florida. Several cultivars of papaya were introduced into Hawaii during the early 1900's. About 11.8 million kg of papaya fruit were shipped from Hawaii to the mainland of the United States in 1974 (Morton, 1986).

Caribbean fruit fly, *Anastrepha suspensa* (Loew) was rediscovered in Miami Springs, FL., in 1965, and rapidly spread over south and central Florida (Weems, 1966). Swanson and Baranowski (1972) listed papaya as one of 84 fruit-bearing host plants of *A. suspensa*. Therefore, it is required that papaya grown in Florida receive a post-harvest treatment for *A. suspensa* before being exported to Japan and California.

In Costa Rica, fully ripened papaya was used to mass rear *Anastrepha* sp. (Lara et al., 1989); however, research from Hawaii and Costa Rica demonstrated that tephritid fruit flies infested only fully ripened 'Sunrise' papaya in the field (Lara et al., 1989). Unripened papaya is likely resistant to tephritid fruit fly infestation because of the presence of benzyl isothiocyanate (BITC) in the latex of the fruit. The concentration of BITC decreases with ripening and survival of the fruit fly larvae increases (Seo and Tang, 1982; Liquido, 1991; Liquido et al., 1989).

The purpose of this study was to determine if the cultivar 'Solo' Sunrise papaya is a suitable host of *A. suspensa*.

Materials and Methods

Laboratory Test. The test was conducted by placing fully ripened 'Solo' papaya fruit from a commercial grove in Jamaica in a plexiglass oviposition cage (20 × 30 × 40 cm). The number of fruit placed in each plexiglass cage varied from one to three depending on the size and availability of fruit shipped from Jamaica to the Gainesville laboratory facilities. Each plexiglass cage was innoculated with 25 pairs of sexually mature *A. suspensa*, 6 to 10 days old, which were obtained from the FDACS-Division of Plant Industry Caribbean Fruit Fly Laboratory in Gainesville. A local variety of open pollinated (op) papaya fruit harvested in Winter Haven, FL., was also used in a parallel test.

Four plexiglass cages were used for each replication and the experiment was repeated five times. Forty-eight hours after introduction of *A. suspensa* adults into the cage, all fruit was removed from the oviposition cage and placed together in an 8-liter ice cream container. A 3-cm layer of moistened vermiculite was placed in the bottom to serve as a pupation medium for larvae. The experiment was conducted in a room at 26.7°C, 60%-80% RH and a 14L:10D photoperiod.

After the fruit remained in the container for 12-14 days, the vermiculite was sifted to obtain any larvae that might have crawled out of the fruit for pupation. Fruit were also cut and examined for larvae. All larvae and pupae from the same cage were recorded and allowed to emerge as adults over a period of 15-20 days. Flies were then counted to determine the percent emergence and sex ratio.

Field Test. The field experiment was conducted in a commercial papaya grove operated by Florida Premier Fruit Company located near Clermont, Lake County, FL. To prevent cold weather damage during the winter, the papayas were grown in a 10.8 ha block covered by nylon muslin screen or shadecloth. The screen cover was about 4.5 m high. The muslin screen surrounding the area could be uncovered when the temperature was over 37.8°C. Papaya trees used for this experiment were planted in February 1992 and had grown to about 2.4-3.7 m tall at the time the test was conducted in November-December 1992. They were irrigated by an automatic micro-jet system and sprayed as needed with a pyrethroid insecticide (Pounce®) to control papaya whitefly, *Trialeurodes variabilis* (Quaintance). Fungicides were applied every other week in the area.

Three papaya trees were selected for each replication. Fruit ripeness was categorized as mature green, colorbreak, quarter-, half-, or fully ripened according to Liquido et al. (1989). These papaya trees had at least 1 or 2 quarter ripe, a half-ripened fruit, and several color breaks and mature green fruit. The ripened fruit was removed from the tree to prevent flies from being attracted to it. Each individual papaya tree was covered with a 183 × 183 × 305 cm cage constructed of a PVC frame and covered with 60-mesh nylon organdy. The nylon organdy passed underneath the bottom of the PVC frame and covered the ground inside the cage to keep flies from escaping. Papaya leaves were also trimmed to fit the cage. A meter-long strip of velcro was sewn into one side of the cage to provide an entry into the cage.

Fifteen pairs of adult *A. suspensa*, 6-7 days old, were released into each cage at 14:00-15:00 hr EST. These flies were mass-produced in the previously mentioned laboratory. A maximum-minimum thermometer was installed in each cage to record the temperature during the release period. Food (sugar and yeast hydrolysate at 4:1 ratio by weight) and water were also provided for the flies. Forty-

The authors express their gratitude to Florida Premier Fruit Company, Clermont, Florida for providing the site for this study; and the assistance of many employees of the Division of Plant Industry is appreciated.

eight hours after the flies were released, five mature green and all-ripened fruit were harvested from the cage and placed individually in paper cups to transport to the laboratory in Gainesville for incubation. The maximum-minimum temperatures in each field cage were recorded daily. Each cage and papaya tree were then sprayed with 50% alcohol to kill the flies remaining alive in the cage. The screens were removed, dried, and installed around each of 3 other papaya trees for the next replication. Eight replications of 3 individually caged trees were conducted during November-December 1992.

In the laboratory, papaya fruit were incubated individually in an 8-liter ice cream container prepared with a 3-cm layer of moistened vermiculite as described above. The container was covered with a lid from which the center was removed and covered with a piece of 60-mesh nylon organdy. The fruit remained in the container for 6 weeks to allow larval development. A week after incubation began, the vermiculite was sifted to obtain larvae and pupae, with the process repeated every week until the fruit was discarded.

A control test was also conducted in the laboratory for each replication by infesting a fully-ripened 'Solo' papaya in a plexiglass cage. For each replication, 15 pairs of adult *A. suspensa*, 6-7 days old, from the same batch of pupae that were used in the field, were introduced into a plexiglass cage (20 × 30 × 40 cm). A fully-ripened papaya fruit, collected from the field, was placed in the cage and removed 48 hr later. The fruit were then incubated as previously described.

Results and Discussion

Laboratory Test. The average number of pupae produced per 100 g of fully-ripened 'Solo' papaya fruit shipped from Jamaica to Gainesville was 35.6 (Table 1). Emergence averaged 74.1%. No larvae were found in the quarter- or half-ripened fruit collected in Winter Haven. When the flies attempted to oviposit into a freshly-collected papaya fruit, latex was exuded, and the flies moved away.

Field Test. The average maximum and minimum temperatures in the cage during the fly release periods were 29.9 and 19.2°C, respectively. Most of the flies landed on papaya leaves or on top of the cage. Each morning after the fly releases, several dead flies were usually found on the ground around the inside perimeter of the cage. We did not observe any flies attempting to oviposit in the quarter-ripe, half-ripe, color-break, or mature green fruit. Rain occurred during the third replication with a total of 2.4 cm precipitation. However, several adults were observed alive on 24 Nov., just before the papaya fruit was harvested.

Insecticide was sprayed in the grove on 17 Nov., but not in the northwest corner of the grove where the experiment was conducted (Richard Tyson, Production Manager, Florida Premier Fruit Company, personal communication). No larvae or pupae were found from the mature green, color-break, quarter-, or half-ripened fruit collected during the field test. An average of 51.3 larvae per fruit was collected from fully ripened papayas used for the control (Table 2).

Data from this study suggests that mature green, color-break, or quarter-ripened papaya should not be considered suitable hosts for *A. suspensa*.

Table 1. Number of pupae per 100 g papaya fruit, percent emergence, and sex ratio of *Anastrepha suspensa* reared from ripe 'Solo' Sunrise papaya grown in Jamaica.[z]

Replication	No. pupae/ 100 g papaya fruit	Percent emergence	Sex ratio
1	17.3	82.3	42:58
2	17.1	57.6	48:52
3	54.1	75.7	47:53
4	25.8	71.0	50:50
5	63.9	84.0	48:52
Average	35.6	74.1	

Test conducted in the Florida Biological Control Laboratory quarantine facilities, Gainesville, Florida, at 26.7°C and 60%-80% RH.

Table 2. Number of pupae of *Anastrepha suspensa* reared from fully-ripened 'Solo' Sunrise papaya fruit grown in Clermont, Florida and exposed to Caribbean fruit fly in the laboratory.[z]

Replications	Number of pupae per fruit
1	6
2	0
3	41
4	71
5	140
6	46
7	57
8	49
Average	51.3

Test conducted in the Gainesville Biological Control Laboratory quarantine laboratory, Gainesville, Florida at 26.7°C and 60%-80% RH.

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