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BIOLOGY AND NATURAL HISTORY OF *ANASTREPHA INTERRUPTA* (DIPTERA: TEPHRITIDAE)

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Florida's best known member of the genus *Anastrepha* is an introduced pest, the Caribbean fruit fly, *A. suspensa* (Loew). However, Florida is also home to other innocuous species, including *Anastrepha interrupta* Stone. The latter was first reported as an undescribed "species E" collected during an early fruit fly survey program in south Florida (Brown 1937) and eventually described by Stone (1942). It is also known from the Bahamas, Virgin Islands, and Dominica (Steyskal 1977), Cuba (Fernandez et al. 1997), and Puerto Rico (A. L. Norrbom, personal communication). The larvae infest fruits of *Schoepfia schreberi* J. F. Gmel. ("gulf greytwig", family Olacaceae; previously known as *Schoepfia chrysophylloides* (A. Rich.) Planch. (McClahanan & Merrill 1951); because this is its only known host, the fly has been called the "Schoepfia fruit fly" (Heppner 1990). In Florida, *A. interrupta* has been trapped since 1934, and many museum specimens exist up to the early 1960s, but far fewer were collected during later years. The literature contains only a few bits of information concerning this species: Brown (1937)—detection; Stone (1942), Shaw (1962), Weems (1967)—adult identification and taxonomy; McClanahan & Merrill (1951)—host plant; Marsh (1970), Wharton & Marsh (1978)—parasitoids; Steck & Wharton (1988), Steck et al. (1990), Heppner (1990)—larval identification.

In early 2003, a population of *A. interrupta* was discovered through adult trapping and fruit collections in Miami-Dade County near Homestead, Florida at Camp Owaissa Bauer. This population offered an unusual opportunity to make additional observations on *A. interupta*. At the same time, an effort was made to detect other populations of the fly where the hosts were abundant.

Field work was conducted at the Deering Estate at Cutler (Miami) and Camp Owaissa Bauer, both Miami-Dade County Parks. *Schoepfia* fruiting phenology was followed in both parks, and two distinct patterns were observed. There was one fruiting season (Mar-Apr) at Deering Estate at Cutler, and two fruiting seasons at Camp Owaissa Bauer (Mar-Apr and Oct-Nov). Even though they are near each other (32 km apart), Camp Owaissa Bauer is in the interior (11 km from the Atlantic coast), unlike Deering Estate at Cutler, which is directly on the Atlantic coast. It has been observed that populations of *Schoepfia* in the Florida Keys flower and fruit at different times than the mainland populations (R. Hammer, personal communication). Phenological differences may be due to climatic differences among locations, or, alternatively, differences in soil composition and nutrients or plant variety may result in different capacities to produce fruit or different adaptive fruiting schedules.

Adult trapping was conducted during Mar and Apr, 2004 at Deering Estate at Cutler in 3 locations within the park where *S. schreberi* occurred. Five multi-lure traps (Better World, Fresno. CA) with torula yeast pellets dissolved in water were deployed and serviced every 2 weeks. Only one adult female specimen was trapped in Apr. At Camp Owaissa Bauer we did not conduct any trapping activities for fear of reducing the resident fly population.

Two hundred fruit were collected at the Deering Estate at Cutler in Mar and Apr, 2004, and 150 fruits in Mar, 2005, but no larvae were obtained. At Camp Owaissa Bauer, fruits were collected in Oct 2003, Mar, Oct, and Nov 2004, and Mar 2005 (about 100 fruits on each occasion). The fruits ranged in fresh weight from 61.1 mg to 316.0 mg and averaged 146.9 ± 54.9 mg (n = 25). More than 50% of the collected fruit was infested.

Anastrepha interrupta apparently oviposits into the fruit of *S. schreberi* while they are still green and not yet full size. We observed only 1 larva per fruit based on field observation of about 100 infested fruits, in which the seed had been entirely consumed leaving most of the space inside the fruit occupied by the third instar. Normal fruits became purple as they matured, but infested fruits did not appear to fully mature and change color. The oviposition puncture was clearly evident to the naked eye, and the larval exit hole was relatively large, obvious, and circular.

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The samples of collected fruit were maintained in the laboratory (temperature of 25 ± 1°C and relative humidity of 55 ± 5%), in a container with vermiculite until larvae emerged and pupation occurred. The mean weight of *A. interrupta* pupae was 13.6 ± 4.8 mg (n = 25), with a range of 4.9 to 22.7 mg. *Anastrepha interrupta*'s closest relative, *Anastrepha spatulata* Stone (Foote et al. 1993), infests the same host plant in Mexico, where the fruit are slightly larger (mean = 185.0 mg), but the pupae are slightly smaller (12.0 mg) (Aluja et al. 2000).

The adult flies emerged 20-24 d after pupation at 25 ± 1°C and RH of 55 ± 5%. Under the same conditions, adults took about 20 d to mature sexually; i.e., the start of male pheromone production, sexual signaling, and mating. Maximum adult longevity in the laboratory was 177 d (female). This is similar to the lifespan reported for other *Anastrepha* species such as *A. suspensa* (Sivinski 1994). No diapause in the pupal stage was observed; all pupae that developed from the fall collections and the spring collections eclosed as adults within a few weeks of pupation.

We searched museum collections and records of the Florida State Collection of Arthropods (FSCA) and the U.S. National Museum of Natural History (NMHN) (Norrbom 2006) for information on flight time of *A. interrupta* (Fig. 1). Almost all records are based on specimens captured in fruit fly detection traps (McPhail traps). We excluded those few records based on adults reared from fruits. As previously noted (Weems 1967), adults have been collected in every month of the year. Both the number of collection records and the number of flies collected clearly indicate elevated population levels in the months from Dec to May, which overlaps with the primary fruiting seasons of its host. During the winter months of 2004/2005, *A. interrupta* clearly produced at least 2 generations at Camp Owaissa Bauer. Herbarium records at the Fairchild Tropical Botanic Garden (http://www.virtualherbarium.org/, accessed 20 Oct 2006) show that *Schoepfia schreberi* fruits at least sporadically during other months than observed here, e.g. Jan and Feb; and fruiting has also been observed during late Jul, Aug and Sep (R. Hammer, personal communication). The opportunistic availability of fruit throughout the year probably allows additional generations to be produced. An adult life span of several months as observed in the laboratory would allow this specialist species to persist as adults from one fruiting period to another as occurs at Camp Owaissa Bauer. A population may not be sustainable at sites with only a single fruiting season, such as Deering Estate at Cutler, and such sites might be repopulated only by immigration.

After emergence the flies were separated by sex and maintained with food (3 parts sugar and 1 part yeast) and water *ad libitum* in separate cages. At 20 d of adult age, flies from both sexes were placed in the same cage and their sexual behaviors observed. During the mid-afternoon males performed the following peculiar behavior: after approaching a female, the male faced her and then moved laterally, back and forth, in a half circle pattern. It is not known if this behavior is confined to interactions between males and females. Male pheromone calling, recognized by the extrusion of anal membranes and pleural glands, as seen in other tephritids (Aluja 1994), took place only in complete darkness, followed by mating. Male pheromone components were identified and will be de-

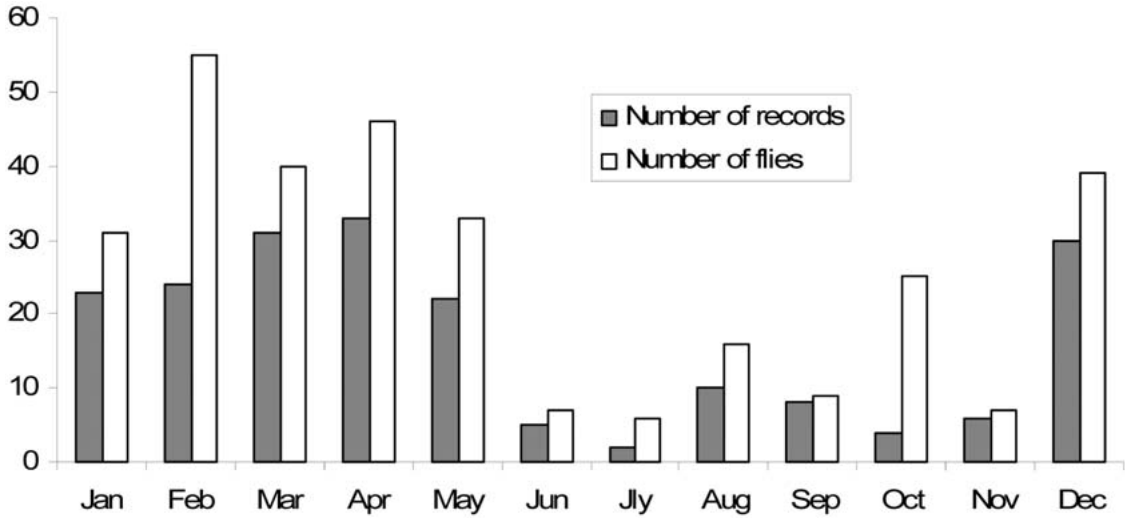


Fig. 1. Phenology of *Anastrepha interrupta* based on Florida State Collection of Arthropods and the U.S. National Museum of Natural History specimens and records, 1934-2003.

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scribed elsewhere (B. D. Dueben, personal communication). Male-male interaction was not observed during the behavioral observations in laboratory.

Two females of the parasitoid *Utetes anastrephae* (Viereck) (Hymenoptera: Braconidae) were reared from fly pupae derived from fruit sampled in Mar 2005. This is the first record of this parasitoid attacking *A. interrupta*. The only other parasitoid previously reported was another braconid, *Doryctobracon anastrephilus* (Marsh) (Marsh 1970; Wharton & Marsh 1978). *Utetes anastrephae* is widespread in South Florida, where it also parasitizes *Anastrepha suspensa* (Loew) (Eitam et al. 2004).

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Summary

Observations on the phenology, larval host feeding, adult longevity, behavior, and parasites of *Anastrepha interrupta* Stone (Diptera: Tephritidae) are presented. A population of this fly was bivoltine in Homestead, Florida where its host plant fruited twice per year. *Anastrepha interrupta* larvae were found singly in fruits of *Schoepfia schreberi* (Olacaceae) in which they consumed the seed. Adult flies lived up to 177 d, and there was no evidence of diapause in the immature stages. Male calling behavior begins after dusk and continues in darkness. *Utetes anastrephae* (Viereck) (Hymenoptera: Braconidae) was reared from pupae, the first observation of this parasitoid on *A. interrupta*.

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