

## SCIENTIFIC NOTES

UNUSUAL CALLING BEHAVIOR OF *ANASTREPHA ROBUSTA* FLIES (DIPTERA: TEPHRITIDAE) IN NATURE

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Male calling behavior in *Anastrepha* (Schiner) fruit flies has been described in the following species: *bistrigata* (Bezzi), *fraterculus* (Wiedemann), *ludens* (Loew), *obliqua* (Macquart), *pseudoparallela* (Loew), *serpentina* (Wiedemann), *sororcula* (Zucchi), *striata* (Schiner) and *suspensa* (Loew) (Aluja et al. 1983, 1989, Dodson 1982, Burk 1983, Morgante et al. 1983, 1993, Nation 1972, Polloni & Silva 1986, Robacker & Hart 1985, Teles da S. et al. 1985). In the cases of *fraterculus*, *ludens*, *obliqua*, *serpentina*, *sororcula*, *striata* and *suspensa* male mating aggregations ("leks") have been reported (Aluja et al. 1983, 1989, Dodson 1982, Morgante et al. 1983, 1992, Sivinski 1989). Within a lek (or outside of it) males typically emit a series of courtship sounds ("calling songs") through wing fanning (Webb et al. 1984; Sivinski 1988), release a sexual pheromone (Nation 1972), and usually defend a territory (individual leaf or portion thereof) (Aluja et al. 1983). While calling, individuals preferably position themselves on the underside of a leaf (Dodson 1982, Aluja et al. 1989) and only rarely take off and return to the same spot repeatedly within a bout of calling.

Here, I report the unusual calling behavior of *Anastrepha robusta* (Greene) males. The discovery was made during a study of the natural history of *Anastrepha* spp. in a mixed chico zapote (*Manilkara achras* L.) - citrus (*Citrus sinensis* Osb., *C. reticulata* Blanco) - guanabana (*Annona muricata* L.) - coconut (*Cocos nucifera* L.) orchard in Apazapan, Veracruz, Mexico during 1990. On June 21, 1990 a single, very large fruit fly male was sighted in a *Citrus reticulata* tree performing a series of elaborate loops with repeated landings within looping bouts (Fig. 1). The specimen was captured and identified as *Anastrepha robusta*. *Anastrepha robusta* is a rare species belonging to the *robusta* group (Norrbom 1988). It has only been reported in Brazil, Panamá (type material), Guatemala (type locality) and Mexico (Stone 1942). To date nothing has been reported about its biology, ecology and behavior.

Eight calling males were observed after the first sighting (1990) and 2 females were captured in McPhail traps placed in a *C. reticulata* tree. In 1991, no individuals were sighted or trapped at this site. In 1992, 5 individuals (3 ♀ & 2 ♂) were trapped in the same location (*C. reticulata* tree) but no individuals were sighted. All captured individuals have been placed as voucher specimens in the permanent insect collection of the Instituto de Ecología, A.C. in Xalapa, Veracruz, Mexico.

A summary of the 1990 sightings is provided in Table 1 [note that *A. robusta* males only call during early morning hours (0700-0930 hours)]. While calling, males performed a mean of  $9.5 \pm 0.5$  (SE) loops  $\text{min}^{-1}$ . The distance a loop extended from the point of departure varied from loop to loop but ranged between ca. 15 and 40 cm. All looping males were observed in the outer canopy of trees (both *C. aurantium* and *A. muricata*) and loops were always performed in wide open spaces between trees or branches. While looping, flies flew on both horizontal and vertical planes. Typically, an individual would take off, fly out into the open on an horizontal plane, loop downward and then fly back to the departing point (leaf). On only two occasions were two males seen calling simultaneously at the same site (males were ca. 15 cm apart on two separate leaves ca. 3 m above the ground in an *Annona muricata* tree). Never were females seen in the vicinity of looping males.

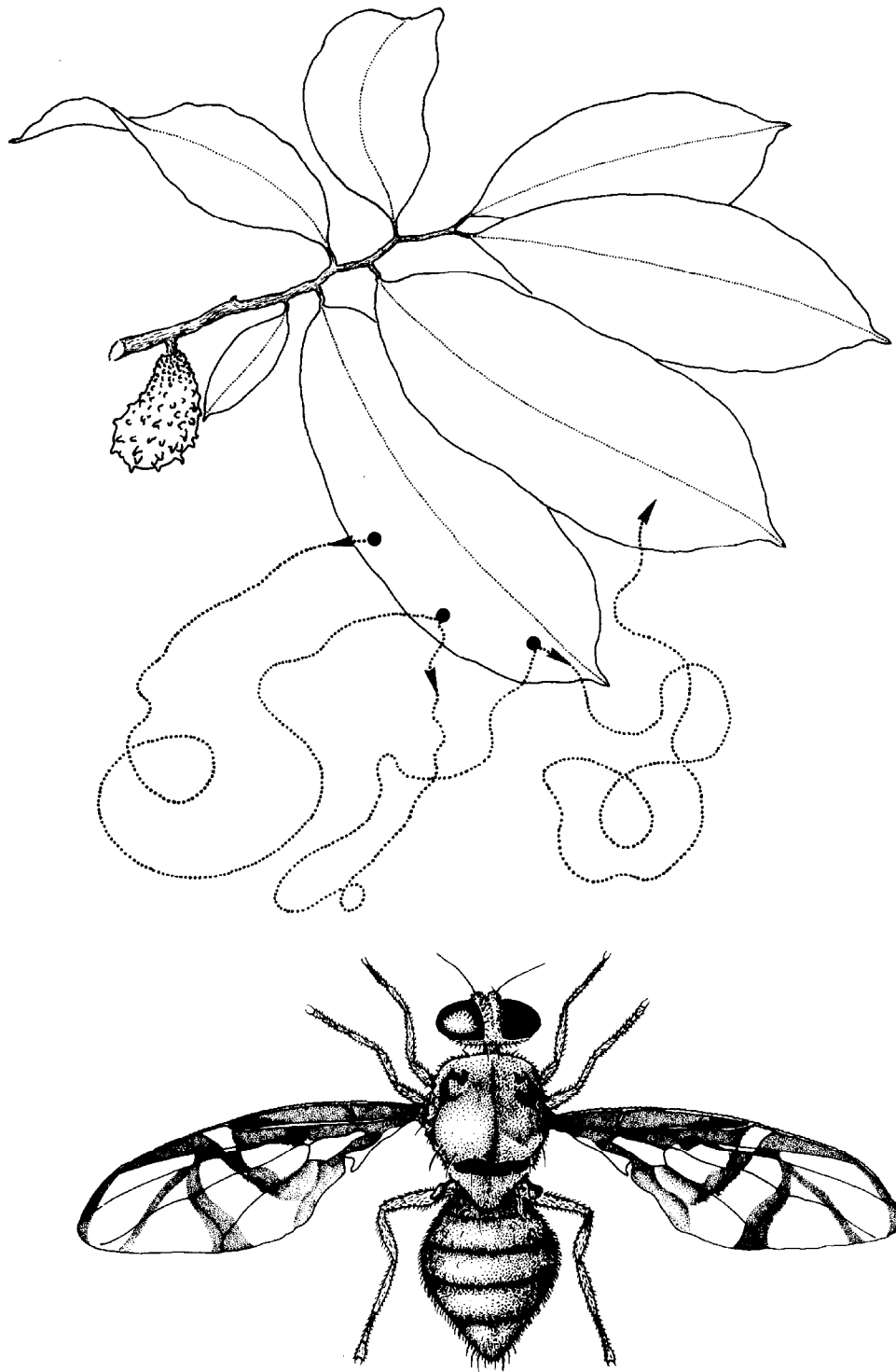


Fig. 1. Graphic representation of loops performed by *Anastrepha robusta* males while calling.

TABLE 1. SUMMARY OF *ANASTREPHA ROBUSTA* BEHAVIORAL SIGHTINGS IN APAZAPAN, VERACRUZ, MEXICO.

Sighting No.	Date and Hour of sighting	Number of loops min <sup>-1</sup> *	Comments
1	21/VII/90 08:50	Not recorded	Wing fanning, puffing of lateral abdominal pouches and everted proctiger. On <i>Citrus aurantium</i> foliage
2	23/VII/90 08:30	Not recorded	Same as above
3	25/VII/90 08:30	10.3	Same as above
4	25/VII/90 09:10	9.6	Same as above
5	31/VII/90 07:20	11.1	Same as above. On <i>Annona muricata</i> L. foliage
6	31/VII/90 08:15  (2 individuals sighted)	7.6	Same as above. On <i>Annona muricata</i> L. foliage Repeated touching of leaf surface with tip of everted proctiger Territorial behavior exhibited by one male
7	31/VII/90 09:15  (2 individuals sighted)	8.7	Same as above. On <i>Annona muricata</i> L. foliage Resting bouts between calling bouts
8	31/VII/90 10:15	---	Resting
9	31/VII/90 11:15	---	Resting

\*It could not be ascertained if sounds were produced during loops, but this is very likely due to intensity of wing movement during flight

The calling behavior exhibited by *A. robusta* flies under natural conditions differs from the behavior displayed by other *Anastrepha* species in one striking aspect: no other *Anastrepha* species studied to date exhibits the complex and frequent looping bouts observed for *A. robusta*. These displays have not been reported in any of the other economically important fruit fly genera [*Bactrocera* (*Dacus*), *Ceratitidis*, *Rhagoletis*, *Toxotrypana*] (Landolt & Hendrichs 1983, Kuba & Koyama 1985, Prokopy & Bush 1973, Prokopy & Hendrichs 1979), nor have they been observed in other genera of tephritids such as *Aciurina*, *Chaetostomella*, *Eutreta*, and *Isoconia* (Freidberg 1986, Jenkins 1990, Steck 1984, Stoltzfus & Foote 1965). Interestingly, many other details of the calling behavior are shared with other tephritid species, e.g. territory defense, wing fanning, pheromone gland puffing, extrusion of proctiger (anal pouch) and intermittent touching of leaf surface with tip of everted proctiger. A possible function of such an

elaborate and energetic courtship behavior in *A. robusta* flies could be to magnify the various signals emitted by calling males. This might be important if fly populations are usually as low as they appeared to be in the study site.

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**GOETHEANA SHAKESPEAREI (HYMENOPTERA:  
EULOPHIDAE) AN IMMIGRANT PARASITOID OF THRIPS  
IN FLORIDA AND GUADELOUPE?**

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In 1935 the eulophid parasitoid *Goetheana shakespearei* Girault (under the name *Dasyscapus parvipennis* Gahan) was introduced from West Africa into Trinidad as a biological control agent for the cocoa thrips *Selenothrips rubrocinctus* (Giard) (Cock 1985). Between 1936 and 1942 it was shipped from Trinidad to Grenada, Jamaica, Puerto Rico, continental USA and Canada (Lewis 1973). *G. shakespearei* is reported to be established in Trinidad and Jamaica (Cock 1985) and Puerto Rico (Clausen 1978). Wolcott (1951), referring to the introduction of *G. shakespearei* to Trinidad and Puerto Rico, stated "economically it is of little importance because it becomes sufficiently abundant to destroy many thrips only during wet weather, when thrips are least numerous and the injury they then cause is negligible". On at least four visits during 1987-1991 this parasite was found at several localities in central and western Puerto Rico but levels of parasitism were generally low and considered to have only minimal impact on