A LIVE TRAP FOR MONITORING *EUPHASIOPTERYX* AND TESTS WITH *E. OCHRACEA* (DIPTERA: TACHINIDAE)

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ABSTRACT

A trap was developed for *Euphasiopteryx* spp. that caught as many *E. ochracea* females as a sticky trap but kept them healthy. Traps worked well for more than a year without repair. A trap in a north Florida pasture caught 1059 *E. ochracea* in one year; a trap in a nearby woods caught 1576. Seasonal patterns of captures in the two habitats were similar. Numbers captured correlated with moon phase, periodically peaking within a few days after new moon.

RESUMEN

Se desarrolló una trampa para *Euphasiopteryx* spp. que atrapó tantas hembras de *E. ochracea* como las trampas pegajosas, pero las mantuvo más saludables. Las trampas funcionaron bien por más de un año sin reparaciones. Una trampa en el norte de la Florida atrapó 1059 *E. ochracea* en un año; una trampa en un bosque cercano atrapó 1576. El número capturado está correlacionado con las fases de la luna, periodicamente el auge ocurre pocos días después de la luna nueva.

Tachinid flies of the tribe Ormiini are parasitoids of crickets and katydids. Gravid females home in on their host's calling song and deposit living larvae on or near the caller. If a larva contacts a host, it burrows in and completes its development in about two weeks (Sabrosky 1953, Cade 1975, Mangold 1978, Fowler 1987).

Studies of the ormiine genus *Euphasiopteryx* have recently been stimulated by plans to release in Florida a South American species, *E. depleta* (Wiedemann), as a biocontrol agent against introduced pest mole crickets. A closely related species, *Euphasiopteryx ochracea* (Bigot), occurs throughout the southeastern United States and parasitizes field crickets (*Gryllus* spp.). Learning about the readily accessible *ochracea* facilitates work with *depleta*. For example, attempts to rear *depleta* failed until techniques developed for rearing *ochracea* were applied (Wineriter & Walker, unpublished).

This paper describes a new type of live trap for *Euphasiopteryx*, tests of the trap using *E. ochracea*, and results of using it to monitor *E. ochracea* for one year.

Developing and Testing a New Type of Live Trap

The only *Euphasiopteryx* spp. adults that can be collected readily are gravid females attracted to recorded or synthesized calls of their hosts. Because the numbers are usually low and the flies arrive from dusk until dawn, some means of retaining the attracted flies is needed. High voltage grids and sticky materials (e.g., Tack Trap) work well if the flies are only to be counted (Fowler 1987, Walker 1986), but if healthy flies are needed for biological studies or for shipment and release, a live trap must be used. Cade (1979) and Fowler (1988) devised live traps for *E. ochracea* and *E. depleta* that

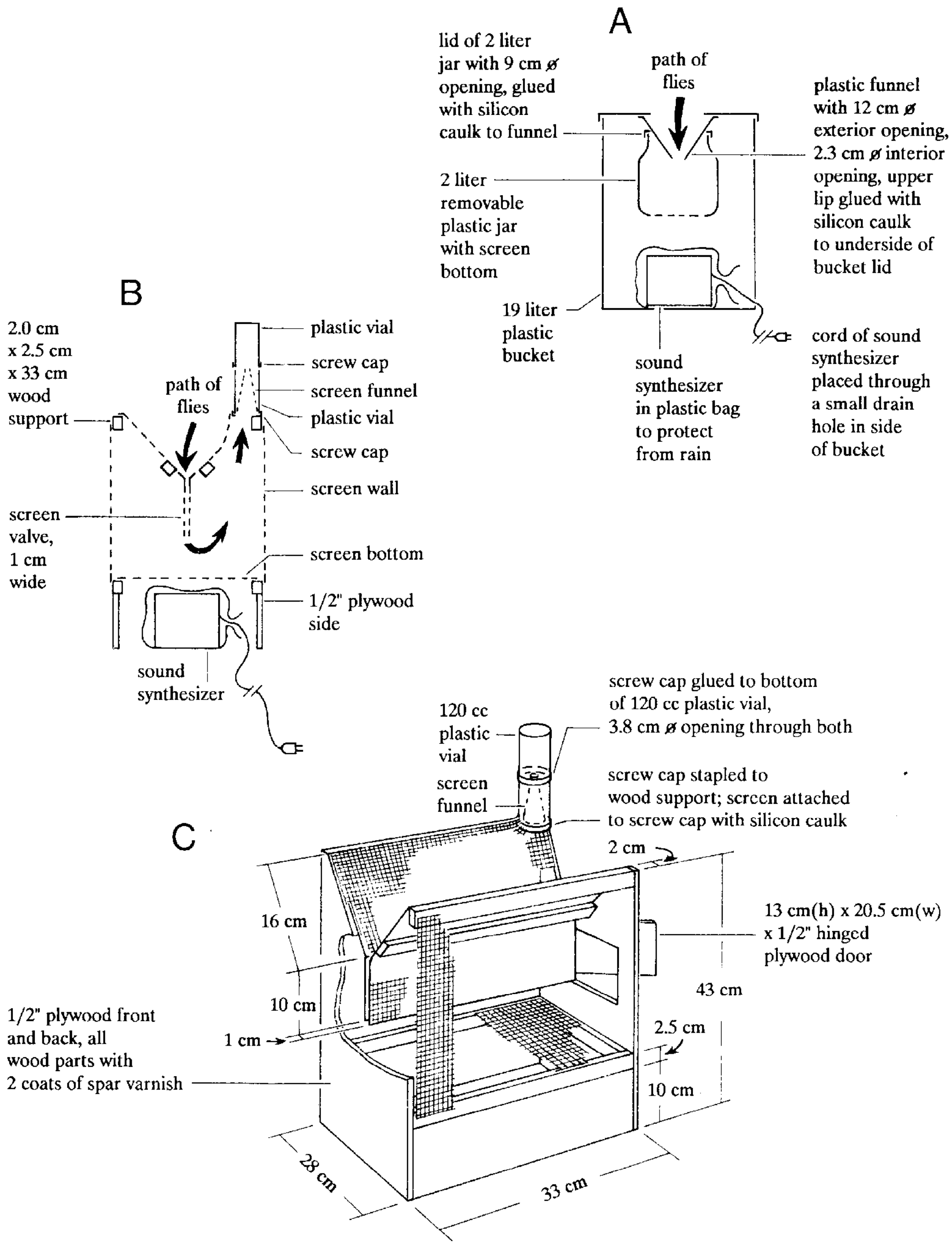

Fig. 1. Construction details of live traps. A. Cross-section through bucket trap . B. Cross-section through slit trap. C. Perspective view of slit trap. (For a photo of slit trap, see Walker 1988.)

consisted of screen and muslin funnels leading into holding cages. Fowler (1988) reported that his best funnel trap, a complex arrangement of five muslin funnels, caught only a third as many *depleta* as a sticky trap.

My version of a funnel trap, the *bucket trap*, was simple to construct and service. Unfortunately it caught few *E. ochracea* at a time of year when they were abundant.

My next trap, the *slit trap*, was intended to exploit the tendency of gravid females to land on vertical surfaces near an attracting sound and run straight down—which I had observed while using a thin vertical shaft to set the distance of a sound level meter from a sound source.

Trap construction. The bucket trap consisted of a 19-liter plastic bucket with a sound synthesizer (Walker 1982) at bottom and a two-liter, screen-bottomed, plastic collecting jar at top. Flies entered the collecting jar through a plastic funnel 10 cm dia above and 2.3 cm dia below (Fig. 1A).

The slit trap had two screen inclines that led to a valve 30 cm long made of two vertical, parallel pieces of aluminum screening ca. 1 cm apart (Fig. 1B-C). The valve gave access to a screen cage 33 x 28 x 30 cm. Flies that entered the cage eventually went through a small screen funnel into a plastic collecting tube that could be replaced with an empty tube when the trap was serviced. Construction details are in Fig. 1B-C.

Tests of traps. Two trapping stations 30 meters apart were established in woods near Gainesville, Florida, where *E. ochracea* was abundant. Each evening for nine nights a slit trap was operated at one station and a bucket trap at the other. Each trap was baited with a microprocessor-based sound synthesizer programmed to produce 50 pulses per second of a 4.8 KHz carrier frequency (= synthetic *Gryllus rubens* call of Walker 1986). Sound level was set at 100 dB, as measured 15 cm above the entrance to the trap with a Bruel & Kjaer model 2219 sound level meter. A clock turned the synthesizers on at sunset and off at sunrise. The traps were swapped between stations every third night. The slit trap outperformed the bucket trap every night. A Wilcoxon paired sample test rejected the hypothesis that the traps were equal ($P = 0.02$). Two nights were excluded from the analysis because the lack of flies in the bucket trap could be attributed to tree frogs the trap had captured. Total flies caught during the nine nights was 206 for the slit trap and 11 for the bucket trap (excluding the two tree-frog nights, when the traps caught 134 and 10 flies).

The efficiency of the slit trap was compared to that of a sticky trap in tests at the same two stations, 15-24 Oct 1987. The sticky trap was made by smearing Tack Trap on the top and the upper 1 cm of the sides of the rainproof plastic bag that enclosed the sound synthesizer. The sound level of the synthetic *rubens* call was set at 106 dB at 15 cm above each synthesizer. Traps were swapped the first night and every second night thereafter (two nights were disregarded because fewer than three flies were caught). During the course of the tests, each trap operated at each site for four nights. The total catch for the sticky trap was 97, for the standard trap 103. The sticky trap out-performed the slit trap four of the eight nights, and one night was a tie.

Discussion. The poor performance of the bucket trap may have been due to the acoustics of the bucket rather than the funnel valve. However, Fowler (1988) had poor results relative to sticky traps even when he used a trap with good acoustics and multiple funnels.

The approximate equivalence of catches between the sticky and slit trap was a surprise, because flies were observed landing on the slit trap and not entering. Removal of flies from the sticky trap by birds was apparently not a problem, because flies left on it for several days remained intact.

A slit trap operated briefly in Brazil caught some *E. depleta*, but its efficacy for that species, compared to a sticky trap, has not been tested (J. H. Frank, personal communication). The behavior of *depleta* attracted to sound may be substantially different from that of *ochracea*. Fowler (1987) timed 20 *depleta* females, and all left the sound source 3 sec or less after arrival. On the other hand, in field tests of phonotaxis in *ochracea*, most females stayed at the sound source for at least several minutes (Walker, unpublished). When Fowler and I watched *depleta* and *ochracea*, respectively, at the traps we were testing, their behaviors seemed more similar. Fowler (1988) reported "Field

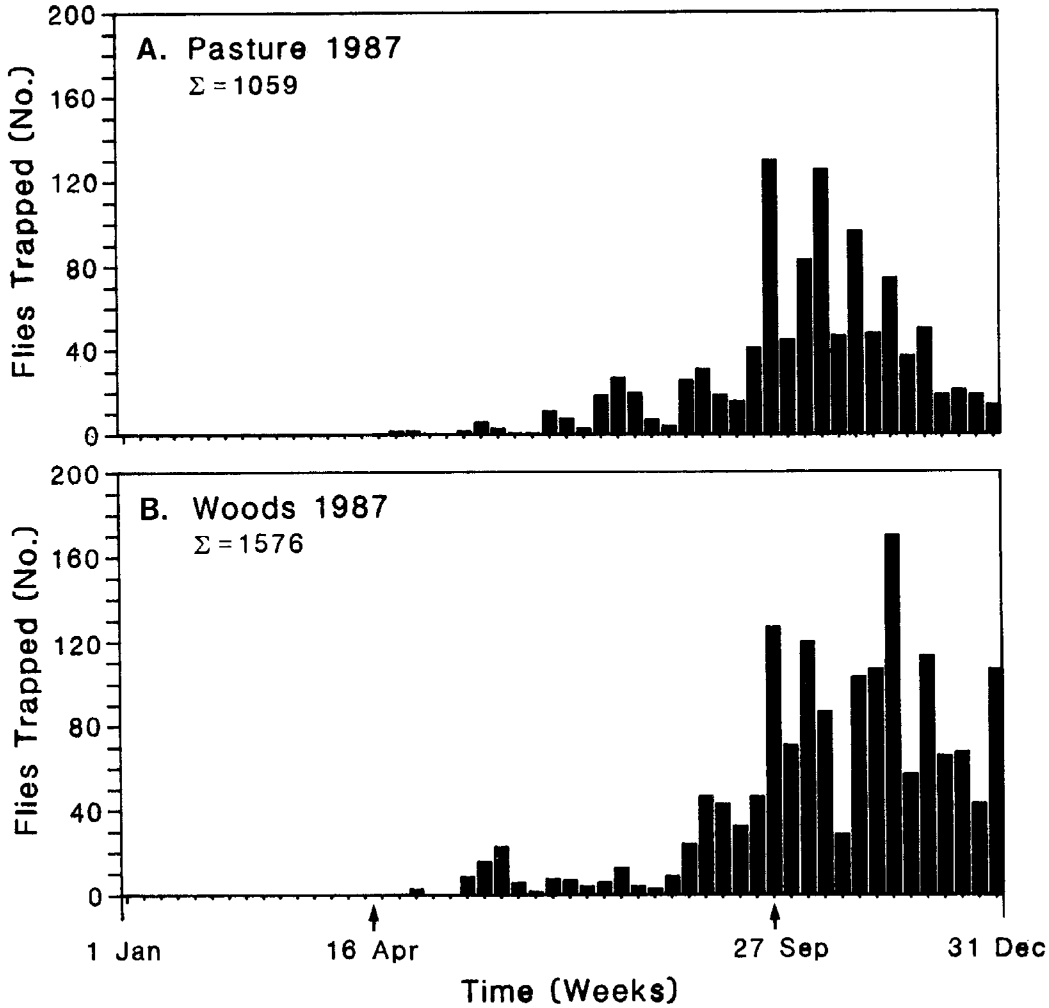

Fig. 2. Weekly numbers of *E. ochracea* caught in slit traps west of Gainesville, Florida, 1987. A. Trap at pasture station. B. Trap at woods station.

observations indicated that flies alighted on the muslin and walked extensively over the trap's external surface until they were channeled into its interior through the funnels.".

Seasonal Abundance of *E. ochracea*

Methods. To test trap durability and to collect data on seasonal abundance of *E. ochracea*, two slit traps were operated for all of 1987 in an area west of Gainesville (township R19E T9S, nw 1/4 of section 31). One trap was in a 5 ha pasture surrounded by woods (Walker 1986) and the other was ca. 380 m away and 200 m into the woods. Sound and sound level were the same as in the tests with a sticky trap. The two traps were serviced daily, and captured flies were permanently removed from the area.

Results. The first fly caught at the pasture trap was 22 April; at the woods trap, 26 April. The numbers gradually increased until late September and remained high during October and November (Fig. 2). Total catch for the pasture trap was 1059; for the woods, 1576. At both stations five cycles of increase and decline in numbers trapped

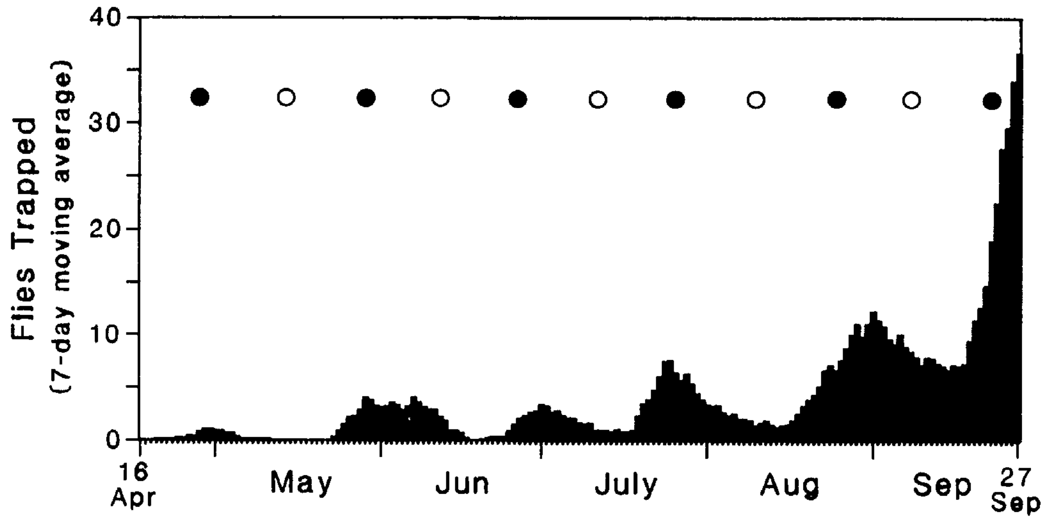

Fig. 3. Seven-day moving average of daily totals of trapped *E. ochracea*, 16 Apr to 27 Sep 1987 (period indicated by arrows in Fig. 2) [y_i = (sum of catches for days i-3,i-2, i-1,i,i+1,i+2,i+3)/7]. Phase of moon is indicated by black dots (new moon) and circles (full moon).

occurred between April and late September. These cycles, partly obscured when data were grouped by week, were evident in the daily data from each trap. To reveal the modes of the peaks, summed daily catches were smoothed with a 7-day moving average (Fig. 3).

Discussion. The traps worked well with no repair or maintenance for more than a year but were in need of revarnishing after 15 months of service.

Modal dates for successive periods of abundance (Fig. 3) were 28 Apr, 28 May/6 June, 30 June, 24 July, 31 Aug, 28 Sep, making peak-to-peak periods of 35, 28, 24, 38, and 28 days. The mean period was 30.6 days. Since the lunar month is 29.5 days, a possible explanation of the cycles is that trap catch depends significantly on phase of the moon. The peaks of abundance came, on average, 4 days after the new moon (range = 1 to 7 days), but why more flies should be caught at a sound-baited trap near new moon than near full moon is not evident. A second possible explanation is that the peaks represent successive synchronous generations of flies. The period of a generation—27 to 32 days from planidia to first planidia in a laboratory colony at 25° C (Wineriter & Walker, unpublished)—is compatible with this explanation but because females deposit planidia for several weeks, synchrony of generations is not expected. Periods of cold weather after mid-September confounded any other periodism of the trapping data.

E. ochracea was trapped during all of 1983 at the pasture site (Walker 1986) and during all of 1988 at the wood site (Walker, unpublished). In both instances most flies were captured during September to December. So few flies were captured during April to August that the data could not show the sort of conspicuous cycles evident in the 1987 data.

ENDNOTE

I thank J. H. Frank, J. P. Parkman, and S. A. Wineriter for review of this manuscript. S. A. Wineriter drew Fig. 1. This research was supported in part by USDA/ CSRS Tropical and Subtropical Agriculture funds (83-CRSR-2-2162). Florida Agric. Exp. Stn. Journal Series No. 9404.

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DISCRIMINATION BY *DACUS DORSALIS* FEMALES (DIPTERA: TEPHRITIDAE) AGAINST LARVAL-INFESTED FRUIT

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ABSTRACT

In laboratory assays of *Dacus dorsalis* Hendel populations that had been cultured on host fruit in the laboratory for one generation, we found that ovipositing females discriminated strongly against kumquat fruit infested by young conspecific larvae or young larvae of *Ceratitis capitata* (Wiedemann) but not against uninfested kumquat fruit whose surface was treated with fly-deposited substances such as kumquat juice, feces, or host marking pheromone. Discrimination against larval-infested fruit could allow *D. dorsalis* to avoid possible detrimental effects of intraspecific as well as intergeneric competition among larvae for limited host fruit resources.