

ATTRACTION OF MEXICAN FRUIT FLIES (DIPTERA:
TEPHRITIDAE) TO LURES EMITTING HOST-FRUIT
VOLATILES IN A CITRUS ORCHARD

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Better lures for the Mexican fruit fly are needed because existing lures are cumbersome to use and last less than two weeks in traps. Robacker et al. (1992) developed an attractant (CEHO) for the Mexican fruit fly (*Anastrepha ludens* Loew) containing four components of volatiles from fruit of chapote amarillo (*Sargentia greggii* S. Wats.), a natural host of the fly. The attractant was more attractive than *Torula* yeast in McPhail traps during flight-chamber tests.

The purpose of this paper is to report evaluation of a novel formulation of CEHO as an attractant for the Mexican fruit fly in a citrus orchard. Lures were prepared using a membrane-based formulation described previously for synthetic pheromone of *Toxotrypana curvicauda* (Gerstaecker) (Heath et al. 1996). CEHO chemicals (1,8-cineole, ethyl hexanoate, hexanol, and ethyl octanoate, all >98% pure) were obtained from Aldrich Chemical Company (Milwaukee, WI). Two loadings of the chemicals were prepared. Loading "A" contained 25 μ l and "B" contained 100 μ l of a 10:1:1:10 mixture of CEHO chemicals in the sequence listed above.

Tests were conducted in a citrus orchard in Weslaco, Texas. Laboratory culture Mexican fruit flies (origination Morelos, Mexico, 1953) were used. Flies were irradiated with 70-85 Gy (¹³⁷Cs source) 1-2 days before adult eclosion. Two thousand 2-13 day old flies (sex ratio approximately 1:1) were released evenly throughout the orchard twice each week. Flies were fed sugar and water until release. Ten linear blocks of four trees each were selected in the orchard. Six blocks contained Meyer lemon and four blocks contained naval orange trees. Baits were tested in McPhail traps (Baker et al. 1944) that were hung one to a tree. Each block contained 3-4 traps: 1-2 CEHO treatments; a water blank; and a standard *Torula* yeast trap. *Torula* yeast traps contained three *Torula* yeast/borax pellets (Sit-Khem Corp., Michigan City, IN) in 300 ml of water. CEHO lures were suspended in the entrance holes on the undersides of traps. CEHO traps, and water blanks, contained 300 ml of amber-colored water prepared from red, yellow and green McCormick food colors (McCormick & Co., Inc., Baltimore, MD) to mimic the color of *Torula* yeast. The water also contained 0.01% Triton (Rohm and Haas Co., Philadelphia, PA) as a wetting agent. Traps were washed and flies were counted each week for four weeks. Positions of treatments within blocks were randomized for the first week, then moved sequentially within each block each week. *Torula* yeast and amber-colored water were replaced each week. CEHO lures were reused each week for four weeks.

Three experiments were conducted. Experiment 1 treatments were: CEHO (A); CEHO (B); *Torula* yeast; and water. Each lure type was replicated 80 times (10 blocks \times 4 weeks for each of 2 sets of lures) from April 22 to June 16, 1994. The orchard contained scattered mature fruit and only a little new fruit at the beginning of the experiment, and nearly full grown immature fruit by the end. Experiment 2 treatments

TABLE 1. PERCENTAGE CAPTURES OF MEXICAN FRUIT FLIES IN MCPHAIL TRAPS CONTAINING WATER, CEHO LURES OR TORTULA YEAST¹.

	Exp. 1: Spring			Exp. 2: Summer			Exp. 3: Autumn		
	M	F	Total	M	F	Total	M	F	Total
Water	0.6 a	0.5 a	0.5 a	1.7 a	1.4 a	1.4 a	1.1 a	1.4 a	1.3 a
CEHO(A)	24.8 b	23.8 b	23.9 b						
CEHO(B)	29.0 b	26.6 b	27.3 b	18.3 b	17.9 b	18.0 b	25.3 b	23.8 b	24.4 b
CEHO(BB)				16.0 b	18.3 b	18.2 b			
Torula	45.7 c	49.1 c	48.3 c	64.0 c	62.4 c	62.5 c	73.6 c	74.8 c	74.3 c

¹Mean percentage captures in the same column followed by the same letter are not significantly different at the 5% level (Fisher's Protected Least Significant Difference test). Mean flies captured per trap per week (summed over sex and treatment): Spring 17.4, n=316; Summer 8.5, n=320; Autumn 59.6, n=160.

were: CEHO (B); CEHO (BB), i.e. two CEHO (B) lures in the same trap; Torula yeast; and water. Treatments were replicated 80 times, as described above, from June 17 to August 18, 1994. Fruit were large but remained green throughout the period. Experiment 3 treatments were: CEHO (B); Torula yeast; and water. Treatments were replicated 40 times (10 blocks \times 4 weeks \times 1 set of lures) from October 28 to November 24, 1994. Trees were laden with large, nearly mature, aromatic fruit.

Captures in each trap were transformed to arcsin of the square root of proportions captured in each block per week for statistical analyses. Data from each experiment were analyzed by analysis of variance (ANOVA) separating out effects of treatment and treatment by week interactions. Subsets of data were subjected to regression of captures on lure age for each CEHO lure treatment. Analyses were conducted using SuperANOVA (Abacus Concepts 1989).

Captures in traps baited with CEHO (A, B, or BB) were significantly greater than captures in traps with water and significantly less than captures in traps with Torula yeast for males, females, and total flies (males+females) in each experiment (Table 1). All nine ANOVA's (males, females, total flies, for three experiments) had significant F statistics (smallest $F=131.2$; $df=3,300$; $p<0.0001$ for males in Experiment 1). Captures in traps baited with different dosages of CEHO were not significantly different from each other in any experiment. Treatment by week interactions were not significant indicating that attractiveness of CEHO lures relative to Torula yeast did not change as lures aged. Also, linear regression demonstrated that attractiveness of CEHO lures did not change significantly as they aged (Fig. 1). Visual inspection of Table 1 suggests CEHO lures were most attractive in spring when they captured about 50% as many flies as Torula yeast, while capturing 25-33% as many during summer and autumn. Statistical analyses were not conducted because season was unreplicated. Captures of males and females were about the same for all treatments during the three experiments (water, 54% females; Torula yeast, 53% females; all CEHO lures, 51% females).

Our data show that this novel formulation of CEHO is highly attractive (compared with blank traps) for four weeks under hot orchard conditions in southern Texas. The durability of the CEHO lures gives them an advantage over Torula yeast. However, the CEHO lures were less attractive than Torula yeast, greatly diminishing their potential value as commercial lures. The possibility of developing an improved attractant for Mexican fruit fly by combining CEHO with other attractants needs to be investigated.

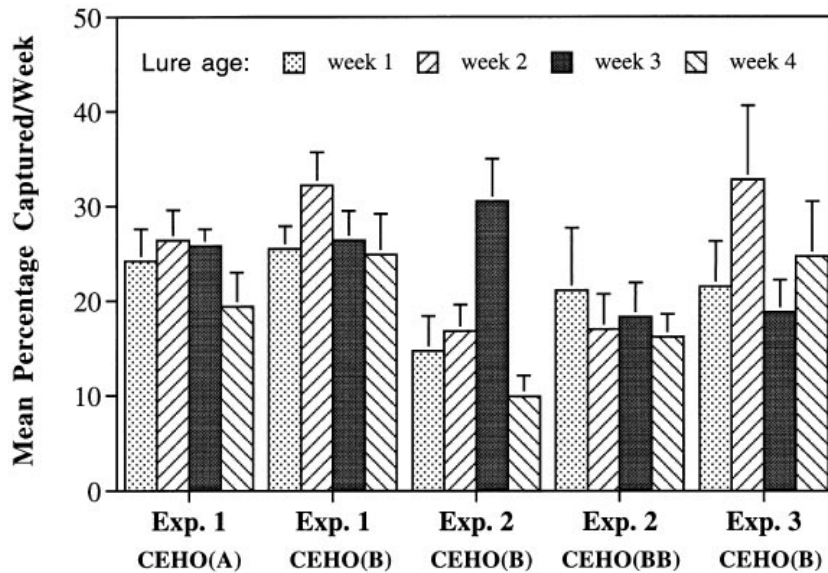


Fig. 1. Attraction (mean percentage captures \pm SE) of Mexican fruit flies to traps baited with CEHO lures of different ages.

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SUMMARY

Lures containing CEHO, a synthetic attractant emitting four components of host-fruit volatiles, were evaluated for attractiveness to *Anastrepha ludens* in a citrus orchard. CEHO lures were at least 12 times more attractive than water, but only about 29-56% as attractive as Torula yeast in three experiments. CEHO attracted male and female flies equally. Lure age (up to one month) did not affect attractiveness.

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