Mixing Male Lures Results in an Effective Multispecies Bait for Trapping Bactrocera (Diptera: Tephritidae) Fruit Flies

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Mixing male lures results in an effective multispecies bait for trapping Bactrocera (Diptera: Tephritidae) fruit flies

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The genus Bactrocera Macquart (Diptera: Tephritidae) contains invasive, polyphagous species that threaten fruit and vegetable production worldwide, and many countries maintain continuous surveillance programs to detect and monitor these pests (e.g., Jessup et al. 2007). These programs rely heavily on traps baited with male-specific lures, namely, methyl eugenol (ME, a natural plant product) and cue lure (CL, a synthetic compound), which attract several species within the genus (Jang & Light 1996). These lures are presented in separate traps, and it has long been recognized that traps baited with a blend of these liquid lures would greatly reduce costs of trap materials and servicing. Unfortunately, ME-CL mixtures generally show reduced performance relative to single-lure treatments. For example, Vargas et al. (2000) reported that traps baited with an ME-CL mixture captured similar numbers of the CL-responding species Bactrocera cucurbitae (Coquillett) as traps baited with CL alone but significantly fewer individuals of the ME-responding species Bactrocera dorsalis (Hendel) than traps baited with ME alone.

Recently, a solid dispenser or wafer (Farma Tech International, North Bend, Washington) containing ME and raspberry ketone (RK, a natural analogue of CL) has been found to perform as well as standard, single-lure presentations (Shelly 2010; Vargas et al. 2010). Given this result, the present study was undertaken to compare captures of B. cucurbitae and B. dorsalis male flies in traps baited with ME-RK mixtures versus traps baited with the single lures.

We assessed the attractiveness of 3 ME-RK mixtures that varied in the relative amounts of ME (a liquid) and RK (a powder). By weight, the 3 mixtures contained ME and RK in proportions of 85:15, 90:10, and 95:5. A toxicant (naled, a liquid) was then added to each mixture (5% by volume). Solutions were stirred thoroughly, and aliquots of 5 mL containing ME alone. Lure type had no detectable effect in tests with the 85:15 (F<sub>1,140</sub> = 0.1; P = 0.73). No significant ME-RK mixture. Week had a significant effect in comparisons involving 90:10 (F<sub>4,140</sub> = 20.1; P < 0.001) and 95:5 (F<sub>4,140</sub> = 22.5; P < 0.001) ME-RK blends but not the 85:15 mixture (F<sub>4,140</sub> = 1.6; P = 0.17). Where significant, temporal variation in male fly captures appeared to reflect not monotonic decreases in trap catch (resulting, for example, from a decrease of lure attractiveness), but natural fluctuations in population size. The lure type × week interaction term was not significant in any of the tests (P > 0.05 in all 3 cases).

For B. dorsalis (Fig. 1), lure type had a significant effect only for the comparison involving the 90:10 mixture (F<sub>1,140</sub> = 20.1; P < 0.001), where traps containing the ME-RK blend captured more male flies than traps containing ME alone. Lure type had no detectable effect in tests with the 85:15 (F<sub>1,140</sub> = 0.1; P = 0.73) or 95:5 (F<sub>1,140</sub> = 3.3; P = 0.07) ME-RK mixture. Week had a significant effect in comparisons involving 90:10 (F<sub>4,140</sub> = 20.1; P < 0.001) and 95:5 (F<sub>4,140</sub> = 22.5; P < 0.001) ME-RK blends but not the 85:15 mixture (F<sub>4,140</sub> = 1.6; P = 0.17). Where significant, temporal variation in male fly captures appeared to reflect not monotonic decreases in trap catch (resulting, for example, from a decrease of lure attractiveness), but natural fluctuations in population size. The lure type × week interaction term was not significant in any of the tests (P > 0.05 in all 3 cases).

For B. cucurbitae (Fig. 2), lure type did not have a significant effect in any of the comparisons (85:15 blend: F<sub>1,140</sub> = 0.7; P = 0.42; 90:10 blend: F<sub>1,140</sub> = 0.1; P = 0.99; 95:5 blend: F<sub>1,140</sub> = 2.5; P = 0.12). Week had a significant effect only in the comparison involving the 95:5 mixture (F<sub>4,140</sub> = 21.1; P < 0.001) but not the 85:15 (F<sub>4,140</sub> = 0.2; P = 0.95) or 90:10 blend (F<sub>4,140</sub> = 1.9; P = 0.11). In the test involving the 95:5 ME-RK mixture, male fly captures showed a consistent decrease over time, but whether this trend reflected decreased lure attractiveness or natural population dynamics is unknown. The lure type × week interaction term was not significant in any of the tests (P > 0.05 in all cases).

Whereas previous studies (Vargas et al. 2000; Shelly et al. 2004) showed that liquid ME-CL mixtures attracted fewer B. dorsalis male flies than liquid ME alone, the present data revealed no inhibitory effect of liquid ME—granular RK solutions on B. dorsalis male fly captures, a result consistent with field trials involving solid dispensers (wafers) containing ME and RK in a single matrix (Shelly 2010; Vargas et al. 2010). Why ME mixtures containing RK, but not CL, effectively attract B. dorsalis male flies is unknown, but the present results suggest the ME-RK solution is an effective multispecies lure that could greatly reduce costs of tephritid trapping programs.
Detection of *Bactrocera* Macquart (Diptera: Tephritidae) fruit flies relies on male-specific lures, methyl eugenol and cue lure, which are presented singly in traps. We compared the efficacy of the standard single-lure treatments against mixtures of methyl eugenol and raspberry ketone (a natural analogue of cue lure) deployed in the same.

**Summary**

Detection of *Bactrocera* Macquart (Diptera: Tephritidae) fruit flies relies on male-specific lures, methyl eugenol and cue lure, which are presented singly in traps. We compared the efficacy of the standard single-lure treatments against mixtures of methyl eugenol and raspberry ketone (a natural analogue of cue lure) deployed in the same.
No significant differences were found in captures of *Bactrocera cucurbitae* (Coquillett) or *B. dorsalis* (Hendel) male flies over 8 wk intervals between traps baited with a single lure and traps baited with any of the 3 mixtures tested.

Key Words: trapping; detection; semiochemical; invasive species

**Sumario**

La detección de moscas de la fruta *Bactrocera* (Diptera: Tephritidae) depende de los señuelos específicos para los machos, metil eugenol y el señuelo de referencia, que se presenta individualmente en las trampas. Se comparó la eficacia de los tratamientos estándar de un solo señuelo contra mezclas de metil eugenol y la cetona de frambuesa (un análogo natural del señuelo de referencia) puesto en la misma trampa. No se encontraron diferencias significativas en las capturas de machos de *Bactrocera cucurbitae* (Coquillett) o *B. dorsalis* (Hendel) por los intervalos de 8 semanas entre las trampas cebadas con un único señuelo y trampas cebadas con cualquiera de las 3 mezclas probadas.

Palabras Clave: atrapando; detección; semioquímicos; especies invasivas

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