Lures and Traps


Cucurbitacin E glycoside, extracted from a bitter mutant of Hawkesbury watermelon [Citrullus lanatus (Thunb.) Matsum. & Nakai (Syn. Citrullus vulgaris Schrad)] is the active ingredient of a feeding stimulant for the corn rootworm complex. It is the primary component of a water-soluble bait that can be combined with toxins for adult diabroticite control. Studies were conducted using phloxine B (D&C Red 28), a xanthene dye, as the toxin. This dye was efficacious against Diabrotica undecimpunctata howardi Barber, spotted cucumber beetle, and Acalymma vittatum (F.), striped cucumber beetle, in cucumber plots and could be recovered from cucumber leaves for 8 d after treatment. The average amount of dye recovered per dead spotted cucumber beetle at 8 d after treatment was 0.173 microgram. Concentrated and sugar-free fermented forms of the watermelon extract were developed and compared with the fresh juice in field applications on cucumber plants. There was no significant difference in mortality of beetles from phloxine B-bait prepared with fresh, fermented, or concentrated extract, although in laboratory studies, fermented juice had higher feeding stimulant activity.


A Malaise trap is a passive flight intercept trap relying on instinctive insect behavior; strong-flying insects like dipterans and hymenopterans attempt to escape the trap by flying upwards towards light and are collected at the apex of the trap. The objective of this study was to design an easy Malaise-type trap. This modified Malaise-type trap design might be useful for insect monitoring in field experiments due to its simple construction. Advantages of this design include: (1) readily available, sturdy materials for construction including wood, PVC pipe, plastic milk jugs, staples, duct tape, and spunbonded polyester netting that all last for a season with minimal repair; (2) low cost of materials; (3) ease of transportation, installation, and removal from the field provided by compact, light weight, folding tripods; (4) durable installation in the field because tripod legs can be set firmly in the ground and excess netting covered with soil; (5) simple insect collection provided by a plastic milk jug placed at the apex of the trap and an easy-to-handle killing agent using a wide-spectrum insecticide that lasts for 3 months.

Field studies were conducted in 12 locations in southeastern Virginia to evaluate 3 trap attractants, 1,2,4-trimethoxybenzene, indole and trans-cinnamaldehyde (TIC), trans-cinnamaldehyde, alone, and sex pheromone (10-methyl-2-tridecanone), for monitoring adult southern corn rootworm, *Diabrotica undecimpunctata howardi* Barber, phenology in peanut, *Arachis hypogaea* L.; and to determine the relationship of trap catch to peanut pod damage as it occurred throughout the season. Pheromone traps caught more beetles than TIC or cinnamaldehyde on most sample dates and at most locations. Pheromone traps detected 2 distinct beetle peaks, the 1st between 16 and 23 June, and the 2nd between 21 and 28 July, and consistently caught more males than females. TIC and cinnamaldehyde traps caught more females in 14 out of 180 observations (15 sample dates, 12 locations) and failed to detect the 2nd beetle peak. Peanut pod damage began to increase in all locations at the end of July. Total pod damage (immature plus mature pods) exceeded 40% in all but one location. Peak damage occurred at all but 1 location on approximately 11 August. Peak pod damage by southern corn rootworm larvae consistently lagged behind the 2nd peak in the beetle population by 2.1 +/- 0.5 (+/- SEM) wk. Number of beetles trapped accounted for only 10% of the variance observed in peak pod damage. Use of pheromone traps by growers could allow for a more precise timing of insecticide applications and improve management of southern corn rootworm in peanut.


Sticky traps with and without the attractant TIC (1,2,4-trimethoxybenzene, indole, and trans-cinnamaldehyde) were evaluated in cucurbits for capture of striped cucumber beetle, *Acalymma vittatum* (F.), spotted cucumber beetle, *Diabrotica undecimpunctata howardi* Barber, western corn rootworm, *Diabrotica virgifera virgifera* LeConte, and northern corn rootworm, *D. barberi* Smith & Lawrence, in New York and western striped cucumber beetle, *Acalymma trivittatum* (Mannerheim), and western spotted cucumber beetle, *Diabrotica undecimpunctata undecimpunctata* Mannerheim, in California. Traps with TIC lures captured more beetles than unbaited traps for all species except for western spotted cucumber beetle in 1 of 2 California trials. Yellow traps captured more striped cucumber beetle and western spotted cucumber beetle than did white traps but did not increase capture of spotted cucumber beetle or western striped cucumber beetle. The response of the western corn rootworm and northern corn rootworm to TIC varied by time of day, the greatest response occurring around midday. Increases in TIC per trap resulted in increases in capture of western spotted cucumber beetle, western striped cucumber beetle, western corn rootworm, and striped cucumber beetle, but not for northern corn rootworm or spotted cucumber beetle. For cucurbits with short plant canopies, traps were most effective when placed close to the ground. In pumpkins with taller canopies, traps at canopy and midcanopy height captured the most beetles. The effect of trap height varied by time of day for spotted cucumber beetle, western corn rootworm, and northern corn rootworm, and the pattern varied for the species. Sex ratio
of captured beetles varied among species and time of day. Overall, western corn rootworm and northern corn rootworm were captured in greatest numbers during the middle of the day whereas the greatest captures of striped cucumber beetle occurred between 1800 and 0600 hours EST. Significantly greater numbers of striped cucumber beetle, western corn rootworm, and northern corn rootworm were captured on the downwind side of traps. Traps replaced 2 times per day had greater captures than traps replaced 1 time per day or 1 time every 2 days.


Field trials to test the efficacy of insecticidal semiochemical baits for management of the southern corn rootworm, Diabrotica undecimpunctata howardi Barber, in peanuts were conducted in 1992, 1993, and 1994 in North Carolina and Virginia. The baits contained a mixture of cucurbitacins as a feeding arrestant, volatile feeding attractants (1,2,4-trimethoxybenzene, indole, and trans-cinnamaldehyde), and carbaryl as a toxicant. Results were similar in both North Carolina and Virginia. In 1992 and 1993, there were no statistically significant differences in in-shell yield because of treatment. Numerically highest yields were always obtained in the chlorpyrifos-treated plots; numerically lowest yields occurred in the semiochemical bait-treated plots in 1993 and 1994. In 1994, in-shell yield was significantly higher in the chlorpyrifos-treated than in granular semiochemical bait-treated peanuts. Percentage of undamaged pods was highest in chlorpyrifos-treated and lowest in bait-treated peanuts. Possible reasons for lack of efficacy of baits as applied are discussed relative to the biology of southern corn rootworm in peanuts.


The effect of the addition of volatile chemicals to water traps was examined for adult thrips species in New Zealand and the Netherlands. The chemicals ethyl nicotinate (3-pyridinecarboxylic acid), p-anisaldehyde (4-methoxybenzaldehyde), and benzaldehyde (benzoic aldehyde) increased trap capture (up to 35 times) for a number of flower-inhabiting thripid adults. Ethyl nicotinate increased trap capture of the New Zealand flower thrips, Thrips obscuratus (Crawford), by > 100 times. The addition of ethyl nicotinate to water traps for early-season monitoring of T. obscuratus in a nectarine orchard significantly increased capture of adult male and female thrips (up to 27 times), and on several occasions thrips were caught in traps with ethyl nicotinate before traps without ethyl nicotinate. The addition of p-anisaldehyde to sticky boards for control trapping of the western flower thrips, Frankliniella occidentalis (Pergande), in glasshouses increased capture of adult females between 1.8 and 6 times. Behavioral
responses for thrips host-finding are discussed with emphasis on the use of volatile chemicals for thrips pest management.


A field of maize in Texas was used to evaluate responses of Mexican corn rootworm beetles, *Diabrotica virgifera zeae* Krysan and Smith, to ten volatiles or blends of volatiles that are known attractants of other Diabrotica beetles. Traps baited with 100 mg of any of the attractants captured significantly more male and female *D. v. zeae* than did unbaited traps, but the increase in capture was greater for female beetles than for males. Traps baited with a 1:1:1 mixture of trimethoxybenzene, indole and cinnamaldehyde ("TIC") captured the greatest number of females (a 50-fold increase over capture on unbaited traps) but did not capture significantly more beetles than traps baited with a 1:1:1 mixture of veratrole, indole and phenylacetaldehyde ("VIP") or with indole alone. When this test was duplicated in South Dakota where the subspecies present is *D. v. virgifera* responses of females to the attractants were generally similar to those of female *D. v. zeae*, although relatively more *D. v. virgifera* females were captured in traps baited with 4-methoxycinnamaldehyde. Male *D. v. virgifera* were less responsive to the volatiles than were females, but relative responses of male *D. v. virgifera* to the various volatiles differed from those of male *D. v. zeae*. In a third study, *D. v. zeae* showed little dose-response to four levels (0.1-100 mg) of 4-methoxycinnamaldehyde, although traps baited with 100 mg captured significantly more females than did traps baited with lesser amounts. The availability of non-pheromonal attractants for *D. v. zeae* may prove useful to programs for managing populations of this pest species.


A series of tests done in commercial and research apple (*Malus domestica* Borkh.) orchards during 1986-1988 evaluated different trap designs and treatment thresholds for apple maggot, *Rhagoletis pomonella* (Walsh). No difference in catch efficiency in unsprayed trees was observed among Ladd yellow-panel-plus-red-hemisphere traps, red wooden-sphere traps, and Olson sphere traps covered with standard, brushable, or diluted adhesive mixtures. Of 10 trap designs that we tested in 20 commercial orchards, all sphere traps baited with synthetic apple volatiles were more effective at catching apple maggot adults than were unbaited sphere traps, which caught more adults than did yellow-panel traps. In a test using the baited traps to time control sprays in commercial orchards, we achieved acceptable levels of control with a catch action threshold of eight adults per trap. With this threshold, 70% fewer sprays (2.8 fewer applications) were applied than in a calendar-based program. Trials in 16 blocks scouts by growers with baited traps and a threshold of five adults per trap for timing sprays resulted in 0.6 fewer
applications and no difference in fruit infestation levels, compared with blocks sprayed
according to the growers' conventional schedules. Despite the use of a threshold of five
adults per trap, which was chosen to be more conservative than that in the research trials,
growers did not always follow the recommended treatment guidelines. The use of this
trapping system has been incorporated into current commercial pesticide
recommendations for New York apple growers.

Southern and Western Corn Rootworms (Coleoptera: Chrysomelidae: Diabrotica
The attraction of Diabrotica spp. (Coleoptera: Chrysomelidae) to single-component and
multicomponent lures was evaluated in corn fields by comparing the relative number of
beetles caught on sticky traps over a 24-h period. Initial tests in 1985 showed that a
mixture of veratrole (V), indole (I), phenylacetaldehyde (P), trans-anethole (A), and
eugenol (E) (=VIPAE mixture) caught 26 times more Diabrotica undecimpunctata
howardi Barber, southern corn rootworms (SCR), than untreated control traps and was at
least 3 times more active than any of the traps baited with a single component.
Significantly fewer D. virgifera virgifera LeConte, western corn rootworms (WCR), were
cought on the traps baited with VIPAE mixture than those baited with 100 mg of trans-
anethole. Furthermore, only SCR adults exhibited a concentration-dependent response to
the VIPAE mixture. SCR response to the sequential removal of the individual
components from the VIPAE mixture suggested the primary attractants to be veratrole,
indole, and phenylacetaldehyde. Additional tests showed traps baited with a three-
component VIP mixture (veratrole, indole, and phenylacetaldehyde at 20 mg per
component) caught ca. 8 times as many beetles as the expected mean additive response
with the individual components; therefore, the SCR response was synergistic. The
attraction and synergistic response of SCR adults to the VIP mixture was verified by
similar tests conducted in 1986. The VIP mixture was also compared with a chemically
related mixture consisting of 1,2,4-trimethoxybenzene (substituted for veratrole or ortho-
dimethoxybenzene), indole, and trans-cinnamaldehyde (substituted for
phenylacetaldehyde) (=TIC mixture) at dosages ranging from 1 to 30 mg per trap.
Although both mixtures exhibited approximately the same activity for SCR adults, only
the new TIC mixture attracted WCR adults. TIC baited traps caught ca. 6 times more
WCR adults than did untreated controls at 1 mg per trap and ca. 29 times more WCR
adults than controls at 30 mg per trap.

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1. This paper analyses catches of flower thrips, grass thrips and predatory flies in
water-traps of seven colours.
2. A correlation is demonstrated between type of host-plant of thrips and the relative
numbers caught by traps of different colours.
3. The literature is reviewed and some general relationships with the effectiveness of different trap colours are hypothesized for: non-grass foliage insects and their predators and parasites; grass foliage insects; flower dwelling insects; predators and parasites not associated with foliage; biting insects; and woodborers.

4. This may permit trap colours to be chosen, in particular circumstances, that are ecologically selective for different types of insect.


In field trapping studies in central Florida during the fall of 1981 and the spring, summer, and fall of 1982, more *Diaprepes abbreviatus* (L.) were captured with frass or frass extracts than with other treatments. Extracts of frass from male weevils in traps captured more males or females than extracts of frass from female weevils. Extracts of frass in methanol captured more weevils at high than at low concentration.


Border rows of snap beans planted prior to soybeans functioned to attract and hold emerging overwintering adult *Epilachna varivestis* Mulsant. Destruction of the trap crop generation of Mexican bean beetles resulted in protection of the adjacent soybean fields. Beetles were destroyed in the trap crop by disking, spray application of carbaryl, or release of *Pediobius foveolatus* (Crawford). Trap crops planted prior to lima beans failed to attract and hold the beetle. A .4-hectare trap crop will cost ca. $184.00 based on 1976 costs.


Data on responses of the striped cucumber beetle, *Acalymma vittatum* (F.); and the spotted cucumber beetle *Diabrotica undecimpunctata howardii* Barber, to lamp sources of electromagnetic radiation have been extracted from experiments conducted over a 15-year period in Lafayette, Ind. Trap collections using various lamps are indicated, with blacklight fluorescent lamps, green fluorescent lamps, and combinations of these showing greatest attraction. Influence of trap design and placement are also indicated. Omnidirectional designs, use of suction fans, and placement at 12-foot height all increased collections.