



POTENTIAL FOR THE USE OF MALE PHEROMONE COMPONENTS IN FEMALE TRAPPING: A PROGRESS REPORT

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Abstract

Experiments were conducted to determine if reducing the male population using TML traps and pheromone baited traps would enhance female Mediterranean fruit fly capture. Investigations were conducted in citrus plantations in Mallorca. In the first trial (0.36 ha, Son Coll Vey, Palma) Agrisense yellow delta traps were deployed on every third tree in adjacent rows. On each other tree, a TML bait was placed with an insecticide strip containing Dichlorvos. Thus, each of the delta traps was surrounded by a hexagon of TML + insecticide baited trees. The rationale of this experiment was to remove males from the vicinity of pheromone-baited traps and thereby increase the apparency of the female lure. Before the trial, male catches averaged 4.1 per day in TML traps. During the trial, this was reduced to approximately 0.6 males/trap/day. The traps with pheromone (pyrazines in various combinations and ratios) caught around 0.05 females/trap/day. The pheromone traps remained female selective, with a negligible male catch, similar to that in unbaited traps. The most likely cause for the very low female catch may be that insufficient males were removed by the lure and kill devices. In the second trial (0.67 ha, Inca, Mallorca) the proprietor had deployed 83 traps, baited with TML and insecticide, for 18 days prior to the placement of five treatments with six replicates. The delta traps were placed on every third tree, with replicates every third row. The female catch showed a progressive enhancement over a period of 6 weeks, reaching a level about six times that of males in TML traps.

The identification of a plethora of medfly pheromone components opened up exciting possibilities for the development of novel attractant mixtures. On the basis of laboratory tests, these appeared to be powerful tools, but the promise has not followed through to the field where their activity has not been confirmed and results are, at best, capricious.

Over a period of about ten years, trials were carried out based on mixtures containing linalool, one of the principal components of male-produced volatiles [1] together with alkyl pyrazines. A number of pyrazines were identified by Herbert [2] from glandular extracts of sexually mature male flies.

These trials were in mainland Spain [3], the Balearic Islands, Sardinia [4], Mexico [5], Brazil [4], and Morocco (Bakri, unpublished). One very positive result obtained in citrus in Andalusia proved unrepeatably. Other trials with these ingredients were disappointing, sometimes resulting in average catches that were lower than those in unbaited controls. As such, there is no value in reporting them in detail. However, trials in citrus orchards in Sardinia gave catches of females that were more than 50% of catches of males in TML traps, but only in the late season when population densities were high [4].

Field work carried out by Baker et al. [5] in Chiapas, Southern Mexico, produced low catches of medfly, but it was found that the male : female ratio changed with the season, fruit crop, and fruit phenology. Taken together with the evidence from Sardinia, the hypothesis was developed that calling wild flies in the crop could out-compete pheromone lures leading to low female catches.

An alternative hypothesis, that the female catch rate is determined by masking or synergism with host fruit volatiles has not been borne out by results of trials in peach, apricot, opuntia or chirimoya. Although interactions with host volatiles do undoubtedly occur [4], they may be subsidiary to other factors, including the distribution of calling males.

The former hypothesis was tested in Brazil by J.J. Knapp [4]. The male population in a coffee plantation was first reduced by spraying a slow-release lure and kill formulation (Polycore, AgrisenseBCS) containing TML. Yellow sticky pheromone-baited traps were then deployed in the central part of this area. High catches of female medfly were obtained, which exceeded (on a catch per trap basis) the numbers of males caught by TML traps in a neighbouring untreated area.

The influence of TML traps was further investigated in citrus plantations in Mallorca. In the first trial (0.36 ha, Son Coll Vey, Palma) Agrisense yellow delta traps were deployed (six replicates of eight treatments) one every third tree in adjacent rows. On each other tree, a TML bait was placed with an insecticide strip containing Dichlorvos. Thus, each of the delta traps was surrounded by a hexagon of TML + insecticide baited trees. The rationale of this experiment was to remove males from the vicinity of pheromone-baited traps and thereby increase the apparency of the female lure. In these trials, linalool was omitted from the attractant bait because of the difficulty of controlling release rates. Previous trials may have failed because of rapid loss of the more volatile components from lure substrates (R. Heath, personal communication).

Before the trial, male catches averaged 4.1 per day in TML traps. During the trial, this was reduced to approximately 0.6 males/trap/day. The traps with pheromone (pyrazines in various combinations and ratios) caught around 0.05 females/trap/day.

The pheromone traps remained female selective, with a negligible male catch, similar to that in unbaited traps. The most likely cause for the very low female catch may be that insufficient males were removed by the lure and kill devices.

In the second trial (0.67 ha, Inca, Mallorca) the proprietor had placed 83 traps out, baited with TML and insecticide, for 18 days prior to the placement of five treatments with six replicates. The delta traps were placed on every third tree, with replicates every third row. The female catch showed a progressive enhancement over a period of 6 weeks, reaching a level about six times that of males in TML traps. The results of these two trial are shown in Table I.

From comparison of the results above from Brazil and from the two Mallorcan orchards, it appears that reduction of the male population must occur before a female pheromone becomes attractive. If this conclusion is justified, it suggests that the presence of males may indeed interfere with response of females to alternative attractants. There is strong evidence that TML is a lekking parapheromone, inducing lek formation at a distance from the source [6]. The action of the TML sources around the treatments in the first Mallorcan trial may therefore have been to encourage lekking in the trees next to the treatments, which would then divert females from the artificial attractant sources.

TABLE I. MEDFLY CAPTURES IN CITRUS ORCHARD, MALLORCA, 1996

Trial Weeks 1-3			Trial Weeks 4-6		
	Male	Female		Male	Female
TML (N=6)	0.54	0.29	TML (N=6)	0.11	0.087
Blank(N=6)	0.00793	0.49	Blank (N=6)	0.00793	0.16
All Pheromone Treatments (N=18)	0.00794	0.6	All Pheromone Treatments (N=18)	0.00794	0.39
Best Pheromone Treatment (N=6)	0.00793	0.94	Best Pheromone Treatment (N=6)	0.016	0.63

Although most of the trials that have been conducted so far with pheromone-based attractants have yielded few female flies, the reasons for this are now becoming evident. If prior reduction of male populations is carried out with a suitable TML formulation, the prospects for mass-trapping of females using a pyrazine bait appear to be very promising.

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