SAND BED RELEASE OF STERILE QUEENSLAND FRUIT FLY (*BACTROCERA TRYONI* (FROGGATT)) AT YOUNG, NSW

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Summary

A new release method of sterile fruit flies using an artificial sand bed technique was tested. Pupae were placed in a sand bed in an orchard to simulate pupal emergence from soil. Fruit flies escaped successfully from the sand surface as adults without protection from predation. The emergence rate of pupae was 82.3% and the recapture rate of adults was 0.0404% on a 1 km trapping grid.

INTRODUCTION

The successful use of the sterile insect technique (SIT) for the Queensland fruit fly *Bactrocera tryoni* (Froggatt) in more remote rural areas will rely on the development of a release technique that requires minimal resources. The garbage bin technique used in South Australia (Jackman *et al.* 1996) uses resources such as an insectary and coolroom, which are not available in small rural towns. Dominiak *et al.* (1998) reported on trials using field cage releases, which were less reliant on dedicated insect rearing facilities. The use of sand covering pupae as a mass release method for flies was reported by Theunissen *et al.* (1975). This note describes a field trial to evaluate a technique that requires virtually no local infrastructure or resources.

METHODS AND RESULTS

Sterile pupae (800,000) were air freighted from the rearing facility at Camden to Young on 1 October 1996. Pupae were delivered to an orchard in an air-conditioned vehicle the following day. Twenty litres of river washed sand was spread in a circle one metre in diameter on the ground between two trees. Pupae were spread over the sand in a layer about 4 mm deep. Pupae were then covered with another 20 litres of sand and left unattended. Adults emerged from their pupal cases and crawled up through the top sand layer to dry their wings on the sand surface or on weeds immediately around the sand bed. Heavy rain and a cold change occurred on the fourth day after establishment; many adults were killed on the sand surface. One week after establishment, four sub samples were taken from the pupal layer and counts made of empty cases, partly emerged flies and dead pupae.

There was an average of 82.3%, 4.5% and 13.1% for empty cases, partly emerged adults and dead pupae respectively. An estimated 329,200 sterile males emerged the pupal layer, but considerably fewer left the sand surface, due to adverse weather.

Monitoring traps were established on a one kilometre grid in the Young orchard areas and the sand bed was about 400 metres from the nearest trap. Sterile male flies were recovered from this nearest trap but not from two other traps about one kilometre away. Weekly recoveries from 21 October to 31 December numbered 2, 60, 29, 23, 15, 0, 0, 0, 3, 0, and 1. A total of 133 flies were recovered for a recovery rate of 0.0404% corrected for emergence, or 0.0325% based on the total number of pupae supplied only. The emergence rates, release techniques, recapture rates, and intensity of monitoring trapping grids are given in table 1 along with comparisons with other sterile Queensland fruit fly campaigns.

Ants appeared not to attack the pupae and there were no obvious bird marks on the sand; the pupal layer appeared to be undisturbed. Adult emergence and survival appeared better at the edge of the sand, possibly because these adults found and climbed up weeds to dry their wings while adult flies in the centre of the sand became crowded and could not spread and dry their wings.

DISCUSSION

High emergence of flies from pupae is the first critical step to a successful release technique. The emergence rate of 82.3% from the sand bed technique compares favorably with other Australian release campaigns where the garbage bin release technique was predominantly used (table 1).

James (1992) recorded an average emergence of 45.0% for a trial at Cowra although the percentage varied in each third of the campaign (53.0%, 31.4% and 72.7%); the average perhaps understates the best performance at the end of this program.

Recovery rates of sterile flies may be a gauge of their competitiveness. Unfortunately, most previous campaigns used monitoring grids other than the 1000 m grid used at Young (table 1). However some comparison may be drawn from figures recalculated from Horwood and Keenan (1994). They reported an

Table 1. The percentage of emergence, using different release techniques, and recapture rates, using different intensity of trapping grid, of sterile male Queensland fruit fly in this and other studies

Place of study	Emergence rate (%)	Release technique	Recapture rate (%)	Trapping grid intensity	Reference
Young, NSW	82.3	Sand bed	0.0404	1000 m	This study
Perth, WA	60.7	Bin	—	—	Fisher (1992)
	—	—	0.104	Variable	Yeates *et al.* (1992)
Adelaide, SA	62	Bin	0.0039	400 m	Perepelicia and Bailey (1993)
Adelaide, SA	70	Bin	0.009	400 m	Perepelicia *et al.* (1994)
Adelaide, SA	60	Bin	0.0065	400 m	Reynolds *et al.* (1995)
Adelaide, SA	67.8–89.1	Bin	0.02–0.10	400 m	Jackman *et al.* (1996)
Adelaide, SA	76.8–81.5	Bin	0.222	400 m	Perepelicia *et al.* (1997)
Cowra, NSW	45.0	Bin	0.028	400 m	James (1992)
Griffith, NSW	54–61	Bin	1.65	275 m	calculated from Horwood and
			0.29	1000 m	Keenan (1994)
Wagga Wagga, NSW	77.7	Field cage	0.0677	400 m	Dominiak *et al.* (1998)
Trangie, NSW		Bin	0.27–0.58	400 m	Rajakulendran (pers. comm.)

overall recapture rate of 0.73% in a program of 13 weeks of garbage bin releases. However monitoring was conducted for a further 10 weeks after releases ceased. During the initial 8 weeks, the monitoring grid was 275 metres (66 traps) with a recovery rate of 1.33%. Subsequently the monitoring grid reverted to 1 km (16 traps). Released flies are rarely recaptured in the same week as release. When this report is re-examined, the recapture rate in the first eight weeks for the first seven weeks of release equates to 1.65% recovery rate in the 275 metre grid. The recovery rate of the 1 km grid was calculated to be 0.29%. However this figure is an over-estimate as there is no way to exclude the trappings in the second period from other releases in the first period.

The recovery rate in this trial on the 1 km trapping grid at Young was 0.0404%. The recovery rate, and hence competitiveness of the flies in the trial reported here, is comparable with previous work on Queensland fruit fly, especially as adverse weather appeared to kill many of the newly emerged adults.

Predation and adverse weather would appear to be limiting factors in such a simple release strategy. Birds and ants are considered to be the most common predator for fruit fly release programs and layers of sand appear to have prevented the predators from finding the pupae. Ants were a reported problem in the rearing facility at Adelaide (Perepelicia *et al.* 1997) and ants are not a purely field-related problem. However, the adverse weather appeared to kill large numbers of adults but this was not assessed.

This simplified release technique gave satisfactory emergence and recapture rates and warrants further investigation. It offers a simple low cost option for rural distribution of sterile fruit flies from centres where few facilities or personnel are available. Future research could refine the optimum conditions for maximum release of viable males; while sand was used in this trial, materials such as sawdust and vermiculite are other possible options. Strategies to increase recapture rates, perhaps such as supply of food, water and shelter, also need to be researched.

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