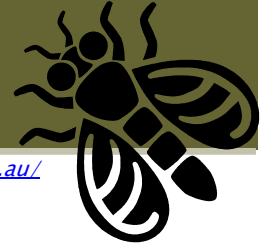


AUSTRALIAN SIT NETWORK

AUSTALIAN NEWSLETTER ON FRUIT FLY STERILE INSECT TECHNIQUE



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Welcome

Welcome to the first Australian SIT Network Newsletter. The aim of this newsletter is to allow Australian fruit fly workers access to current research, meetings, and SIT production and release information. The next issue is planned for April. Send me an email to include your work for the next issue.

As Christmas fast approaches us we have all been busy during our main field season and I would like to thank all writers for taking some time out to contribute to this first issue. Enjoy the read.

Have a great Christmas and I will talk to you all in the New Year.

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Western Australian sterile Medfly group

...who are we?

Based at the Department of Agriculture and Food Western Australia (DAFWA) in South Perth, the group consists of:

Bill Woods, Senior Entomologist (project leader); Ernie Steiner, Operations Manager (irradiation, sterile fly releases, field trials); Roselia Fogliani, Production and QC Manager (fly production and QC, filter rearing); Terry Black, Administrator/Biosecurity Officer purchasing, fly dispatch, field trials); Ian Lacey, Technical Officer (production, QC, field trials, filter rearing); Jeremy Lindsey, Technical Officer (irradiation, QC, field trials, filter rearing); Phil Lawrence, Technical Officer (production); Steve Gibellini, Technical Officer (production); and Wayne Morris, Technical Officer (production).

...sterile fly production.

The team is responsible for production of sterile *ts*/ (temperature sensitive lethal) male-only Medfly pupae for South Australia. Year-round

Medfly per week, increasing to meet demand as required. The VIENNA 7/Mix 99 strain has been in constant production for seven years and the flies meet the quality standards for mass reared Medfly as per the FAO/IAEA/USDA Quality Control Manual. However, serious consideration will need to be given in the near



back l-r: Ian Lacey, Steve Gibellini, Jeremy Lindsey, Bill Woods
front l-r: Roselia Fogliani, Terry Black, Wayne Morris, Ernie Steiner, Phil Lawrence
Photo: Simon Eyres, DAFWA

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WA Sterile medfly group from page 1

future to replacing the colony, either with the same strain or a new one.

We also conduct research into various aspects of SIT and run field trials in Perth and around the State, working with local communities and growers.

...field trials 2006/2007.

Mediterranean fruit fly season is well and truly underway in Western Australia. Weekly production of sterile male Medfly has recently been increased to five million in preparation for this season's field trials. The sterile flies will be released in the rural town of Katanning, approximately 300 Km south east of Perth, for the fourth season. The program is a joint venture between the Shire of Katanning and the Department in response to residents' calls for a solution to their domestic fruit fly problem. The seven weeks prior to the first release of sterile flies just after Christmas. Sterile flies dispatched from South Perth as pupae will be set up in five-litre paper tubs and allowed to emerge and mature. They will be released as five-day-old adults, twice per week over a six square kilometre area for the next two months. One hundred thousand dye-marked sterile flies will be released per square kilometre each week using the mobile ground release method. Shire staff will receive training for the exercise by Department officers. In the past, the initiative has enabled the Department to carry out essential research and development related to the Sterile Insect Technique in a non-commercial fruit growing area.



Shire and Department staff preparing the release vehicle in Katanning.

Photo: DAFWA

This summer, as part of our commitment to the IAEA's Cooperative Research Programme on 'Improving Sterile Male Performance in Fruit Fly SIT Programmes', the Department will further test the response of sterile male flies, either exposed or not exposed to Ginger Root Oil (GRO), to three trap types. A 30-trap grid has been set up in Katanning for this purpose using Tephri, Lynfield and Jackson traps. For the GRO exposures, conventional paper tubs housing the adult flies have been modified with screen vents. These will allow the aroma from cotton wicks impregnated with GRO and placed in the emergence room to enter the containers over a period of 24 hours. Based on the work of Todd Shelly (USDA) in California and Guatemala, this 'whole room' exposure will replace the previously used technique whereby each tub contained a piece of blotting paper with GRO from the time of pupae set up until adult release. It is suspected that this long-term exposure to GRO may have led to the detrimental 'overdosing' of flies in previous trials.

...biological control.

An application has been submitted to DAFF and DEH to import *Fopius ceratitivorus*, a braconid wasp parasitoid of Medfly. Collected from Medfly in its native Africa, the wasp is currently the subject of host specificity testing and evaluation in the USA. If approved for importation, it will undergo additional testing in the Department's recently renovated and upgraded quarantine insectary. The wasp parasitises eggs and early instars of Medfly and thus offers a better chance of success than other candidate biocontrol agents which target later instars or pupae. Biological control in combination with SIT has been shown to be effective in controlling pest fruit flies in Hawaii and Mexico, and it is hoped that the same will be true for Medfly in Western Australia.

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...conferences and visits.

Ernie Steiner and Terry Black visited sterile Queensland fruit fly operations in NSW and Victoria in May. They visited the Qfly rearing facility at Camden and the ANSTO irradiation facility at Lucas Heights, NSW, and inspected experiments and release operations in NSW and Victoria. Discussions with managers and technical staff associated with Qfly control programs in both States proved enlightening and enabled a useful exchange of ideas. A detailed report has been prepared. Ernie Steiner attended the 7th International Symposium on Fruit Flies of Economic Importance in Bahia, Brazil, in September, and presented two posters on behalf of the group: 'Seven years of successfully rearing VIENNA 7/Mix 99 Medfly in Western Australia' and 'Improving efficiency and accuracy of irradiation of Medfly in nitrogen in Western Australia', both of which were well received.

Also in September, Bill Woods presented a paper entitled 'A sticky situation: monitoring fruit flies in Australia' at the Australian & New Zealand Entomological Societies Conference in Adelaide.

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Tristate meeting

Tri-State Fruit Fly Committee

The Tri-State Fruit Fly Committee farewelled long-serving Community Awareness Officer Marilyn Marrows Voullaire and retiring Chairman David Cartwright and Secretary Nell Snaidero at the recent meeting in Mildura on 8 November. The meeting provided an opportunity for members to thank Marilyn, David and Nell for their dedicated service over many years.

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Factory Fly Research at the FFRC

The strain of Q-fly farmed in the Fruit Fly Production Factory (FFPF) is, by necessity, highly adapted to the artificial environment of the FFPF. If this were not the case, it would be impossible to produce the millions of flies required each week for SIT programs.

However, domestication of any organism usually has some undesired side-effects. In the case of Q-fly, experience suggests that domestication may have compromised the ability of the flies to perform outdoors after release. Therefore, we are investigating methods of domesticating Q-fly (so it is sufficiently productive in the FFPF) that avoid some the undesirable side-effects of domestication.

The initial part of the project has involved comparing the existing FFPF strain with its wild relatives and strains undergoing domestication. For the last three years, we have collected 12 wild lines of Q-fly and established them in the lab. As a result, we have various lines that have been in the lab for between 1 and 17 generations. Some of the characters we have been measuring in these lines and the FFPF strain include development times and viability of larvae and pupae, adult size, egg-laying rates and longevity. We are also using DNA microsatellite markers to measure the rate of inbreeding in these lines. In particular, we are interested in whether different production schedules (i.e. details of exactly when flies are fed and egged) affect inbreeding rates.

A second part of our work is to determine how deliberate affects production traits. At present, it appears that controlled outbreeding results in little loss of productivity but further research is required on various strategies of outbreeding.

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Macquarie University

In the *Centre for the Integrative Study of Animal Behaviour* (CISAB) at Macquarie University we have a variety of current Q-fly projects, carried out by two post-docs (Dr Diana Perez-Staples & Dr Chris Weldon) and two PhD students (Preethi Radhakrishnan & Sam Collins). Our work has two main themes: sexual biology and refining SIT protocols.

We have recently made some useful and interesting progress in studies of sexual biology. Diana carried out a series of experiments to understand the economy of sperm use by females, and found that evidence that they use the spermathecae as a long-term 'deep storage' and use the ventral receptacle to maintain a much smaller number of sperm at a time for fertilizations (in press at *Physiological Entomology*). This allows them to efficiently maintain and use sperm over many weeks.

We have also found, much to our consternation, that irradiation causes a massive reduction in the number of sperm produced by males. If a wild female mated by a released sterile male later remates with a wild male, there will be few sterile sperm in her storage organs to compete and the female will very likely deposit mostly fertile eggs. Luckily, despite the low number of sperm, females are no more likely to remate after mating with a sterile male rather than a fertile one (published in *Journal of Insect Physiology*). We hypothesised that this was because products in accessory gland seminal fluid, not sperm numbers, are responsible for female remating inhibition. Indeed, Preethi's PhD work has now confirmed that male accessory gland fluids do inhibit female remating when extracted and injected directly into the body of virgin females (in press at *Journal of Insect Physiology*). Preethi is continuing her exploration of mechanisms controlling remating inhibition in Q-flies, as this is a very important and often overlooked factor in SIT success.

We have also made some promising progress in studies of adult nutrition. Diana has found that addition of

protein to the adult diet, even for just a short period, can give both male and female Q-flies a massive boost in sexual development and performance (in press at *Physiological Entomology*). We wait to see whether this also works in the field...

In January Sam will begin the first of a series of his PhD experiments designed to optimise irradiation procedures. He will be starting out with a study of how total dose and dose rate influence sterility and fly quality. Chris will be involved in the irradiation work, as well as carrying out field cage QC tests in the new year and collaborating with Diana on some truly perverse experiments on regulation of copula duration (more details in the next newsletter).

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Join the Tephritid Workers Database

www.tephritid.org

Directory and information

Fruit Fly in Victoria

The fruit fly season began in Victoria in late August when overwintering flies resumed their activity. Control operations including baiting and targeted larval searches have been carefully targeted using current monitoring records and DPI Victoria's large database of past records, which have been used to understand QFF phenology in key areas on the state's north-eastern border. To aid this activity a strike team has been formed whose purpose is to enable rapid response to outbreaks and pro-active work to prevent or enable earlier detection of outbreaks. All of these activities are aimed at stopping outbreaks from occurring or ensuring they are detected as soon as possible to shorten outbreak duration.

Effort is also being put into clarifying the effectiveness of the Male Annihilation Technique (MAT) under the dry conditions that occur in inland areas. One trial was

conducted in spring involving the assessment of one type of MAT lure in an isolated area of 400 households. A second trial has just begun involving 1000 households with two types of MAT lure evaluated. This trial is being jointly conducted by VIC & NSW DPI staff.

On the SIT front, planning and costing of the new pupal rearing facility to be located at DPI Tatura is still in progress and it is hoped that construction will begin early in the new year. This season's SIT release program will begin in early January and will be focussing on further fine tuning of release methods and once the new rearing facility is completed it will enable improved quality control procedures to be introduced.

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Trapping Female Fruit Flies: *Bactrocera* (Diptera: Tephritidae)

Traps used in Australia to capture female *Bactrocera* spp which are based on an attractant (generally a protein source) suspended in water need replacement once a week due to biological deterioration. The trap becomes unattractive to fruit flies and unpleasant to service. A longer-term but effective female attract-and-kill trapping system is needed to ensure timely detection of incursions of exotic flies whose males are not responsive to parapheromone lures. Female trapping systems, if sufficiently cost-effective, could play a role in reducing fruit fly populations in Area Wide Management programs.

NSW DPI researcher, Andrew Jessup has developed two prototype long-lasting female lures: a dry lure for use in humid climates and a moist lure for dry climates which are showing potential. A third lure developed by former NSW DPI (Now Biosecurity Australia) researcher, Glenn Bowman, is based on oviposition stimulants.

All three lure types show promise but need further development. Experiments are under way to test the efficacy and longevity of female fruit fly lures based on:

- Moist attractants (gel baits): gel, ammonium acetate, sucrose, fungicide, protein, fruit pulp and essences and
- Dry attractants (dry baits): ammonium carbonate, powdered protein

Gel baits and dry baits were placed in the base of plastic Dome traps (similar in design to the glass McPhail trap) with a 1 cm square of dichlorvos-impregnated fibre (commercial clothes moth killer). Traps were set out in citrus trees at Gosford so that they were within the canopy in the North-Eastern quadrant.

Work, so far, has been trial and error and results have shown that there is potential for all three prototype lures. More experimentation will

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concentrate on:

- Continuing experiments through each season
- Improving recipes for attractancy and longevity
- Expanding trials to commercial orchards under different climatic locations

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This newsletter will be on the Web!

A new Australian FF network
website

Web site address

Early 2007

Suburban Mediterranean fruit fly SIT program

A Mediterranean fruit fly (Medfly) outbreak was declared as a result of male flies trapped in the industrial suburb of Wingfield, Adelaide. In total 11 adult male flies were caught between 24/4/06 and 9/5/06. Fruit checks throughout the area did not detect any larval infestations.

For the first time in an Adelaide SIT program, the pre-sterile baiting program used Naturalure (1:6.5 water) instead of Malathion (from 28/4/06 to 11/5/06) at a rate of 50 spots (50ml) per hectare, well below the recommended rate of 150 spots per hectare due to the limited foliage available on large factory/commercial premises in the area. Sterile male Medfly (Mix 99 *ts*) produced by the Western Australian Department of Agriculture were released at rates of between 80,000 – 190,000 sterile males per sq km per week from 18th May to 26th June 2006.

Average post-irradiation, post-shipment quality control results (see table 1 below) indicated the flies

were generally of a high quality. Mortality under stress, conducted for the first time in a South Australian Medfly SIT program, showed that a relatively high proportion of flies died within 48 hours if given no food or water. This test is designed to reflect nutritional reserves in the newly emerged flies, and suggests an area where the flies could be improved.

Recent modelling of degree-days required for development of Medfly in Adelaide, indicates that if eggs laid in early May had survived to develop into adults, second generation flies would be present in the area in December 2006. Weekly trapping has continued in the area with no further detection of wild flies.

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Table 1: Quality control results during the Medfly SIT program 2006

Quality control test	Average result	USDA acceptable mean
Pupal weight	8.4mg	7.5mg
Emergence (%)	85.3%	65%
Flightability (% fliers)	78.1%	55%
Mortality under stress	65.2%	40%
Longevity outdoors (mean)	23 days	n/a

Effects of protein diet on recaptures of field released sterile Queensland fruit fly

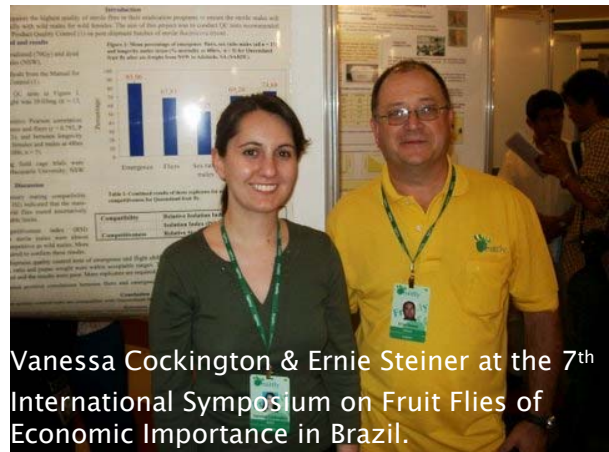
Vanessa Cockington and Cathy Smallridge from the South Australian Research and Development Institute (SARDI) are in the process of conducting a series of field releases to compare the recapture data of sterile Queensland fruit fly either fed on the standard pre-release diet of 5% sucrose or fed the sucrose solution in addition to *ad lib* access to protein for 1–2 days before release.

Recent work published by Phil Taylor and co-workers from Macquarie University has demonstrated that male Queensland fruit fly need protein in order to mature. One hypothesis to explain relatively poor recapture rates in South Australia is that released sterile flies may have delayed maturation due to an inability to find sufficient protein to mature in the wild. Providing protein to the males prior to their release may enable them to mature earlier and a greater proportion would become sexually active prior to succumbing to natural field mortality. This would be reflected in higher recaptures of protein-fed flies soon after their release.

SARDI FRUIT FLY MEETINGS...

Vanessa Cockington attended the 7th International Symposium on Fruit Flies of Economic Importance and the 6th Meeting of the working group on fruit flies of the western hemisphere in Brazil. SARDI presented 2 posters, one on Quality control tests on sterile Queensland fruit fly and the other, on behalf of Macquarie University, on Protein supplements enhancing sexual performance of male Queensland fruit flies. It was a fantastic opportunity to show case our work and a worthwhile experience for all researchers to enable face to face interactions with other international researchers.

Earlier in Brazil as part of the satellite meetings at the symposium, Cathy Smallridge met with other members as part of the Co-operative Research Program co-ordination meeting for “Improving male performance in the sterile insect technique”. It was the second meeting and essential to re focus and aim for common goals. The next one is in Spain 2008.



Vanessa Cockington & Ernie Steiner at the 7th International Symposium on Fruit Flies of Economic Importance in Brazil.

Vanessa and Cathy presented at the Australian and New Zealand Entomological Societies conference, the theme was *Biosecurity - Caring for the Environment and Agriculture*, in Adelaide. The Fruit fly Symposium included a great blend of attendees and presenters from both research and management. A full day was focused on fruit fly and there was plenty of time during the conference for interacting. Eric Jang (USDA) was the keynote speaker and provided a US twist on the NZ and Australian presentations.

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