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The Queensland fruit fly eradication campaign

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Western Australia has started an extensive eradication campaign against the Queensland fruit fly, one of the worst horticultural pests in the world.

The programme, the largest of its kind in Australia, and one of the biggest in the world, involves the integration of three techniques for fruit fly control: lure trapping, protein baiting and the release of sterile male flies.

More than $5 million will be spent to eradicate the insect from the Perth metropolitan area and to stop its further spread. Fortunately, it has not been found outside suburban Perth.

Campaign co-ordinators, the Department of Agriculture and the Agriculture Protection Board, led by programme manager John Bradshaw, say that if the fly establishes in Western Australia commercial growers and home gardeners will have to increase the amount of insecticide to produce fruit and vegetables. The horticultural industry estimates it could cost an additional $2 million a year in control measures if the fly remains unchecked.

Fruit fly eradication expert, Dr Alan Bateman formerly of CSIRO, who reviewed the Queensland fruit fly outbreak in this State, says the approach taken has an excellent chance of eradicating the fly while the outbreak is restricted to part of the Perth metropolitan area (see map).

Queensland fruit fly has the potential to be more devastating than the Mediterranean fruit fly. The adult is a bigger, more mobile fly with a greater reproductive capability. It attacks tomatoes, capsicums, eggplants and avocados, as well as fruit that the Mediterranean fruit fly infests.

Defining the infested area

Since the Queensland fruit fly was first identified in the Perth metropolitan area in February 1989, monitoring traps situated about one kilometre apart have located the extent of the infestation.
Initial control measures
By mid October 1989 inspectors had visited 50,000 houses in the infested areas to nail a wood fibre (canite) lure block on a fruit or evergreen tree in each garden. The match-box sized baits, which last for six months, are impregnated with malathion insecticide and a lure that attracts and kills only adult males of the Queensland fruit fly.

In spring, fruit and other broad-leaved trees were squirted weekly with a bait made of malathion and a vegetable protein extract similar to Vegemite that attracts and kills male and female fruit flies. Each tree received one to two 100 mL squirts of bait mixture, but no more than six squirts in each garden. Fruiting trees were always baited if they were accessible. Baiting will not kill all the male flies; some will survive to mate with fertile female flies. The release of sterilised flies will then swamp and eradicate the remaining population.

In the baiting programme malathion is used at a low dosage rate. It has a low toxicity and is not persistent.

Residents who do not want their fruit trees treated must completely strip each tree of fruit and dispose of it correctly, either by boiling it, or soaking it in water with a film of kerosene on top for five days. The treated fruit can then be buried.

At the site of the original infestation entomologist Bill Woods has set up temperature probes and wind speed recorders to get a better understanding of how fruit and soil temperature influence the rate of development of the fly. This data will help determine when the next generations of adult Queensland fruit fly are likely to emerge, indicating the need for extra care in monitoring and baiting.

In Western Australia, the first eggs were probably laid at the beginning of September. The eggs hatch in the fruit, the maggots fall to the ground where they pupate and emerge as flies in late October-early November.

Sterile breeding programme
Once in full swing in early 1990, the breeding and release of millions of sterile fruit flies each week will make it the biggest project of its type in Australia. It will be far bigger than the work associated with the release of 15 million sterile Mediterranean fruit flies each week during the campaign which eradicated this fly from the Carnarvon horticultural area from 1981 to 1984. The breeding colony for the Perth eradication campaign totals 5 million flies.

The latest project draws on the experiences of the Carnarvon one, but there are biological differences between the two flies. It takes the female Queensland fly two weeks to become an egg-laying adult, compared with four days for her Mediterranean counterpart. She needs humidity to stimulate egg-laying because she comes from a tropical environment; the Mediterranean fly comes from an arid one. Female Queensland flies must be reared at 80 to 85 per cent humidity, compared with 60 per cent for the Mediterranean fly, so the rearing rooms are like saunas.

The Department of Agriculture's Entomology Branch has imported 60,000 Queensland fruit fly pupae from Queensland and New South Wales to start its breeding colony. Because of the sheer numbers involved, the team, led by entomologist Kingsley Fisher, is studying labour saving techniques to collect eggs from the females and to mass rear them.

At present, the colony is housed in small cages, each containing 4,000 to 5,000 fertile adult flies. They lay eggs into special containers, which simulate fruit, called egging receptacles. The eggs are placed upon a mixture of straw and nutrients, looking much like horse manure, for larval growth. Six tonnes of the mixture on 1800 trays will be used each week, and the used mixture will be burnt.
Halfway through the larval stage, the larvae are taken out of the incubation room to a cooling room to control metabolic temperature and to reduce the death rate of the maggots. Full grown maggots leave the straw mixture as they would fruit and pupate in trays. Just before maturity the pupae are sterilized by radiation and dusted with a fluorescent dye powder. Two days later they emerge as sterile, mature flies with flecks of powder clinging to the body.

Sterilisation does not affect the behaviour of the flies. Sterilised males are the most important component of the sterile insect technique for biological control programmes. Once released the sheer numbers overwhelm the wild population, preventing the fertile male flies from meeting a fertile partner.

Sterilised flies will be taken to the release sites, 500 m apart in the infested area, in 800 bright yellow garbage bins specially cast for the project. Each bin can hold 20,000 adult flies. Bins are sterilised after each use to ensure there is no carry-over of disease from one generation to the next.

The earliest release date possible is February 1990 because of the vast numbers of flies to be bred. The entomologists also want to be certain that the sterilization process is successful. Fly species differ in their resistances to irradiation, and the dosage that worked on the Mediterranean fly may not be suitable for the Queensland fly.

Sterile Queensland flies should live up to four weeks in the field, compared with one week for the Mediterranean fly. The release of sterile male flies will continue until June 1990, and the Department is confident of eradication.

The whole breeding process will be housed in a new $500,000, secure quarantine insectary specially built for the project to ensure no fertile flies escape. Existing buildings were not suitable to mass rear such a large number of flies and modifications would have cost almost as much money and would not have been ready in time. This building can be used for other biological control research work when the project has finished.

**Monitoring**

Progress of eradication is monitored by two techniques: male cuelure (pheromone) trapping and larval rearing. Entomologist David Yeates is in charge of the monitoring programme.
Inspector Graham Tibbs and Nedlands resident Sally Pyvis inspect a lemon tree in her garden.

One of the spraying teams, Hayley Baker (left) and Barbara Lehndorf, on their rounds through suburban Perth.

Four hundred cuelure traps have been set about one kilometre apart outside the infested area, with a security band of traps 300 m apart on the perimeter of the infested area. These traps monitor the spread of the fly and are checked once a week. By November 1989, additional traps had been set up in Carnarvon, Geraldton, Bunbury, Manjimup, Yanchep, Gingin, Toodyay, Mandurah, York and Albany. Only a handful of flies have so far been collected outside the infested area, all within the Perth metropolitan area.

Once a male fly is collected in a trap outside the infested area, the monitoring programme in that suburb is intensified. An additional 10 male cuelure traps and five protein traps are placed up to 400 m around the site of the original trap. These traps are checked twice a week, and remain in place for 12 weeks.

If more Queensland fruit flies are collected in these additional traps they are assumed to be breeding in the area. A full eradication campaign starts in the area within a 1.5 km radius from the site of the original trap.

At the same time, entomologist Andy Sproul is collecting infested fruit and rearing the larvae to the adult stage to distinguish between the Queensland fruit fly and the Mediterranean fruit fly. This will indicate potential breeding sites that need intensive eradication. He is also boiling part of each sample of maggots in chemicals and examining their jaws under a microscope to distinguish between the two flies. This technique was developed in South Australia and is useful in the early identification of an infestation.