Eastern roadblocks

Fruit fly larvae bred from fruit collected from eastern roadblocks are *Bactrocera* species, mainly Qfly, consistent with their movement from fruit fly areas in eastern states.

The first South Australian roadblock was established at Yamba in 1957, primarily as a response to the discovery of an outbreak of Qfly at Mildura. In 1965 a boom gate was erected across the Sturt Highway at Yamba to better control traffic. In 1997 the Yamba roadblock operates full time throughout the year, to monitor traffic from the Murray Valley.

Staff at the Yamba roadblock inspected 301 926 vehicles in 1996–1997.

Percent of vehicles carrying fruit by number plate of vehicle (1996-97).

Roadblock	SA	Vic	NSW	Qld	WA	Other
Yamba	36	24	24	8	3	5
Oodla Wirra	27	7	35	20	6	6
Ceduna	12	20	13	9	42	4

In 1962, a part-time roadblock was set up on the Wentworth-Renmark road (12 km east of Renmark) to inspect traffic which had previously by-passed the roadblock at Yamba. This roadblock was manned three days a week on random days and was finally closed in September, 1977 because of the low volume of traffic which used the road.

In 1959, part-time roadblocks were established at Blanchetown and Mt. Gambier for a trial period, but these ceased in 1961 as the volume of traffic and the limited amount of infested fruit intercepted could not justify the expense.

In 1960, a part-time roadblock was established at Cockburn because of outbreaks of Qfly at Broken Hill; it became permanent in 1961. Cockburn operated twenty-four hours a day year-round until May, 1980, when it was closed and relocated to Oodla Wirra in December 1980, to operate from December to May inclusive from 6am - 10pm. The new site at Oodla Wirra was equipped with two boom gates to stop interstate traffic and allow local traffic through without inspection. Oodla Wirra presently operates 16 hours per day, 6am - 10pm September-May and 7.6 hours per day, 8am - 5pm June to August.

In 1963, in response to pressure from growers at Loxton who feared the introduction of Qfly from the east, inspectors from Yamba began to conduct a staggered four-hour daily survey at Pinnaroo. By June 1968, a part-time road block had been established there operating during daylight hours using a tent at first for a shelter for the on-duty inspectors. A casual employee erected a galvanised tin shed at his own expense. The South Australian Government approved the establishment of a Fruit Fly Inspection Station at Pinnaroo in January, 1971. Staff at this roadblock were halved in 1980 and it now operated sixteen hours a day (6am - 10pm) between the months October to May inclusive and 7.6 hours per day 8am - 4pm June to September.

An analysis in November 1977, of records from the four main border stations, Ceduna, Cockburn, Yamba and Pinnaroo for nine year period 1968-1977 showed that the critical period for inspecting traffic for Qfly was December to April inclusive, while for the remainder of the year the

Vehicles, interceptions of fruit and batches of fruit fly larvae per annum, averaged for the five year period 1991/2 - 1995/6.

Mean per annum (1991/2-1995/6)	Eastern Roadblocks (Qfly)			Western Roadblock (Medfly)
	Yamba	Pinnaroo	Cockburn	Ceduna
No.vehicles	305 072	129 335	122 254	63 571
% vehicles with fruit	6.8	5.8	5.4	11.3
Wt fruit (tonnes)	41.5	9.1	11.2	8.4
No. vehicles with infested fruit	8.4	2.4	29.0	22.4

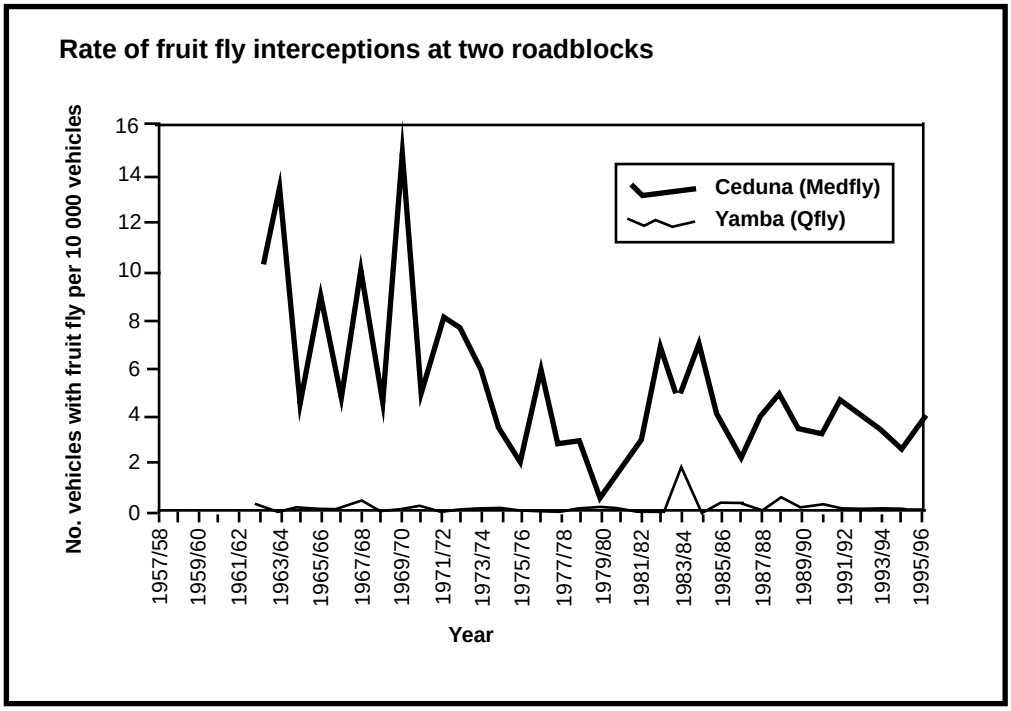
risk of fruit fly introductions were comparatively low. However, for Medfly there was no obvious low risk period, and year-round inspection of traffic was justified. The frequency of fruit intercepted at night was much lower than during the day. As a result, the Cockburn station was operated for the period December to May inclusive and then only between 6am to 10pm.

At Bordertown and Mt. Gambier there are quarantine “honesty” bins for the disposal of fruit by travellers.

Western roadblock

Samples of fruit fly larvae reared from the western roadblock have all been Medfly, consistent with an origin in Western Australia.

In 1957 a temporary roadblock was set up on the bridge at Port Augusta on Highway 1 following an outbreak of Medfly there. This roadblock was transferred in 1958 to Ceduna , where it was easier to intercept east-bound traffic, and in 1971 the roadblock was re-sited 1km from the original to prevent vehicles by-passing inspections. In 1965, inspection site at the Ceduna roadblock was tightened by closing a stock route which was being used as a by-pass. Two boom gates were erected at Ceduna in February 1987 to prevent vehicles speeding through the roadblock, which operates full time.



Administration of roadblocks

Administration of the roadblocks was first managed by staff of the Department of Agriculture headquarters in Adelaide and in August, 1983, technical supervision was transferred to the Officer-in-Charge, Pest Eradication Unit, Adelaide. When the Department of Agriculture changed to a regional structure, roadblock staff were jointly administered by Plant Industry Division,and the Chief Regional Officer of the Region. This dual management was simplified when the Department was reorganised in 1992 and roadblocks became a direct responsibility of the Horticultural Division, with local administration carried out by Service Delivery Managers.

Inspections of other transport

Rail inspections

From 1949 an endeavour was made to educate travellers about the dangers of introducing fruit fly. Notices, posters and announcements over public address systems were used at railway stations and police at Port Augusta and Port Pirie inspected trains as part of their duties. By 1974, Port Augusta had seven full-time and one part-time inspectors, Port Pirie had one full-time and one part-time

inspector; and Peterborough had one part-time inspector. Route changes of trains from Perth in 1986 eliminated inspections at Peterborough, and finally Port Pirie. By 1992 all passenger train inspections ceased because little infested fruit was detected; during a three year period, for example, only one batch of infested fruit was detected.

Interstate passenger trains were inspected for fruit during a number of periods. The Melbourne-Adelaide train was inspected after 1954 , when an Inspector boarded at Mt. Lofty each morning and inspected all passenger compartments. Inspections of the east-bound train from Perth started 1959 by an inspector at Pimba. Passenger trains from Perth to Adelaide were inspected between Port Augusta and Port Pirie until 1992. In that year, the timetable was changed so that trains from Perth arrived at Port Augusta at midnight; all inspections were cancelled to avoid disturbance to sleeping passengers. Inspections on west-bound trains from New South Wales started in 1961 when the Broken Hill-Adelaide express stopped at Cockburn where inspectors boarded the train. In 1970 the India-Pacific line came into operation and an inspector met passengers who disembarked at Peterborough for Adelaide. The south bound passenger train (The Ghan) from Alice Springs was inspected between 1959 and 1992 by an inspector who boarded at Telford.

Fruit collection by an inspector on an interstate train in the 1970s.

Airport inspections

Airline operators announced quarantine restrictions of fruit to passengers on aircraft entering South Australia but there was no check of luggage. By 1954, inspectors met all interstate aircraft at Adelaide and by their presence reminded passengers of their quarantine obligations, in addition to leaflets distributed by the airline companies. By 1965 every air-entry point either had honesty bins or inspection. Staff from the Ceduna roadblock inspected light aircraft at the Ceduna airport. The International terminal in Adelaide opened in 1982 and quarantine officers meet all aircraft from overseas.

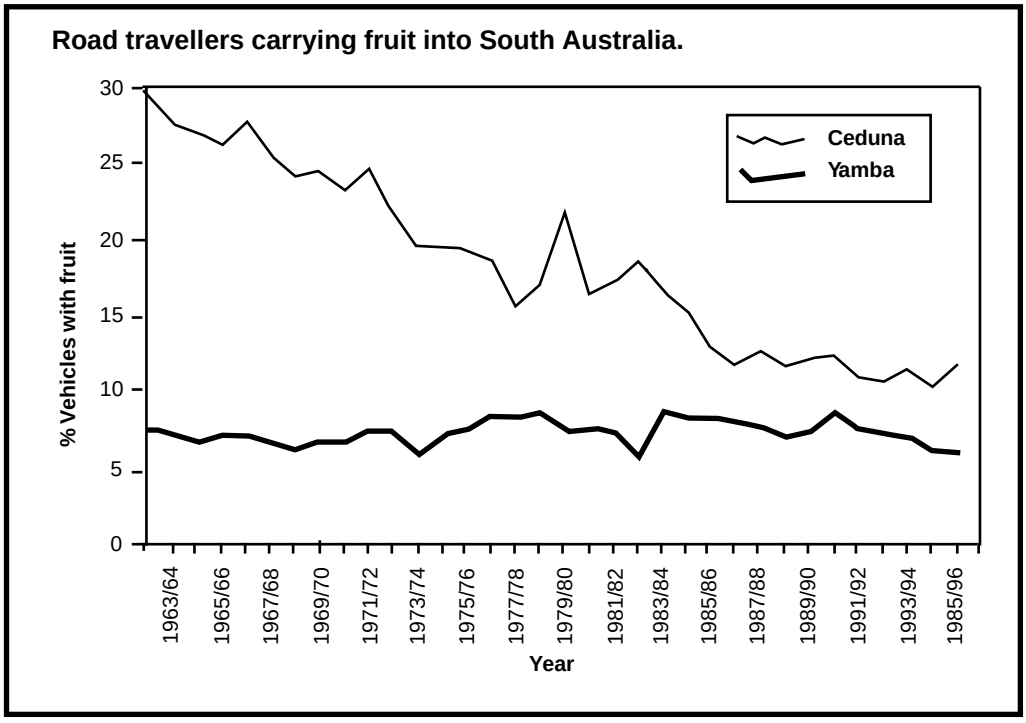
Port inspections

In 1949, inspections began at the Port Adelaide Inspection and Fumigation Depot; and the few commercial imports of fruit were all inspected. In later years, inspection of commercial horticultural imports is obviated by an International Health Certificate under the Commonwealth Quarantine Act. Garbage waste from all ships is incinerated at a Marine and Harbours facility.

Passengers on ships were also required to give up fruit in their possession. On the occasion when a passenger ship arrives at Outer Harbour, customs screen passengers for fruit and supply a disposal bin. In the past, mail ships made regular visits here; inspections of passengers revealed very little fruit.

Publicity

Fruit-fly publicity within South Australia is aimed at raising the awareness of South Australian residents of the impact of fruit flies on their lifestyle and to encourage them to report occurrences of larvae in fruit. It is also aimed at warning visitors and returning residents not to bring fruit into South



Australia. The effectiveness of the publicity campaign may be measured by changes in fruit being brought into South Australia. The proportion of vehicles bringing fruit from Victoria has remained fairly constant at less than 10% during 35 years, while the proportion of cars carrying fruit from Western Australia has declined from nearly 30% in 1962-3 to about 12% in 1996-7.

Lectures and talks

Sheila Morphett.

During the years 1970 to 1982, a special Education Officer, Sheila Morphett was appointed to visit schools and councils in the State and to give talks to interested groups. Talks were given to all class levels in primary and secondary schools, when a simple story of the biology of fruit fly and the ecological significance of the eradication program in South Australia were presented. Students received transfers and project material which included information for their parents. Most school teachers were pleased to receive this information, and many encouraged the children to undertake fruit-fly projects in association with social studies.

Television commercials

For many years, television advertising was found to be expensive and outside the financial ability of the Pest Eradication Unit. In 1983, Channel 9 made two 10 second commercials at a reasonable cost, and these were shown in the 1983-84 and 1984-85 seasons.

Signboards

In 1947, Department of Agriculture co-operated with the Phylloxera Board to erect eight notices on the Victoria-South Australia border roads aimed at warning road travellers against transporting fruit and vines into South Australia. These signs were erected at Frances, Pinnaroo, Penola, Coorong motor by-pass, Mt. Gambier aerodrome, Renmark-Mildura road and Parafield aerodrome. Later, four new signs were erected at Outer Harbour and Pt. Adelaide, followed by Adelaide and Murray Bridge railway stations.

In 1963, a contract was let for the construction and maintenance of 25 roadside border signs. One was on the west coast, two in the far north, nine in the Murray Mallee

and thirteen in the South East. By 1965, all road, rail, air and sea entry points into the State were covered by either a quarantine barrier or signboards. In 1973, these signs were replaced on major roads at Ceduna, Cockburn, Pt. Augusta, Renmark-Wentworth, Renmark-Lindsay Pt., Pinnaroo, Bordertown, Naracoorte-Apsley, Glenburnie and Mt. Gambier-Nelson., each with a large sign, a satellite sign and an honesty bin. Twelve minor roads had one large sign each; they were at Noora, Taplan, Murtho, Ellerslie, Wrattonbully, Penola-Casterton, Mt. Gambier-Casterton, Mil Lel-Casterton, Mt. Gambier-Heywood, Wanuarra, Francis and Binnum. Other signs in the State were at the Adelaide airport (two), Parafield airport (two plus bin), Yamba roadblock, Outer Harbour, and Nos. 2 and 18 Berths at Pt. Adelaide.

Eighteen signs on major road-entry points are currently maintained by a contractor and the remainder by the Department.

Signboard at Pinnaroo around 1947.

DETECTION

The successful eradication of outbreaks since 1947 can be attributed to the early detection of fruit flies. Reports by householders of larvae in fruit, together with a detection program based on traps for adult flies, has resulted in most outbreaks being restricted to one, or a small group, of infested trees or to a very small number of flies trapped.

Proportion of outbreaks reported by members of the public; the remainder were detected by the trapping grid. During the period 1946-1978, the trapping grid was not as extensive nor the traps as efficient as in the period 1978-1997.

Period	Qfly	Medfly
1946-1978	67%	93%
1978-1997	49%	52%

Reports from householders

The cooperation of householders is reflected in the number of outbreaks they report. The response to all public reports is attendance by an inspector who visits the house and examines the specimens. In most cases, other insects, commonly larvae of codling moth, lightbrown apple moth, dried fruit beetle, metallic-green tomato fly or ferment flies are identified. When putative fruit fly larvae are found, they are referred to an entomologist .

Detection traps for male Qfly and Medfly

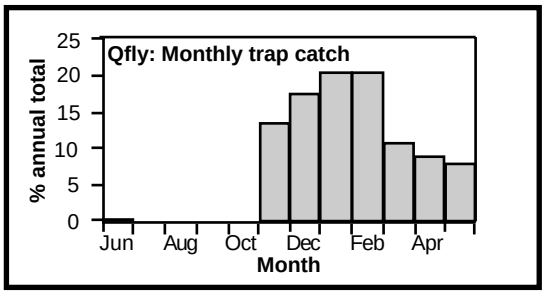
The use of traps to detect the presence of adult fruit flies in South Australia has evolved since the first outbreak in 1947. The design of trap, the lure used to attract the flies, and the distance between traps in the grid has changed to reflect new technology (particularly in the composition of lures), new trap designs (an “improved” trap design is described in the literature every two to three years) and the resources available to service the detection grid.

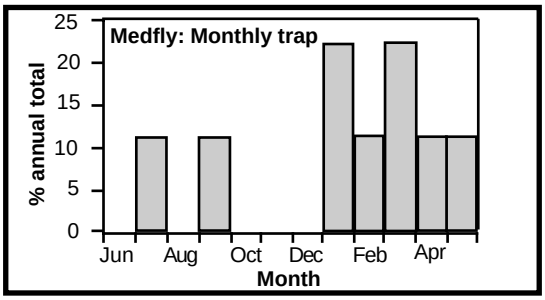
Almost all the information used to construct the detection grid has been derived from research on Qfly by CSIRO and state Departments of Agriculture in New South Wales, Queensland and Victoria, and the University of Sydney and on Medfly by a number of foreign institutes, particularly the United Stated Department of Agriculture (USDA), but also by the Western Australian Department of Agriculture. No research has be done in South Australia on the comparative behaviour of the traps under South Australian conditions.

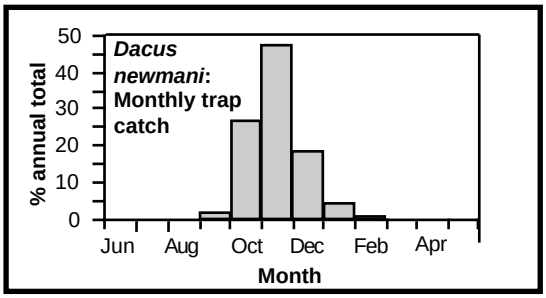
The months in which male Qflies were caught in Cuelure Jackson traps 1985-1992 are shown in the figure below, and reflect a pattern of detection during summer and early autumn. Outbreaks were declared on the basis of catches of many of these flies, but some were isolated catches of single males, assumed to have dispersed from their point of introduction.

The pattern of detection of Medfly, as reflected in male catches in Capilure Jackson traps, 1985-92 is shown in the Figure. Detection usually starts later than Qfly, and extends into winter.

Males of the inland fruit fly, *Dacus newmani,* are attracted to Cuelure, and are caught coincidentally during trapping operations. They become active in spring and peak during summer.



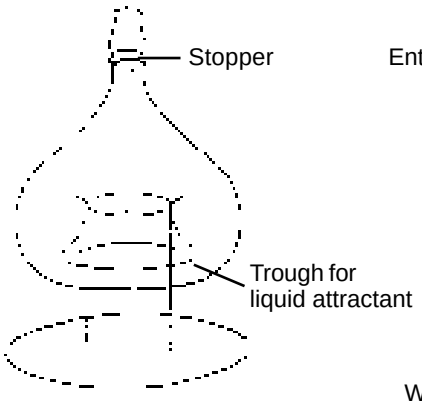




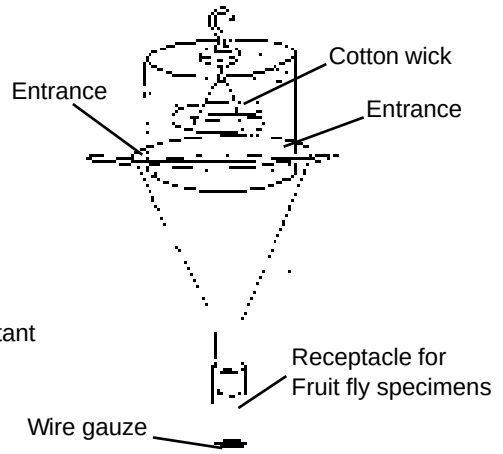
Baits and lures.

Baits are food substances which attract fruit flies. Proteins derived from yeast (usually in the form of protein hydrolysate or protein autolysate) are produced commercially, and can attract adult male and female flies from many metres away. Protein baits may be mixed with water in **"wet traps"**, in which attracted flies are drowned, and serve as an indication of the population of flies in an area.

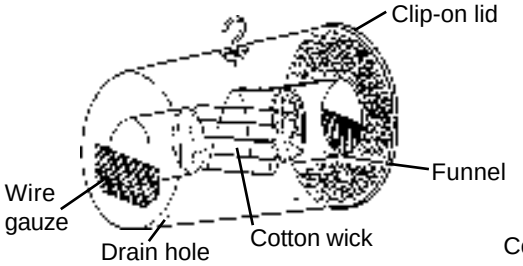
Lures are usually synthetic substances which attract one sex, usually males. Lures are used in traps to detect the presence of fruit flies in an area. Lures have a greater range of attraction than baits. Lures are usually used in conjunction with **sticky traps** and **"dry traps"**



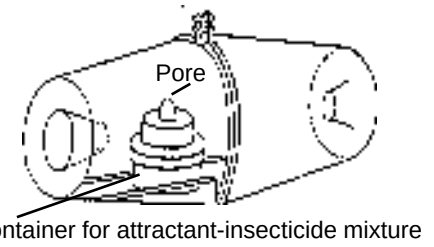
McPhail trap



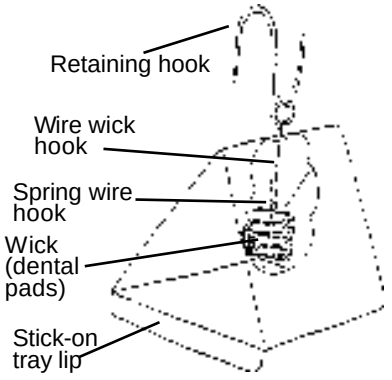
Bateman trap modification



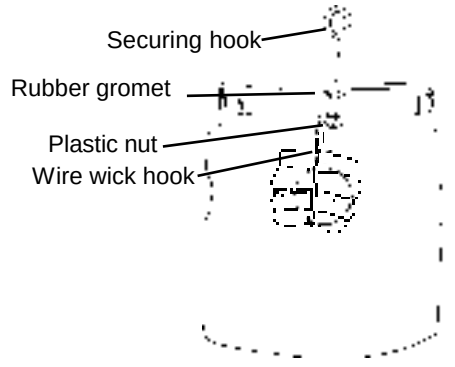
Steiner trap (Queensland modification)



Israeli trap



Jackson trap



Lynfield trap

From Drew, Hooper and Bateman:1978 *'Economic Fruit Flies of the South Pacific Region'*.

Summary of traps and lures used for monitoring adult fruit flies in South Australia. One trap each for Qfly and Medfly is located at each site.

YEAR	QFLY		MEDFLY		NO. OF SITES IN SA	SPACINGS OF GRID
	Trap	Lure	Trap	Lure		
1947	Treacle tins Agee jars	Clensel				
1948			McPhail	orange-ammonia		
1950			McPhail	vanillin-ammonia	500	1/2 mile
1954	McPhail	Vanillin-ammonia				
1957	McPhail	Staley No. 7	McPhail	Medlure		
1959						
1960	Bateman	Willison's			800	1/2 mile
1961			McPhail	Trimedlure	1,290	
1962	(Dak-pots unsuccessful)		(Dak-pots unsuccessful)			
1963			Steiner	Trimedlure and glycerine	400	1/4 mile
1964	Bateman	Cuelure			1,386	
1965					1,508	
1970			Israeli	Trimedlure and Dichlorvos		
1973					1,875	400 m
1979	Steiner (modified)	Cuelure				
1981					2,463	
1982					2,506	
1983					2,712	
1985	Jackson	Cuelure	Jackson	Capilure	2,730	
1986					3,362	
1992	Lynfield	Cuelure				
1995			Lynfield	Capilure	3,491	

Sentinel traps to detect incursions of other fruit flies

The lures used to attract Qfly and Medfly to traps do not attract many other fruit flies of economic importance which may be accidentally introduced to South Australia. There are a group of economically important fruit flies which are attracted to the lure methyl eugenol; these flies include the mango fly *Bactrocera papayae* and the Oriental fruit fly, *Bactrocera dorsalis.*

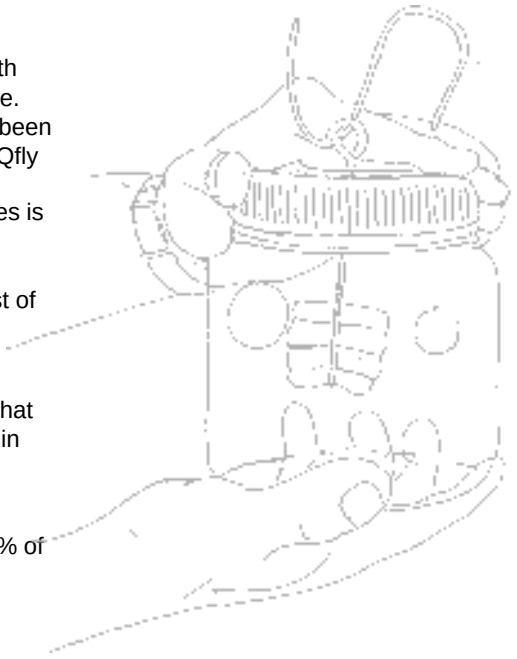
The response in South Australia to the suspected outbreak of oriental fruit fly *B. dorsalis* in northern Australia in 1975 was to put out 35 traps baited with methyl eugenol., distributed over in the metropolitan grid. The numbers were later increased to 40. Seven Bateman traps were placed in Riverland towns in 1987. No *B. dorsalis* were collected while these traps were in operation.

Attractiveness of lures

The range of attraction of lures varies with the species of fruit fly, and the type of lure. Although no detailed observations have been done of the attractiveness of Cuelure to Qfly under South Australian conditions, an attractive range of several hundred metres is probably reasonable, making the 400m distance between traps a compromise between behaviour of the fly and the cost of detection.

Medfly does not appear to be nearly as attracted to lures as Qfly, and it is likely that the attraction to traps may be measured in scores of metres.

The proportion of males of a population attracted to traps is probably less than 4% of the flies in the vicinity of the trap.



ERADICATION

Eradication is the destruction of all flies and larvae within the outbreak area. For quarantine purposes, eradication is defined as when no flies or larvae are detected within that area for a period equivalent to three fly generations. Under local conditions in summer in Adelaide, that period is 12 weeks, but this is longer in cooler seasons.

Eradication or suppression?

The operating model for fruit fly eradication in South Australia is of repeated introductions of fruit fly into South Australia from outside the state; these are detected, usually before they produce a second generation, and are eradicated. The evidence from numbers of flies caught in traps, and larvae found in outbreak areas suggests that the number of flies in each outbreak does not total more than several hundred.

It is likely that both Medfly and Qfly, left uncontrolled, could survive in many South Australian areas, including Adelaide.

A comprehensive analysis of the South Australian outbreaks was done by Derek Maelzer on data up to 1987. Maelzer concluded that the pattern of outbreaks was consistent with repeated introductions. Certainly, the data from roadblock interceptions indicates a mechanism by which regular introductions could occur.

Management of detection, eradication and general operations associated with fruit flies in South Australia is covered in the Pest Eradication Unit's Operational Manual, which is revised annually. Operations associated with eradication in a commercial orchard district are covered in the Fruit Fly Contingency Plan - Riverland, also revised annually.

From 1947, the first action taken after an outbreak was proclaimed was to search for larvae in fruit in the suspect area, to determine the extent of the outbreak. Fruit in all properties within a half mile radius of the original

sighting, was examined for larvae of fruit fly. These early checks involved large numbers of staff from the Department of Agriculture, including those from country areas, as it was considered important to determine the extent of the outbreak as quickly as possible. By 1971 the procedure for eradicating outbreaks included stripping of all host fruit in the area of one quarter mile radius of the outbreak centre, cover spraying the area within a half-mile radius of the outbreak centre, baiting of the entire area and placing of lure pads between the half mile and the outer perimeter. Baits of protein hydrolysate 10 oz (283.5g); maldison 9 oz (255g); Water 3 gals (13.6L) were squirted onto one or more trees in each house yard.

From 1975, less emphasis has been placed on intensive checking and more emphasis placed the prompt establishment of a baiting program, particularly in the outbreak zone. Technical checking and fruit stripping were labour-intensive and stripping of fruit from trees had little biological support.

Baiting

Baiting, to kill adult flies, has been an important part of the eradication program but, until the early 1970s, was not considered as important as the killing and removal of larvae. The bait used in 1947 was brown sugar and tartar emetic (antimony potassium tartrate), the first as a food lure and the second as a stomach poison.

The bait was applied using a knapsack, at the rate of 6 fl oz per ‘spot’ every 7 days. The sprayers were instructed to apply bait to all trees with fruit or berries that looked as if they may attract a fruit fly, and all ornamental shrubs. Baiting remained on a weekly basis and continued throughout winter until the 31st of October. There were no reports of phytotoxity. This technique minimised danger of contact by householders and other non-target organisms.

After a conference on Fruit Fly, conducted by the Department in 1957, the tartar emetic sugar bait was replaced by a by a protein-insecticide bait, based on the

Operators with knapsack sprays applying protein and insecticide to the foliage of backyard and street trees.

developments of a new attractant method by Dr. L.F. Steiner (USDA) in the early 1950s. In 1962, the bait was altered to a protein/hydrolysate/ maldison/sugar/water mixture, and was applied weekly until the end of October within the outbreak area and in the following year the bait was modified to: protein hydrolysate 21.9% 170g; maldison 255grams active constituent formulated as a wettable powder 142g; Water 4 gal (15.14L).

Baiting and cover sprays

Protein from yeasts is attractive to fruit flies and the females, in particular, need to feed on yeasts naturally occurring on plant surfaces to enable them to produce eggs. In the early days of baiting, a protein produced from flour was used, but it had a high salt content and tended to be phytotoxic. Protein hydrolysate produced from brewer's yeast as a by-product of beer-making is very attractive to fruit flies. Protein autolysate, made by a slightly different process, is presently used because of its low salt content. The bait attracts both male and female flies from many metres away.

Cover sprays are insecticides applied to foliage and fruit, which kill adult flies by direct contact or by residual action. Cover sprays may also be applied to the ground beneath trees to kill adults as they emerge from the soil. The insecticide may also be absorbed into fruit, and kill developing eggs and larvae.

Improvements to baiting techniques

Dr Alan Bateman, CSIRO Division of Entomology in New South Wales trials found that about 20 bait spots applied at equal spacings over an acre of vegetation killed most adult Qflies in the area, most of them within a few hours following the application of the bait. In 1972, Bateman's spot- baiting method (each bait spot containing protein hydrolysate 4gm; maldison 1g active in 100mL water) was introduced to South Australia.

On the 4 January 1974, these eradication procedures were used for the first time on an outbreak of Medfly at Kent Town. Other Medfly outbreaks had occurred in the same year in the metropolitan area. There appeared to be a failure in the bait spraying technique and a meeting was held on the 13-14 February to discuss the problem.

Attending that meeting were Horticultural Branch staff associated with the program and entomologists from the Waite Institute, Roseworthy College, West Australian Department of Agriculture and the CSIRO Division of Entomology. During the discussions, Alan Bateman found that the bait mixture was wrongly mixed, and the concentrations of materials that were used in were inadequate to attract and kill fruit flies; only 1/10th of the necessary protein and 1/2 of the necessary maldison were being applied. At the time, the bait used was: Protein hydrolysate 21% 56g actual instead of 620g; Maldison 25% 70g actual instead of 154g; Water 13.2L.

The failure of baiting to achieve eradication was not a fault in the technique itself, but was a result of the low rates of materials used in the bait mixture. It was also noted that the formulation had been tried against Qfly, but not Medfly, the latter being more difficult to eradicate by baiting. A correctly mixed test batch was checked for phtytotoxicity in an abandoned garden with disastrous results; most trees and shrubs showed extensive salt damage within 72 hours. Following discussions with Sanatorium Health Foods in Western Australia, a suitable protein autolysate was produced with three times the concentration of the (acid) hydrolysate but only one third of the salt (NaCl) content and the cost was the same by

weight. The first baiting of a commercial orchard using low-salt, high protein formulation was used in 1974 when larvae were found in peaches in a suburban backyard on 5 March and in a nearby plum orchard on 7 March.

By March 1974, baiting was integrated with cover-spraying using fenthion within a 1/4 mile radius of the centre of the outbreak, associated with the removal of windfalls and ripe fruit within a 1/8 mile radius. Later in the year, officers of the Horticulture Branch decided that a further investigation of the baiting approach should be made, and that baiting should be the technique used to eradicate any outbreaks during the 1974-75 season.

Formation of Fruit Fly Technical Committee

Following on from the meeting on fruit fly held in February 1974, a group of senior Department of Agriculture officers associated with the detection and eradication of fruit fly was organised to supervise operations. On 12 September 1974, senior Departmental staff met to review the 1973-74 program and to discuss proposals for 1974-75. At that meeting, a Technical Committee called the Fruit Fly Technical Committee was formed to undertake responsibility for the technical aspects of detection and eradication programs. The Committee consisted of the Chief Horticulturist and Chair (Tom Miller), Principal Horticultural Officer (Bill Harris), Officer-in-Charge of the Pest Eradication Unit (Jack Botham) and the Senior Entomologist (Paul Madge). The Committee met again on 11 November and 2 and 19 December, 1974. At these meetings an eradication program for 1974-75 was prepared. The protocol developed for treating an outbreak was recognised by the Committee as a substantial ‘overkill’ and that eradication should consist of distribution of notices to householders; prohibition of the removal of fruit from the outbreak area, concurrent with prompt and intensive bait spraying, and prompt removal of fallen fruit in the outbreak zone.

The baiting program consisted of two baiting teams sent to the outbreak zone to begin spot-spraying, all trees and tall shrubs with theprotein-maldison bait, but avoiding those likely to be damaged by the spray. Spot-spraying in the outbreak zone is done twice weekly for six weeks,

then weekly as in the remainder of the outbreak area. The bait now consisted of: protein autolysate 420g/L protein + 1L; maldison 5% 142mL in 16 L water. Technical maldison with a minimum quantity of formulating solvent was used, as the solvent acted as a repellent to the fruit fly; but some was necessary to enable technical maldison to be mixed with water. Baiting in the remainder of the outbreak area starts at the perimeter moves towards the boundary of the outbreak zone, applying bait at the rate of at least 100 'spots' per hectare once a week. Baiting continues for 9-12 weeks (depending on temperatures and extent of the outbreak) after the last fly or larva is found in the quarantine area.

Baiters in the early days assembling to go out to the outbreak area.

Further improvements to baiting techniques

Until 1977, baiting teams travelled in privately hired vans with the driver employed by the owner of the van. Teams consisted of a ganger and six sprayers who worked in pairs. One sprayer carried a knapsack containing the bait mixture and applied the bait to trees and shrubs in front and rear yards of household properties, while the other carried additional protein and insecticide and assisted his

colleague. When the knapsack was empty, it was filled with water (17 litres) in the street and the protein and insecticide was added from the pre-measured bottles carried. By 1978, government cars were used to tow departmental and hired trailers that carried the necessary equipment. The baiting teams were reduced to a ganger who drove the vehicle and supervised four sprayers who worked in pairs. About 170 properties were baited each day by each pair of sprayers.

In an attempt at quality control, mixing was done at a central point where bait preparation and application could be better supervised. The concentration of bait in the knapsack was checked at random by the Inspector in charge, using a hydrometer. The specific gravity reading was to be 1015 and the checks showed that the bait settled in the knapsack, especially if left standing after preparation. In spite of these precautions, it was discovered in July 1981 that the bait mixture was not correct. In a knapsack with 16 litres of water, the protein was reduced from 1 litre to 850 mL, and the maldison-Hymal® was increased from 142 mL to 147 mL.

In 1982, Bert Hayter, Officer-in Charge, and Nick Perepelicia, supervisor, introduced a procedure in which a pre-mixed bait was carried in bulk tanks on Departmental trailers. These tanks contained 110 litres and were filled 2 or 3 times a day under the supervision of a Departmental Inspector. The bait was kept mixed by a constant-running electric pump. This procedure not only resulted in a more strict control of the preparation of bait (supervised by an Eradication Supervisor) but also resulted in the reduction in costs by reducing the size of the baiting team from five to three. The advantages of this

system over the previous was that it maintained a uniform and accurate mixture of bait, reduced costs by eliminating the need for a sprayer to carry refill bottles of protein and insecticide; a team now consisted of a ganger and 2 sprayers. Each sprayer need only carry in the knapsack, the actual quantity of bait required and hence reduce the workload, more properties could be baited each day by each sprayer and it was not necessary to rely on householders to supply water.

Hydrometer tests were gradually eliminated as the mixing of bait became better supervised. As a further move towards greater efficiency, trailers with 400 litre bulk tanks for bait (a full day's supply) were introduced in 1983. The bait was prepared in the morning and kept agitated during the day. The bait mixture has not been altered since corrections were made in 1982. To make 20 litres of bait, the quantities are: low salt protein autolysate 1L; Maldison 115WV Hymal® 174ml; Water 18.826L. The bait is applied in 100 mL spots to 6-8 fruit trees, shady trees or shrubs in each house yard or 100 spots per hectare.

Knapsack sprayer filled from a 400 L bulk tank services a spraying team for one day.

Cover spraying

Cover spraying to kill adults sheltering on foliage, was used extensively during early eradication campaigns. A sweetened tartar emetic spray was used during 1947 and was replaced by DDT in 1948. Fruit trees near the outbreak centre of infestations were sprayed thoroughly with 0.1% DDT (2lbs of 50% WP DDT in 100 gallons of water). Applications of DDT were first applied in the outbreak zone then extended outwards. The cover and ground sprays were repeated every three weeks. Two sprayers operated each power unit with a 250 ft length of hose attached. By 1950 the Department had 6 power spray units.

Street Trees Sprayed Against Fly

Clipping from 'The News' 29/1/52.

During the late 1950s it was found that DDT could harm bees, particularly if applied when the trees were in blossom. DDT killed natural enemies of insect pests

causing secondary outbreaks, such as the upsurge of red scale at Klemzig in 1957. Nevertheless, DDT continued to be used because the side-effects were not thought to be sufficiently important to justify the omission of this important part of the eradication campaign.

Review of use of DDT

The South Australian Fruit Fly Conference in 1957 recommended that DDT be discontinued because of its side-effects. It was recommended that trichlorfon (Dipterex®) be substituted as a cover spray, since it was being used successfully by commercial growers. However, trichlorfon was not substituted because it had greater mammalian toxicity than DDT. In 1962, DDT was applied every 1 to 4 days within the 1/4 mile radius area and every 21 days outside this area. Spraying continued throughout the winter and spring months. Boxthorns that were trimmed to dimensions laid down under the Noxious Weeds Act, were also sprayed. If these bushes were not trimmed within a specified time, they were sprayed with arsenic under supervision and destroyed.

Increasing public concern about the harmful side effects of DDT led to replacement with a new organophosphate insecticide fenthion (Lebaycid®) as a cover spray in 1963. The possibility of spraying it by air was suggested but it was known that small birds were susceptible to fenthion and there was also a problem of contaminating drinking water collected from household roofs sprayed with insecticide. So, the idea of aerial spraying outbreak areas in Adelaide was never put into practice.

The aim of cover spraying was to contact all susceptible fruit on trees in the outbreak area by a fine deposit of the insecticide. Applications of 0.05% fenthion were made monthly and continued throughout the winter. Later, the concentration of fenthion within the 1/4 mile radius area was increased to 0.08% for the first spray and reduced to 0.04% during each monthly spray thereafter. In the 1/4 to 1/2 mile radius area, the concentration was 0.04%. The mixture at 0.08% concentration was 567g of fenthion (50% Lebaycid®) in 363.6 litres of water.

At that time, fenthion was not used in the United States of America and no analytical techniques were available and

High pressure spray nozzles are used to treat dense foliage.

the breakdown products were unknown. However, in South Australia, fenthion proved to be satisfactory in killing fruit fly eggs and larvae at all stages of development in the fruit tissue.Fenthion was sprayed on an area at 14 day intervals. It could also be used on some plants previously burnt by DDT and was not likely to cause outbreaks of red scale. However, as it was very poisonous to small birds, care was required when spraying near aviaries. Fenthion was also tried as a ground spray, but its usefulness was limited as it was effective in the soil only for a short time.

To protect workers handling fenthion, gloves, overalls and respirators were supplied and the workers were briefed on the correct method of handling and applying cover spray. By 1973, there was the capacity to field 25 teams of sprayers, operating from 25 power spray units.

From about 1972, householders were advised by cards of spraying on their property. The leaflet also contained information on the withholding period before fruit could be consumed and advice on washing the fruit.

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