SIGNIFICANCE OF AND MONITORING FOR ALIEN FRUIT FLIES (TEPHRITIDAE)

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SUMMARY

A wide range of fruits and vegetables are host to fruit flies (Tephritidae). The main genera, in order of increasing economic importance, are *Carpomyia*, *Toxotrypana*, *Callantra*, *Ceratitis*, *Rhagoletis*, *Anastrepha* and *Dacus*. These genera are not present in New Zealand. Freedom from fruit flies must be maintained to ensure the continued success of our expanding horticultural export trade. Fruit fly establishment, even for a short period, would threaten New Zealand's access to world markets and lead to increased production costs. Successful eradication of fruit flies would be greatly facilitated by early detection. A national monitoring programme to ensure early detection is operated by the Ministry of Agriculture and Fisheries.

INTRODUCTION

There are over 4600 described species of fruit flies (Tephritidae). Only one third of these species actually attack fruit and vegetables (Prof. E. Hardy, pers. comm.). The rest feed on other parts of plants such as leaves, flowers or stems; a few are scavengers and one Australian species is known only from termite mounds. Relatively few genera are pests and some fruit flies are even useful for weed control. By far the most economically important group is *Dacus*, followed by *Anastrepha*, *Rhagoletis*, *Ceratitis*, *Toxotrypana*, *Callantra* and *Carpomyia*. Henceforth, 'fruit fly' refers to these genera only.

Strict quarantine procedures are used to minimise the risk of fruit fly introduction to New Zealand (Baker and Cowley 1989; Baker *et al* 1989). This paper summarises the reasons for this and describes the additional monitoring practices used for early detection of fruit fly should it arrive.

SIGNIFICANCE

Fruit flies attack ripening fruits and vegetables i.e., at about harvest time. This means that a packed product may contain an early infestation of fruit flies which would become apparent at marketing. Those countries where fruit flies exist must therefore undertake extensive field control measures to limit infestation, followed by disinfestation treatments to kill any eggs or larvae in fruit. New Zealand is spared these practices as it is the only major fruit producing country in the world which is free of fruit flies.

Tephritids infest a wide range of hosts including pipfruit, stonefruit, citrus, solanums, cucurbits, nuts, berryfruit, subtropical and tropical fruits. A few species infest many hosts. For example, Mediterranean fruit fly (*Ceratitis capitata*) has been reared from over 250 different hosts. Most species, however, are limited to fewer hosts (e.g. 10-50 fruits).

Fruit flies are distributed throughout much of the world. Some species are adapted to tropical conditions while others thrive in cool temperate regions. Table 1 summarises the main climatic regions of the various genera.

The multivoltine life history of many species combined with a relatively long-lived adult stage and highly fecund females results in a high potential for rapid population increase (Bateman 1979; Fletcher 1987). These factors and the close association of fruit flies with harvested fruit or vegetables explain the high quarantine profile of these pests.

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TABLE 1: General climatic regions of various fruit fly genera.

Cool temperate genera	Warm temperate genera	Tropical genera
<i>Toxotrypana</i>	<i>Callantra</i>	<i>Carpomyia</i>
<i>Ceratitidis</i>	<i>Ceratitidis</i>	<i>Callantra</i>
<i>Rhagoletis</i>	<i>Anastrepha</i>	<i>Dacus</i>
	<i>Dacus</i>	

Establishment of fruit flies in New Zealand, even for a short time only, would have serious consequences for our export horticultural industry. Several major markets would be closed, at least temporarily. Eradication procedures (Bateman 1984; Baker 1986; Stephenson 1989) would be implemented immediately. These procedures are constantly re-evaluated through liaison with trading partners and overseas visits to outbreak sites undergoing eradication programmes.

During an eradication campaign, produce for export must be certified to have been grown and packed at least 80 km from an outbreak area. This is the principle of area freedom. Alternatively, produce would require a disinfestation treatment of proven efficacy before overseas markets could be reopened. Research to establish such efficacy would be extensive and time consuming. In addition, field practices to protect crops from fruit fly attack are costly.

MONITORING

Since fruit flies have such a high pest status, a national surveillance system to detect their presence is operated by the Ministry of Agriculture and Fisheries. The system is designed to provide an early warning of a fruit fly outbreak as well as assurance to our trading partners of New Zealand's continued freedom from fruit flies.

The surveillance system is comprised of (i) two types of attractant traps placed nationally, in high risk areas and (ii) regular surveys of fruit crops. High risk areas are, in part, defined as localities that have significant horticulture as indicated on maps prepared by Newsome (1987). Populous regions such as cities and large towns are also targeted together with centres for tourism or trade. The suitability of the climate for fruit fly establishment is also considered in identifying risk areas. Overseas climatic tolerances of various species have been examined and compared with New Zealand (Worner 1988a, 1988b; Baker and Cowley 1989). The definition of risk areas remains deliberately flexible to allow frequent reassessment of trap distributions.

Figure 1 shows the intended distribution of trapping localities throughout New Zealand for October 1989. Trap localities in May 1989 are similar to those shown except for an absence of traps at Whangaparua, Kumeu, Oratia, Otaki, Rangiora, Kaiapoi, Roxburgh, Mosgiel and Balclutha. Traps at present in Westport and Invercargill are under assessment due to the paucity of suitable host trees for trap placement.

The monitoring-surveillance system uses both lure and bait traps. The Lynfield non-sticky, pot type lure trap contains one of three different synthetic pheromones to attract male fruit flies. Combinations of these lures are avoided as they are known to depress trapping efficacy (Dr R. Cunningham, pers. comm.). Each lure is effective for specific groups of fruit flies. The synthetic pheromones used are trimedlure, cuelure and methyl eugenol. Trimedlure is specifically for Mediterranean fruit fly. Cuelure and methyl eugenol are effective for much wider ranges of species. Cuelure attracts melon fly (*Dacus cucurbitae*), Queensland fruit fly (*D. tryoni*) and at least 55 other South Pacific fruit flies, while methyl eugenol is effective for Oriental fruit fly (*D. dorsalis*), peach fruit fly (*D. zonatus*) as well as another 21 South Pacific fruit flies (Drew 1974). Although these synthetic lures are primarily male attractants, females may be captured in lure traps, but generally only when populations of males are very low (Steiner *et al* 1965; Nakagawa *et al* 1970).

Bait traps which incorporate a protein food source are effective in attracting both male and female fruit flies of all genera. These traps are used adjacent to lure traps, observing the minimum spacing of 3 m between traps (Dr R. Cunningham, pers.

Fig. 1: Distribution of fruit fly surveillance trapping localities in New Zealand (October 1989).

comm.). Wherever possible, lure and bait traps are located about 1.6 m high in host trees. Host trees appropriate for trap placement include citrus, pipfruit, stonefruit, subtropicals and nuts.

The present trapping system was implemented in New Zealand in 1985. This system has been accepted by our trading partners. Since 1985 many new horticultural crops have reached the production stage and, as a consequence, there has been a vast increase in the value of New Zealand's horticultural industry. A system providing the earliest possible warning of fruit fly presence is thus required. Over 6500 lure (rather than 1250 at present) and 950 bait traps will be installed in October 1989. These traps will continue to be inspected fortnightly and serviced regularly (fortnightly for bait traps, each 12 weeks for lure traps). Trap servicing includes bait replenishment and lure replacement. The new trap densities will greatly enhance efficacy of fruit fly detection (Cunningham and Couey 1986).

Trap operators are trained and tested in all aspects of trap inspection, servicing and sample submission, through annual workshops. Audit procedures are also carried out. These include placement of marked specimens in traps to check that trap inspection and sample submission procedures are carried out correctly. The Plant Protection Centres at Lynfield and Lincoln provide identification services for any suspect specimens. Trap, lure and bait efficacy trials are conducted in co-operative programmes overseas as these aspects cannot be assessed in New Zealand while the country remains free of fruit flies.

Fruit surveys are also carried out. In recent years, Lynfield Plant Protection Centre has conducted annual surveys on export reject fruit. Quantitative analysis of all insects and mites is fundamental to these surveys. Field officers inspect orchards, packhouses and produce for export every season. Export produce is also examined by quarantine officers. Rejected fruits are sent to the Plant Protection Centres for assessment. These

centres also contribute to pre-clearance certification for exported crops. All lines on which pests have been detected are mandatorily suspended from export, awaiting pest diagnosis from the Plant Protection Centres. Clearly, regular inspection of fruit, as described, provides further assurance of New Zealand's freedom from fruit fly.

If a fruit fly is captured in any trap or larvae are detected in New Zealand grown fruit, eradication procedures (Bateman 1984; Baker 1986; Stephenson 1989) will be implemented immediately.

CONCLUSIONS

Fruit flies (Tephritidae) are critical quarantine pests. New Zealand is free of these pests and has established careful quarantine procedures to minimise the risk of their arrival and establishment. This is supported by eradication plans and the operation of an extensive surveillance and monitoring system. This demonstrates to our trading partners New Zealand's continued freedom from fruit flies. In addition its ability to detect an outbreak early will greatly facilitate successful eradication.

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