EVALUATION OF THE ECONOMIC IMPACT OF NEWLY INTRODUCED PESTS

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ABSTRACT

Evaluating the economic impact of an introduced pest is most useful if it can be carried out before the pest arrives, so that contingency plans for eradicating it can be developed. This has been done by MAFQual (the quality control section of the Ministry of Agriculture and Fisheries) for critical quarantine pests such as Tephritidae (fruit flies). Critical quarantine pests are defined as those which would cause immediate loss of valuable export market access. For quarantine pests (i.e., those serious plant pests which do not occur in New Zealand, but which would not necessarily cause loss of export market access) it is difficult to develop contingency plans in advance. For a quarantine pest, therefore, the decision on whether to attempt to eradicate, contain, or accept the pest must be made after establishment. A cost-benefit analysis must be undertaken comparing all of the costs of an eradication with the benefits of avoiding the damages caused by the introduced pest. Provided the benefits outweigh the costs, eradication can be accepted as a viable option. These procedures were followed before removal of the mite *Bryobia lagodechiana* Reck from a rose garden in Auckland.

Keywords: economic impact; cost-benefit analysis; eradication; *Bryobia lagodechiana.*

INTRODUCTION

Many of the serious pests of horticultural crops in New Zealand are of foreign origin. Introduced pests, such as codling moth (*Cydia pomonella* L.), light brown apple moth (*Epiphyas postvittana* (Walker)), and two-spotted mite (*Tetranychus urticae* Koch), repeatedly cause economic loss when the quarantine requirements of our trading partners are met. For example, 40% of the kiwifruit exported to Japan is fumigated on arrival because of the presence of two-spotted mites — an estimated loss to the industry of $4 to $5 million per annum (R.J. Ivess, pers. comm.). In addition to market access problems, there are the costs of pest control during production or for post-harvest treatments. The development of treatments to facilitate access of cherries and nectarines to Japan has occupied many years of research at a unit cost of $120,000 per scientist per year. Apple growers spend vast amounts of money on sprays to combat light brown apple moth and codling moth. It would clearly be to New Zealand's advantage not to have these introduced pests in the first place. Considerable effort and resource are therefore expended in keeping exotic pests at bay.

EVALUATION OF ECONOMIC IMPACT

An evaluation of the economic impact of exotic pests is of most value if it can be conducted before the pests are established. This enables contingency plans to be developed with definition of the eradication procedures (if any) which should be enforced for a particular pest. Proper cost-benefit analysis must be conducted to prevent expenditure on eradication or containment projects for pests of minor importance.

Predictions about the economic impact of introduced pests are fraught with difficulties. One problem is deciding just what effect a new pest may have in the New Zealand environment. Experience in the United States shows that more than 80% of introduced pests behave differently in their adopted environment compared with their original habitat (Mathys & Baker 1980). Oriental fruit moth (*Cydia molesta* Busck) established in New Zealand in 1976. Although known primarily as a pest of stone fruit in other countries, it has also become a significant pest of apples in New Zealand (Baker 1982). Unexpected host/pest relationships may only come to light many years after the initial introduction, by which time decisions on eradication or containment are no longer possible.

A second difficulty, which affects advanced contingency planning for eradication campaigns, is in predicting which pests are likely to become introduced. In New Zealand, MAFQual monitors all intercepted pests and contaminants of commercial produce, passenger baggage, imported plant material, machinery, and so on. In addition, MAFQual scientists can list likely problem pests through their knowledge of the pests that attack plants in other countries. Unfortunately it has become very evident that most of the insects which have become established, have either not been listed as known pests of any significance overseas or have not been intercepted previously. For example, from a list of some 60 insects and mite species newly recorded in New Zealand during the past decade, only two had been intercepted at ports of entry (Lynfield Plant Protection Centre unpubl. data).

In order to make predictions about exotic pests the first step is to list known pests according to their perceived impact. Knowledge of pests is obtained from literature searches but also, increasingly, through contacts with entomologists overseas and quarantine discussions with trading partners.

As a crucial part of its quarantine policy MAFQual has defined four categories of pests.

(i) *Critical quarantine pests:* establishment in New Zealand would have very serious and immediate effects on market access of export crops. Discovery of these pests would provoke an immediate emergency response aimed at complete eradication. Emergency response procedures may be regarded as an insurance policy, costing in excess of $1 million per year for insect/mite pests alone, but providing protection for a horticultural industry valued at close to $1 billion (R. Frampton, J. Cowley, and R. Baker unpubl. data).

At present the only critical quarantine pests recognised are members of the family Tephritidae (fruit flies). The establishment of a damaging species of fruit fly, such as Queensland fruit fly (*Bactrocera tryoni* (Froggatt)), would lead to immediate loss of market access for our most valuable host crops such as kiwifruit and apples

to Japan, United States, and Australia. The value of these exports alone is around $800 million and so eradication costs of $500,000 to $1 million are easily justified.

(ii) *Quarantine pests:* serious pests not occurring in New Zealand and which, if established, would provoke a measured response. This involves a cost-benefit analysis of the likely effects of the pest, carried out after establishment is confirmed, and leads to decisions on eradication, containment, or acceptance of the pest. An example of a measured response is the joint Forest Service/MAF action in eradicating silkmoths from Auckland in 1983. The most recent example, eradication of *Bryobia lagodechiana,* is given at the end of this paper.

(iii) *Injurious pests:* plant pests already occurring in New Zealand and which would normally not provoke any response, unless the pest was of limited distribution, e.g., oriental fruit moth which does not occur in the South Island (Baker 1982).

(iv) *Contaminants:* these are not regarded as plant pests, e.g., spiders, predatory wasps, and fungus feeding beetles.

COST-BENEFIT ANALYSIS

Whether a decision is made to eradicate or accept a newly introduced quarantine pest depends on cost-benefit analysis. The cost of eradication must include technical and administrative input, treatment and material costs, and the maintenance of facilities and staff capable of carrying out eradication campaigns. There may also be environmental costs (i.e., the treatments used may have an adverse impact on native flora or fauna or other non-target species) and health hazards due to chemical residues. Benefits accrue from the damage which is avoided by removal of introduced pests. Damage may include extra costs of production, the need for post-harvest treatments, the loss of productive capacity, reduction in volume of saleable commodities, and the research costs needed to solve the problems encountered. Provided the benefits outweigh the costs, the decision to eradicate the pest can be accepted.

ERADICATION OF A QUARANTINE PEST, *BRYOBIA LAGODECHIANA*

The exotic mite *Bryobia lagodechiana* was first identified in New Zealand on 17 March 1988, having been found on roses and surrounding weeds in a commercial rose garden at Whenuapai, near Auckland, on 22 February 1988 by a MAFQual field officer. *Bryobia lagodechiana* was initially described from USSR (Reck 1953) and is also known from Japan, Switzerland, and Canada (Livschitz & Mitrofanov 1971). Its host range in these countries includes acquilegia, bean, buttercup, campanula, cucumber, currant, *Galium* spp., honeysuckle, horsetail, mint, sweet pea, thyme, wild vetch, and whortleberry. As a result of surveys within the Whenuapai rose garden, new host records from New Zealand are cleaver, mallow, rose, white clover, and willow.

With such a diverse range of hosts it was considered that there was a high probability that the mite would spread to nearby crops of great importance, such as kiwifruit, apples, and strawberries, as well as shelterbelts. The effect on the rose plants was severe, with dramatic silvering of leaves ruining commercial viability for both local

and export markets. Eggs were laid along the stems, particularly around thorns, making it impossible to remove the pest by physical means, such as leaf stripping.

The rose garden involved imported roses from many countries during the period 1984–86. A survey of other rose nurseries, all known to have imported stocks since 1986, was carried out in Auckland, Timaru, New Plymouth, and Levin. No specimens of *B. lagodechiana* were found in any of these areas. It was concluded, therefore, that the mite was confined to two small areas of roses (including associated weeds) within a single site of approximately 30 ha at Whenuapai.

A decision to attempt eradication was made on the following grounds:

- The mite appears to be highly polyphagous and could threaten extremely valuable export crops;
- It was confined to a very small area, with good access for helicopter and ground spraying;
- A very large number of "highly prized" domestic rose bushes would be threatened;
- The cost of the eradication attempt was calculated at less than $40,000 including $5,000 for materials and spray application;
- The export crop in the infested nursery was valued at $400,000.

The eradication strategy was to carry out aerial spraying with bromopropylate (Neoron), at 3.6 litres a.i./ha, on 14 April with a repeat application on 21 April. Follow-up surveys in May and December, i.e., 2 and 8 months later, indicated that the eradication had been successful. By December the mites should have completed about five generations. Females also have high fecundity (up to 1000 eggs). The absence of mites in surveys was thus highly encouraging, and it seemed likely that the control operations had eradicated the mites from the site.*

Most of the work was carried out by staff of the Lynfield Plant Protection Centre at a cost of $31,250. Other costs were for materials $2,400, application $2,700, and national survey $2,500, making a total expenditure of $38,800.

CHECKLIST FOR FUTURE ERADICATIONS

From the initial discovery of the mites until the survey in December, a large number of actions were needed. The actions are listed here as they form a useful checklist for possible future eradication campaigns and a basis for cost-benefit analysis.

Major actions included:

- Initial discovery, rearing of immature specimens, and identification;
- Surveys of infested property, surrounding areas, nurseries in Auckland, Levin, New Plymouth, and Timaru;
- Literature search for details of host plant relationships and distribution;
- Search of permits issued to nurseries to discover other possibly infested areas;

* Since this paper was prepared additional surveys in February and April 1989 have supported this statement. However, in February 1990 two adult females and a few eggs of *Bryobia lagodechiana* were found on clover leaves among rose rootstocks in one of the previously infested areas. Control measures have been implemented and the area will be closely monitored.

- Reports to MAFQual head office suggesting possible actions, costs, and recommendations;
- Decisions to proceed with national surveys and eradication;
- Obtaining maps;
- Liaison with local council, Ministry of Transport, Police, Health Department, Department of Scientific and Industrial Research, Department of Conservation;
- Drafting of notices and leaflets, and distribution;
- Contracting of operators and spraying infested area;
- Surveys of infested area 1 day before first spray, 4 days after first spray, and 5 days after second spray;
- Monitoring of the area 2 and 8 months after eradication;
- Press releases and answering queries from public;
- Research.

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