Commercial Application and Mass Rearing of Beneficial Insects for Integrated Pest Management

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Interest in alternative strategies for the management of insect and mite pests of commercial crops is growing rapidly. The use of mass-reared beneficial insects can be a valuable tool for the practical application of such strategies. This paper discusses some of the problems associated with the production and use of beneficial insects and offers some suggestions for the future.

INTRODUCTION

Beneficial insect and mite species are presently being mass-reared for use in IPM and biological control programmes in Australia for the control of a number of key pests in horticultural and field crops. At this stage the industry is still very small but will be under pressure to expand as the interest in alternatives to conventional pest management grows. It is important that this growth occurs in a logical and ordered way. This will only happen with cooperation between the horticulture industries, the suppliers of beneficials, and government research facilities.

INTEGRATED PEST MANAGEMENT IN CITRUS—A CASE STUDY

IPM has been practised in citrus in Queensland for 13 years now and has resulted in the reduction of pesticide use by around 80% to 90%, with no adverse effect on fruit quality (Papacek and Smith, 1992). The programme features cooperation between growers, consultants who monitor the crop on a regular basis, government researchers, and suppliers of beneficial insects. A similar programme is operating successfully in South Australia.

The development of integrated mite control strategies in glasshouse and nursery environments is paving the way for the transition to a complete integrated pest management package in the industry. Such a transition will best occur within a cooperative framework as in the citrus example.

BENEFICIAL INSECTS NOW COMMERCIALLY AVAILABLE

Four commercial insectaries presently supply the following range of predatory and parasitic arthropods in Australia.

Supplier	Species available	Target pest
Bugs for Bugs	*Aphytis lingnanensis*	California red scale
Mundubbera Q	*Leptomastix dactylopii*	mealybug (*Planococcus citri*)
	Cryptolaemus montrouzieri	mealybugs
	Chilocorus circumdatus	citrus snow scale
	Chilocorus baileyi	oriental scale
Biological Services	*Aphytis melinus*	California red scale

Supplier	Species available	Target pest
Loxton SA	*Encarsia formosa*	whiteflies
	Typhlodromus occidentalis	spider mites
BioProtection	*Phytoseiulus persimilis*	spider mites
Warwick Q		
Hawkesbury IPMS	*Phytoseiulus persimilis*	spider mites
Richmond NSW		

USE OF BENEFICIAL INSECTS IN IPM PROGRAMMES

Predatory and parasitic arthropods can be used to assist in the control of pest species in the following ways:

Inundative Release. Large numbers are released to exercise control over a pest in a short period of time, much as a conventional pesticide would be used.

Inoculative Release. Release of small to moderate numbers to:

- Supplement relatively low numbers of beneficials in the crop, or
- Re-establish populations of beneficials following adverse conditions such as harsh winters and pesticide application.

Dribble Release. Relatively small numbers of beneficials are regularly added to the crop to prevent flare up of the pest population. This technique has been used successfully in glasshouse and nursery crops in Europe.

PROBLEMS ASSOCIATED WITH THE USE OF BENEFICIALS

There are many issues which make the use of beneficial arthropods much more challenging than the conventional or "3S" (squat, squint & squirt) approach.

1) Monitoring is an essential component of any IPM programme and its importance can not be over emphasized. Most crops have a range of pest species and an understanding of their biology and the inter-relationships between pests and their attendant beneficials is an important facet of practical IPM. Insufficient trained personnel are presently available to fill the increasing demand for scouting in IPM programmes.

2) The identification of pests and beneficials is far more critical in IPM than in chemical programmes because many of the beneficials are extremely host-specific. There is an urgent need for access to taxonomic services and good quality field keys for "on the job" identification of insects and mites.

3) More research is required to achieve a greater understanding of the pest and beneficial complex for each crop. Compatible pesticides charts, release rates, and time after spraying for the re-introduction of beneficials are all pieces of the puzzle that need to be fitted into place.

PROBLEMS ASSOCIATED WITH THE REARING OF BENEFICIALS

The mass-rearing of beneficial insect and mite species is fraught with traps and is not for the faint-hearted.

Seasonality. Many beneficials are required for critical times when the pest is active. This may be for only 2 or 3 months of the year. Often they have to be reared year round in order to supply a narrow market window of a few weeks.

Highly Perishable Product. Most beneficial species are extremely delicate and cannot be stored. What is produced today must be despatched today.

High Labour Input Required. The rearing of beneficials is very labour intensive and requires highly skilled and very dedicated personnel. Many beneficial species need some attention 7 days per week.

Highly Specific Product. Unlike broad-spectrum insecticides, most beneficial species are extremely host specific. This dramatically reduces the market potential and increases the relative cost of production. For instance *Leptomastix dactylopii* is an extremely efficient parasitoid of the mealybug *Planococcus citri*. However, where another species of mealybug is the major pest a different species of beneficial must be used.

Complex Production Systems. Most beneficial species have to be reared on their natural host. For instance *Leptomastix* can only be produced if its mealybug host is first reared on another host such as sprouted potatoes or pumpkins. This means that three living organisms are involved in the production of a single species of beneficial. For large numbers of beneficials to be ready at a critical time all living stages must be well synchronised.

Risk of Contamination. The host insect must be reared in isolation from the beneficial species. The danger of cross-contamination of stock cultures is always high and constant vigilance must be maintained to obviate this threat. It is usually necessary to maintain a constant source of pure back-up cultures to cover the eventuality of cross contamination.

BUREAUCRATIC THREAT TO THE INDUSTRY

Two aspects of bureaucratic interference now threaten the industry.

1) Australia now has legislation in place which could force the producers of beneficial insects to undergo a registration procedure for each beneficial produced. At present this could entail an up front fee of $20,000 and exhaustive efficacy testing for each species. Any such move would almost certainly cripple a small but potentially invaluable industry.

2) The importation of beneficial arthropod species for the control of exotic insect and mite pests has virtually ground to a halt under the weight of the recent Biological Control Act. At a time when the public is demanding reduced pesticide usage and we have 50 years of almost total neglect in the area of biological control to catch up on, this legislation is thwarting a critical aspect of alternative pest management options.

CONCLUSIONS

The successful use of beneficial insects as a strategy for IPM in glasshouses, nurseries and indoor atria will hinge on many factors:

1) The training and deployment of personnel with skills in monitoring and assessment of pest problems and their attendant beneficial species.

2) Need for support and funding for entomological research into the use of beneficial insects.

3) Cooperation at all levels of pest management from suppliers of beneficials to scouts, growers, and researchers.

4) An expansion of the range of beneficial insects available for control of key pests (e.g. thrips) — this may include the importation of suitable exotic species of proven performance.

5) An expanded range of "soft" alternatives to complement the use of beneficials, for example:

- Specific target pesticides such as insect growth regulators (IGRs)
- Biological pesticides such as B.T., virus formulations and nematodes
- Improved pheromone and baiting techniques for targeting specific pests
- Other controls such as coloured sticky traps

Some species currently in the pipeline are:

Species	Target pest(s)
Lindorus lophanthae	armoured scale insects
Aphidius colemani	aphids
Trichogramma spp.	various lepidoptera (caterpillars)

Some beneficials which could be subjects for future research and commercial rearing are:

Target pest(s)	Species
Armoured scales	*Encarsia* spp.
	Chilocorus nigritis
Soft scales	*Scutellista* spp.
	Metaphycus spp.
	Microterys spp.
Leafminers	*Dacnusia* spp.
Thrips	*Anthocorids* (*Orius* spp.)
	Amblyseius spp.
Various (esp.scales, mealybugs, mites, aphids)	lacewings

LITERATURE CITED

Papacek, D. and **D. Smith**. 1992. Integrated Pest Management of Citrus in Queensland, Australia - Recent Developments and Current Status. Proc. Intl. Soc. Citriculture, 1992.