

Integrated pest management in ornamentals information kit

Reprint – information current in 2000



REPRINT INFORMATION – PLEASE READ!

For updated information please call 13 25 23 or visit the website www.deedi.qld.gov.au

This publication has been reprinted as a digital book without any changes to the content published in 2000. We advise readers to take particular note of the areas most likely to be out-of-date and so requiring further research:

- Chemical recommendations—check with an agronomist or Infopest www.infopest.qld.gov.au
- Financial information—costs and returns listed in this publication are out of date. Please contact an adviser or industry body to assist with identifying more current figures.
- Varieties—new varieties are likely to be available and some older varieties may no longer be recommended. Check with an agronomist, call the Business Information Centre on 13 25 23, visit our website www.deedi.qld.gov.au or contact the industry body.
- Contacts—many of the contact details may have changed and there could be several new contacts available. The industry organisation may be able to assist you to find the information or services you require.
- Organisation names—most government agencies referred to in this publication have had name changes. Contact the Business Information Centre on 13 25 23 or the industry organisation to find out the current name and contact details for these agencies.
- Additional information—many other sources of information are now available for each crop. Contact an agronomist, Business Information Centre on 13 25 23 or the industry organisation for other suggested reading.

Even with these limitations we believe this information kit provides important and valuable information for intending and existing growers.

This publication was last revised in 2000. The information is not current and the accuracy of the information cannot be guaranteed by the State of Queensland.

This information has been made available to assist users to identify issues involved in ornamental horticulture. This information is not to be used or relied upon by users for any purpose which may expose the user or any other person to loss or damage. Users should conduct their own inquiries and rely on their own independent professional advice.

While every care has been taken in preparing this publication, the State of Queensland accepts no responsibility for decisions or actions taken as a result of any data, information, statement or advice, expressed or implied, contained in this publication.



Queensland Government



Common QUESTIONS

What can you expect to learn from this section?

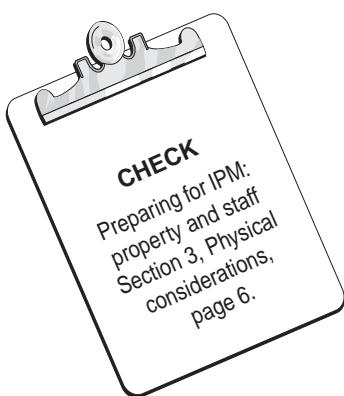
Answers to some of the most commonly asked questions on IPM. They came from a survey of growers and IPM specialists. They will give you a head start to understanding many of the issues.

Contents

| | |
|----------------------------------------------------------------|----|
| About IPM | 2 |
| Cost | 3 |
| Monitoring, and pest and disease diagnosis | 3 |
| Biocontrol | 4 |
| Chemicals | 6 |
| Training | 7 |
| Cultural and physical management strategies or practices | 8 |
| The greenhouse environment | 10 |
| Further information | 11 |



What is IPM?
Section 1



About IPM

What is IPM?

Integrated pest management (IPM) is an approach to pest and disease control that uses regular monitoring to determine if and when treatments are needed. It employs a combination of physical, chemical, cultural and biological tactics to prevent unacceptable damage. Chemical controls are used only when needed, and in the least toxic formulation that is effective against the pest.

I'm only a small grower. Can I use IPM?

Yes. Successful adoption of IPM does not depend on property size. Smaller operators may have more control over crop management than larger enterprises. Smaller operators are on-site more often and are personally involved with more aspects of the production chain. Some small growers have taken the lead in introducing successful IPM programs.

The basic principles of IPM—regular crop monitoring, sound hygiene, property layout, use of beneficial insects and mites, and strategic use of chemicals—are independent of property size and type of operation. Accurate monitoring records and notes for follow-up actions are essential, irrespective of size. Nutrition and water management as well as pests and diseases may also affect plant health. A small grower may need the assistance of a consultant or Nursery Industry Development Officer.

Will an IPM program work in greenhouses?

Yes. Extensive overseas experience has shown that IPM programs can be highly successful in greenhouses. The environment is more contained so that pests and diseases can be excluded through screening and good hygiene. Greater control over environmental growing conditions can benefit biocontrol agents and crop health. Commercially available biocontrol agents work best in greenhouses, but they can also be used in other situations.

Will an IPM program work in open shadehouses, polytunnels and rain shelters?

Yes. IPM can be used in these structures, though the use of biocontrol agents can be less easy to manage than in a totally enclosed environment.

Will an IPM program work in open, full sun areas?

Yes, though different management strategies are needed to get the best results. Good weed control and seasonal management of pests and diseases becomes very important. Monitoring is vital in predicting pest and disease outbreaks. Naturally occurring biocontrol agents will often establish in low chemical use, open production areas.

Kylie Stewart from Colour Options Nursery in NSW, who has been practising IPM for two years, states:

"We compared the costs when we began. We aren't spending as much money now on insecticides, and it is not that expensive to buy the biocontrol agents. The costs worked out about the same."



Know your pests
Section 5



Know your diseases
Section 6



Designing an IPM program: monitoring and decision making
Section 4



Handy Guide 6,
Chemical toxicity to
biocontrol agents

Cost

How much will an IPM program cost?

IPM programs may initially be more expensive than traditional control measures but, once operating successfully, they can be cheaper overall. Many non-chemical pest management strategies, for example the quick removal of diseased plant material, quarantining and inspecting incoming plants, and improved record-keeping, incur little financial cost. The cost depends on the size and complexity of the program. Improved plant quality, reduced chemical and labour costs, better worker comfort and safety, and other benefits will generally offset costs.

Monitoring, and pest and disease diagnosis

What pest or disease is causing this damage?

The major pests and diseases in ornamental crops are covered in this information guide and in the companion diagnostic guide *Pests, Diseases, Disorders and Beneficials in Ornamentals: Field Identification Guide*, see Section 10, *Further reading*. Sections 5, 6 and 7 in this information guide are cross-referenced to pests, diseases and beneficials in the field identification guide and vice versa. Proper diagnosis is crucial to successful IPM. Attend training courses in IPM where available or consult local pest and disease specialists.

How should I monitor for pests and diseases?

There are no hard and fast rules for monitoring for pests and diseases. As you become more proficient at monitoring, you will get to know which crops and areas are most susceptible to pests and diseases. Tools such as sticky traps are available to assist in detection of some flying insect pests.

Should I keep plant varieties with similar pest problems together?

It is advisable to keep such plant varieties together as it makes monitoring for particular pests and diseases easier. It also provides a larger area in which biocontrol agents can be established and helps you evaluate any treatments.

What is an action threshold?

An action threshold is the point at which action is taken to avoid economic plant damage.

How do I decide when to spray?

When you are deciding whether to spray or not, always be guided by the action threshold level for different pests. This can vary for different plant species/crops. Always use monitoring to determine when pests and diseases are present, the location of 'hot spots' and the approximate size of the infestation.

Spraying should be considered as a last option, and spot spraying used wherever possible. Aim to prevent pest outbreaks, crop damage and damage to beneficials. Consider resistance management before spraying.



Pest resistance
Section 1 page 5



Know your pests
Section 5



Using sticky traps
Section 4 page 9



Know your biocontrol
agents
Section 7

Where can I find more information on pests and diseases in my crops?

For more information on pests and diseases in ornamental crops refer to *Section 5, Know your pests* and *Section 6, Know your diseases*. Information on their identification is available in the companion pocket-sized guide *Pests, Diseases, Disorders and Beneficials in Ornamentals: Field Identification Guide*, see *Section 10, Further reading*. Both the information and field identification guides are cross-referenced.

Where can I get help with setting up a monitoring program?

For information on setting up a monitoring program refer to *Section 4, Designing an IPM program: monitoring and decision making* and *Section 9, Directory* for agencies and consultants that can help you with this task.

Where can I buy sticky traps and other monitoring supplies?

Suppliers of sticky traps and other monitoring supplies are listed in *Section 9, Directory*.

How many sticky traps do I need?

Start with one sticky trap per 200 square metres and reduce the number once experience allows you to identify 'hot spots' and points of first entry.

Biocontrol

What is biocontrol?

Biocontrol is the use of beneficial organisms to manage pests and diseases. Biocontrol can be achieved using two approaches—naturally occurring and commercially produced organisms. All of the advice about how to use biocontrol agents in this guide refers to commercially produced organisms, but don't underestimate the value of naturally occurring ones, especially under conditions of reduced pesticide use in an IPM program.

When beneficials are not capable of maintaining pests below the action threshold level, or are not present in the environment, their numbers can be increased by introducing and releasing commercially produced biocontrol agents. It is recommended that you consider using commercially produced biocontrol agents in a preventative manner.

What does biocontrol cost and can I afford it?

The cost of biocontrol varies with the crop, the type of pests and the biocontrol agents used. Biocontrol using commercially produced parasitoids and predators may cost more in the beginning, but the cost often decreases as you become more experienced in monitoring pests and using biocontrol agents. The various side benefits from using biocontrol agents, including worker safety and comfort, can be hard to value, but are significant. Start small, be patient and gradually expand your biocontrol program.



Commercial suppliers
of biocontrol agents
Section 9 page 4

What biocontrol agents are available for pests and diseases?

Consult your local Australasian Biological Control Inc. (ABC) member or IPM consultant for what is commercially available.

Where do I buy biocontrol agents?

Members of the Australasian Biological Control Association Inc. (ABC) produce the biocontrol agents sold in this country. Importation from overseas is illegal and runs the risk of introducing pathogens and contaminants that might have a negative impact on the environment.

How do I know how many biocontrol agents I need, and how often do I release them?

Producers of biocontrol agents can advise on how many biocontrol agents you will need, how to use them and their release rates. Local experience is also helpful.

Can I store biocontrol agents and, if so, for how long?

As a general rule, biocontrol agents are living organisms and should be released immediately on receiving them.

How do I identify and monitor for biocontrol agents in the crop?

Read the product brochures and available literature in advance and familiarise yourself with the appearance of different stages of biocontrol agents. Refer to the companion pocket-sized guide *Pests, Diseases, Disorders and Beneficials in Ornamentals: Field Identification Guide*, see Section 10, *Further reading* for identification of biocontrol agents. Monitor for biocontrol agents in areas where the target pests are usually found.

How long will it take biocontrol agents to control the pest? How do I know if they're working?

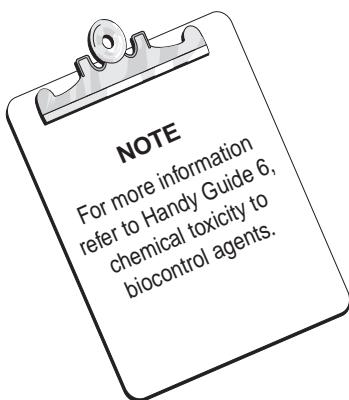
Biocontrol agents are not pesticides. It is much cheaper and more effective to introduce them when pest numbers are very low, so that they prevent pest outbreaks. Do not attempt to use biocontrol when your crop is badly infested. Predators are usually working if you can find them in most pest patches and if pest numbers are declining. Parasites generally take longer to work and should eventually parasitise more than 80% of the target pest stages. Monitoring for both pests and biocontrol agents is essential.

Do environmental growing conditions affect biocontrol agents?

Yes. Most biocontrol agents require moderate temperatures (20° to 30°C) and more than 60% relative humidity to do well. Changes in seasonal conditions can influence the performance of biocontrol agents. South of Queensland, ambient winter temperatures are generally unfavourable for biocontrol agents. In Victoria, South Australia and Western Australia, extreme hot, dry summer conditions can also be a problem.

Environmentally controlled greenhouses should be able to use biocontrol agents throughout the year. In a greenhouse, fans may produce pockets of dry air or cool temperatures, resulting in poor control in these areas. Light quality

or daylength may tip the balance in favour of pests in winter months. Consider using environmental control measures, such as fogging systems and thermal screening, to modify humidity and temperature to benefit biocontrol agents as well as plant growth.



Will biocontrol agents damage the plants after they've eaten all the pests?

No. Some biocontrol agents starve without their normal host, while others may survive on pollen, nectar or fungi.

What chemicals can I use without harming biocontrol agents?

Several chemicals are not harmful to biocontrol agents. Select only from those classified as either soft or *intermediate* and avoid all *hard* chemicals.

Why aren't the biocontrol agents working?

The most common cause of biocontrol agents not working is the presence of pesticide residues in soil, on pots, on foliage or on greenhouse coverings. Temperature, relative humidity, crop characteristics, the health of biocontrol agents and excessive pest numbers may also reduce their effectiveness.

When should I start introducing biocontrol agents?

Biocontrol agents should be released preventatively when pest levels are very low or even beforehand. This may be very early in the growth of the crop and/or at first sign of pests or after use of a compatible chemical. You will need regular monitoring to detect pests and to guide you in the introduction of biocontrol agents.



Know your biocontrol
agents
Section 7

Chemicals

If I use IPM, will I still use chemicals?

Chemicals may still be needed but less toxic and less residual ones should be used. Chemicals should be applied less frequently, with special attention to timing and placement of sprays. Check *Handy Guide 6, Chemical toxicity to biocontrol agents*, for the compatibility of chemicals with commercially produced biocontrol agents before choosing your chemicals.



Registered chemicals
Section 3 page 28

What chemicals are registered for use in my crop?

Refer to *Handy Guide 4, Chemicals currently registered for common pests of ornamentals* and *Handy Guide 5, Chemicals currently registered for common diseases of ornamentals*. Databases of registered chemicals are available to help you choose a chemical for a particular crop. They include *Infopest* from the Department of Primary Industries, Queensland, NSW Agriculture and Northern Territory Department of Primary Industries and Fisheries; *Peskem* from the University of Queensland; the National Registration Authority's *Pubcris* web site; and *Infinder* Farm Chemicals Program, SA.

Do I need training in the safe use of chemicals?

Yes! Spray accreditation is recommended and can be obtained by attending a ChemCert course provided by an accredited trainer in your State.



Pesticide training courses
& information
Section 9 page 19

You cannot buy some chemicals unless you have a current spray accreditation acceptable to the National Registration Authority. Check on your State's requirements.

Most customers see it as highly desirable for growers to be able to demonstrate safe, responsible use of chemicals. One of the best ways to demonstrate this is to obtain an appropriate accreditation. Chemical accreditation courses cover sprayer calibration, occupational health and safety, chemical storage and label use. They do not cover the principles of IPM. Spray accreditation must be renewed every five years.

Do I need to keep a diary of spraying records?

Yes. Records of chemical application are one of the most important pieces of documentation for IPM. In some States, it's a legal requirement. An example of a record sheet for chemical applications has been provided in *Handy Guide 3, Record sheets*. Chemical records allow you to assess costs, evaluate performance and make appropriate adjustments to your IPM program.

You should record what was applied, how much per 100 L and how much spray volume (litres per area), what pest or disease was targeted, what area of the property was sprayed, the crop, what application method was used, by whom, and when the application took place. You should also record when biocontrol agents were used, their names and release location and rates. Don't forget to include the name of the crop sprayed. Also include weather conditions if treating outdoor areas, and temperature and humidity if spraying in a greenhouse.

Training

Where do I get training in IPM?

A national training course on IPM for ornamental producers providing competency-based learning is available. It supports competencies in developing an IPM program. The course is available from several providers. Contact your State industry association for details.

What does the training involve?

An accredited training course will give you the skills to run an IPM program on your property. The course should cover:

- monitoring (setting up sticky traps; number of plants to check)
- identification of pests and diseases
- record keeping (building up a pest and disease history; keeping spray records)
- choice of control and management tactics to be considered
- the theory of IPM
- instruction on designing and implementing an IPM program on your property.



Accredited IPM trainers
& courses
Section 9 page 21

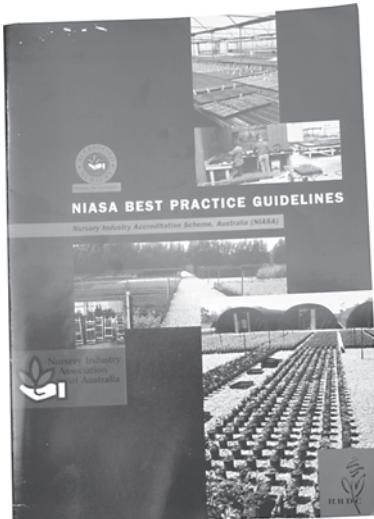
Do I need to employ a consultant/specialist?

No, but it's a good idea. Many growers may initially employ a consultant while they build up their confidence and skills in implementing IPM; some may wish to retain their consultant as a permanent part of their IPM system. Consultants can do a lot of the routine work in monitoring and assist in making management recommendations to remove the pressure from the grower. They can be of great assistance in planning the introduction of IPM and in training staff.

Specialists employed by government agricultural departments and some private consultants provide diagnostic services such as identification of pests and diseases and advice on nutrient management. Growers can access diagnostic services directly or through a consultant.



Consultants
Section 9 page 17



NIASA Best Practice Guidelines;
*every nursery producer should have
a copy. Also visit the NIAA web site:
www.niaa.org.au/*



NIASA Best Practice
Guidelines
Section 10 page 4

Cultural and physical management strategies or practices

What is NIASA?

NIASA is the Nursery Industry Accreditation Scheme, Australia. It involves the accreditation of nurseries and allied businesses that implement the Best Practice Guidelines.

What is cultural control?

Cultural control refers to modifications to crop management that help reduce the threat of pests and disease. These modifications promote good plant health and include appropriate crop selection, fertilisation, irrigation, sanitation and potting medium, using barriers to keep insect pests out, sticky traps, using resistant plant varieties, and employing disinfestation (temperature, ultraviolet, chemical) treatments to kill harmful organisms.

Are there cultural control methods for leaf diseases?

Yes. They include correct light intensity, good moisture and nutrition. You can make the growing environment unfavourable for disease development by improving ventilation to reduce relative humidity, increasing plant spacing and by modifying irrigation methods to keep leaves dry.

What do I do with waste products?

Plant residues from previous crops and spent growing media must be removed from the production area and away from new crops and media storage areas to avoid pest and disease contamination. Spent materials can be disposed of in a landfill. Recycled soil can be disinfested by heat or fumigation before storage or re-use on site. All used materials should be immediately removed from the production areas.

Do I need to treat irrigation water for diseases?

Surface water supplies (dams, springs, streams or wells) are most likely to be occasionally or continuously contaminated with disease organisms. Dam water is particularly at risk because it catches runoff from cropping land. Bores are usually free of disease organisms.

Treatment options include chlorination, bromo-chlorination, chlorine-dioxide, slow sand filtration, ultraviolet radiation, ozonation and microfiltration. Individual circumstances will determine which option is best. Consult your Industry Development Officer for advice.

If water is to be re-used on crops, it most often needs decontamination. It can be re-used without treatment on non-host crops (pastures) away from the property but should not be used on mother stock in gardens.



All production areas should start weed-free, but ...



... only weed matting can guarantee this will continue

Should I grow containerised plants on weedmat over soil, sand or road base?

No. These materials eventually become contaminated with root rot and other disease organisms, which live in them for long periods and continually re-invade new crops placed on them. Wastewater from diseased pot plants runs over these materials and carries disease organisms into the drainage holes of previously uninfected containerised plants.

The surfaces of these materials become depressed, allowing puddling and poor drainage around the base of containers, increasing disease incidence. It is difficult to sterilise these surfaces after contamination. Gravel is generally the most economical base, and should be of 10 mm or greater aggregate size and at least 7 to 8 cm in depth. Ideally plants should be placed on benches.



Good example of a footbath

Does new potting mix contain weed seeds, pests and diseases?

The various ingredients of potting mixes can come with weed seeds, pests and disease organisms. Peat moss can contain *Pythium*, *Chalara*, and also fungus gnat larvae; and river sand and loams *Pythium*, *Rhizoctonia* and *Phytophthora*. Bagasse (sugar cane residue) and sawdust may contain rove beetles, scarab larvae and occasionally earthworms. All ingredients may contain weed seeds. Composted pine barks and newly composted sawdusts are relatively clean.

The greatest source of contamination of unused media and media ingredients is poor storage. Drainage water and dust can contain fungal pathogens and weed seeds. Fungus gnats are attracted to organic matter and can infest poorly stored media. Ideally, potting mix should be stored in containers or on well-drained pads and covered. Contaminated media should be fumigated or heat-treated if it is to be used in production.

Do I need to disinfect containers (pots) before re-use?

Yes. Recycled containers are a regular source of disease (mainly root diseases) and root mealybug contamination. They can be disinfected by aerated steam, fumigation or washing in a disinfectant solution.

Why should I disinfect propagation tools and working surfaces?

Diseases can contaminate propagation tools and working surfaces and these can be spread to other parts of the property or to clean plants if not properly disinfected after each use.

Do I need to disinfect propagating materials (cuttings, seeds, divisions)?

You probably need to disinfect propagating materials to avoid introducing pests and diseases. The mother stock plants should be raised under clean conditions and treated before collecting propagating material or divisions. This can greatly reduce the entry of diseases and pests into the propagation house.

In addition, seed dressings and other chemical treatments can reduce diseases in seedlings, and chemical dips and drenches can minimise cutting infections before and after rooting. Heat treatment of seeds is effective for bacterial diseases. Be aware that pesticide residues on propagation materials can have a significant effect on the establishment of biocontrol agents. Choose treatments carefully. Obtain certified stock from accredited suppliers.

The greenhouse environment

What greenhouse conditions encourage pests and diseases?

Low and high humidity and high temperature can trigger pest and disease outbreaks. Stress is also a major issue. Unscreened vents and doorways allow free entry of pests.



Preparing for IPM: property
and staff
Section 3 page 6



Preparing for IPM: property
and staff
Section 3 page 9



Preparing for IPM: property
and staff
Section 3 page 11

How do I stop condensation in my greenhouse?

The easiest and most effective way of getting rid of condensation is to ventilate the greenhouse to reduce excess humidity. Ventilate in the late afternoon so that the greenhouse and the crop do not start the night exposed to moist humid air. Wet leaves can cause serious disease problems.

Is insect screening a good idea? Does it interfere with ventilation?

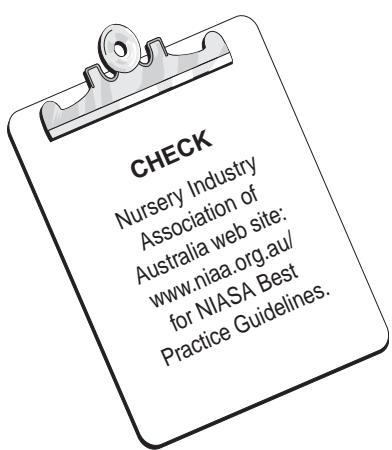
Screening is a good idea because it prevents a lot of flying insects from reaching the crop, and it can cut down on the amount of spraying needed, but it needs to be used in conjunction with good hygiene. Ventilation can be affected but there are ways around this. Where there is a prevailing wind, finer grade screens can be fitted to the upwind side of the greenhouse and coarser grade screens downwind. Fans can also be used to assist air movement through the screens.



Vent screening is an effective way of excluding pests from a greenhouse. The increased surface area will provide adequate air flow in the greenhouse

What can I do to get a clean start?

Periodically or between crops or plant intakes, clean out greenhouses or greenhouse bays. Disinfect floors, walls and benches. Apply high phosphate detergent to remove pesticide residues. Hang sticky traps to detect residual flying pests. Fumigate if necessary. Start with clean propagating material from accredited suppliers.



Further information

Where do I find more information on IPM?

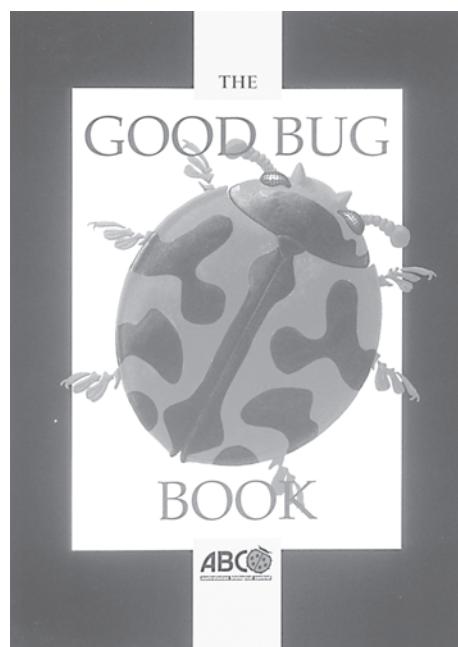
Information on IPM is available from several sources:

- The nationally available IPM training course.
- GrowSearch Australia information service has a huge database of horticultural information. Ring them at the Queensland Department of Primary Industries on (07) 3286 1488 or (07) 3281 3784 for details.
- Industry magazines such as *Australian Horticulture* and *Australian Nursery Manager*, and overseas publications such as *Grower*, *Grower Talks*, and *Greenhouse Grower*.



Directory, Section 9
and Further reading
Section 10

- The Internet provides a lot of information on IPM, much of it based on US conditions. Try these key words in searches: greenhouse, integrated pest management, biological control.
- State departments of agriculture (New South Wales, Victoria, Western Australia) and primary industries (Queensland, South Australia, Tasmania, and the Northern Territory).
- Members of the Australasian Biological Control Association Inc., who produce biocontrol agents commercially for growers.
- Commercial horticultural consultants offer support through pest monitoring, supervising monitoring, providing a sticky trap counting service and giving recommendations.



The Good Bug Book (Section 10 page 7) provides useful information about commercially produced biocontrol agents