INDUSTRY BIOSECURITY PLAN

FOR THE NURSERY & GARDEN INDUSTRY

Threat Specific Contingency Plan

Poinsettia thrips

(*Echinothrips americanus*)

Plant Health Australia

April 2010

Plant Health AUSTRALIA

Nursery & Garden Industry Australia

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1 Purpose and background of this contingency plan

This contingency plan provides background information on the pest biology and available control measures to assist with preparedness for an incursion into Australia of Poinsettia thrips (*Echinothrips americanus*). While many species of thrips occur throughout the world, this document will only refer to Poinsettia thrips (*Echinothrips americanus)*, one of the species of thrips found in greenhouses in eastern Northern America.

This contingency plan provides guidelines and options for steps to be undertaken and considered when developing a Response Plan to this pest. Any Response Plan developed using information in whole or in part from this contingency plan must follow procedures as set out in PLANTPLAN and be endorsed by the National Management Group prior to implementation.

This contingency plan was developed for the Nursery and Garden Industry Australia (NGIA), and therefore is focussed on production nurseries covered by this association. In the event of an incursion, operations not covered by the NGIA (e.g. retail nurseries) will not be eligible for Owner Reimbursement Costs, as defined in the Emergency Plant Pest Response Deed, if affected by actions carried out under the Response Plan.

The information for this plan has, in part, been obtained and modified from "National Diagnostic Protocol for Poinsettia Thrips, *Echinothrips americanus*" developed by Laurence Mound and the Australian Government Department of Agriculture, Fisheries and Forestry (Mound 2008) with additional information sourced electronically. Modifications and additions to the plan have been completed to make the information relevant to an incursion of Poinsettia thrips for the NGIA.

2 Australian nursery industry

The Australian nursery industry is a significant horticultural sector with a combined supply chain (production to retail/grower) valued at more than $6 billion dollars annually. The industry employs approximately 45,000 people spread over more than 20,000 small to medium sized businesses including production nurseries and retail outlets. The industry is located predominantly along the Australian east coastline and in major inland regions servicing urban and production horticulture.

Nursery production adds value to Australia's primary industry's sector and in 2008/2009 is forecast to contribute more than $2 billion to the national economy. Nursery production is a highly diverse primary industry servicing the broader $14 billion horticultural sector within Australia (Table 1).

Table 1. *Nursery production supply sectors within Australian horticulture*

Production Nursery	Horticultural markets	Economic value
Container stock[1]	Ornamental/urban horticulture	$2 billion retail value
Foliage plants[1]	Interior-scapes	$87 million industry
Seedling stock[2]	Vegetable growers	$3.3 billion industry
Forestry stock[3]	Plantation timber	$1.7 billion industry
Fruit and nut tree stock[2]	Orchardists (citrus, mango, etc)	$5.2 billion industry
Landscape stock[1]	Domestic & commercial projects	$2 billion industry
Plug and tube stock[4]	Cut flower	$319 million industry
Revegetation stock[1]	Farmers, government, landcare	$109 million industry
Mine revegetation	Mine site rehabilitation	Value unknown
	Total horticultural market value	**$14.5 billion**

3 Eradication or containment determination

The decision to eradicate should be based on the potential economic impact of host damage resulting from Poinsettia thrips infestation, the cost of eradication and on technical feasibility. Eradication costs must factor in long term surveys to prove the success of the eradication program. A minimum of one year with no detections of the pests will be necessary to confirm that no Poinsettia thrips remain before pest free status can be declared.

No specific eradication matrix has been determined for Poinsettia thrips; however the general decision process as outlined in Figure 1 should be followed in determining if an incursion of this pest will be eradicated or managed/contained. The final decision between eradication and management will be made through the National Management Group.

[1] Data sourced from Market Monitor

[2] Data sourced from Horticultural Handbook 2004

[3] Data sourced from ABARE 2005

[4] Data sourced from industry

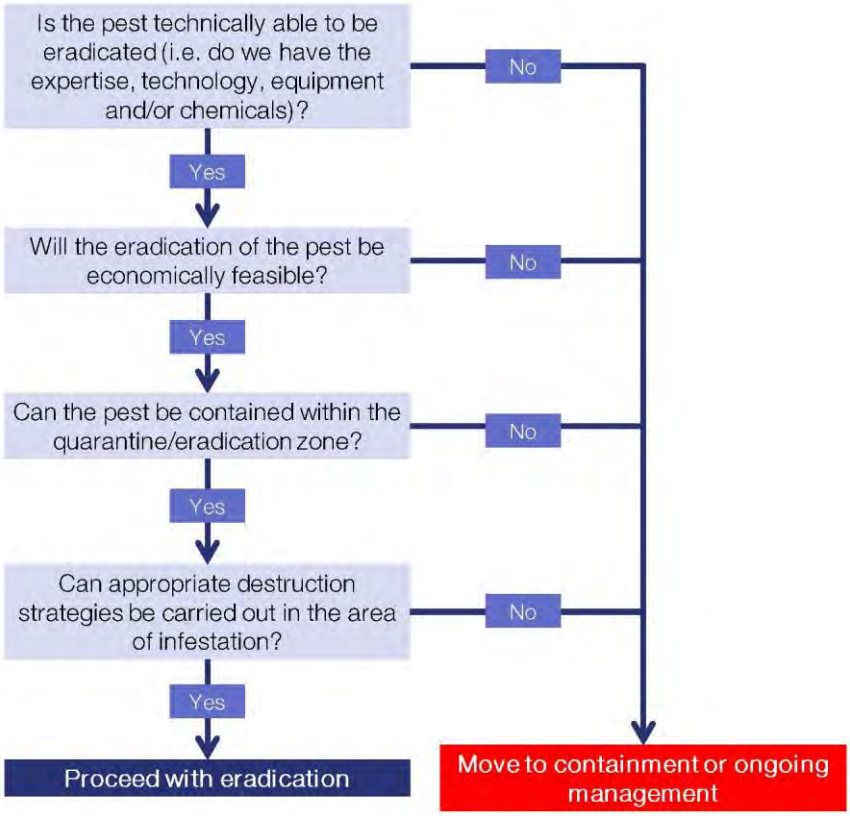

Figure 1. *Decision outline for the response to an exotic pest incursion*

4 Pest information/status

4.1 Pest details

Common names:	Poinsettia thrips
Scientific name:	*Echinothrips americanus* Morgan, 1913
Synonyms:	*Dictyothrips floridensis* Watson, 1919
Taxonomic position:	Kingdom, Animalia; Phylum, Arthropoda; Class, Insecta; Order, Thysanoptera; Family, Thripidae

4.1.1 Background

The Poinsettia thrips (*Echinothrips americanus)* is a member of a small genus, one of the eight already described species of the *Echinothrips* genus (Mound and Kibby 1998). It is the economically most important one with the majority of these *Echinothrips* species native to the warmer areas of eastern America. All species are from the Americas, and of these only *E. americanus* has become widespread. Described originally from Florida and known to be native throughout much of eastern North America, it has been introduced to Hawaii and has become widely distributed by the

horticultural trade throughout much of Europe as a newly established pest in greenhouses (Vierbergen *et al*. 2006). Moreover, it has been recorded in Thailand, is established in Japan, has been intercepted in quarantine in Taiwan, and can be expected to be introduced to yet further countries, including Australia, in association with the widespread trade and transport of particular species of decorative house plants.

Echinothrips americanus is an emerging thrips pest and one of the eleven species of thrips found in greenhouses and ornamental plant species in eastern USA and in some parts of Europe. Relatively little is currently known about this species. It may also be a vector of viruses and there are potentially pesticide resistant strains in the USA.

Although this thrips is not known to vector any plant viruses, other thrips in this family have been identified as vectors. Feeding activity by larvae and adults results in small chlorotic areas on leaves with some shrivelling of leaves. Moreover, soiling of leaves occurs with small black faecal droplets, and these are similar to those associated with the common greenhouse thrips (*Heliothrips haemorrhoidalis*). Although not at all closely related, these two species appear to share the habit of feeding primarily on older leaves, not on young, rapidly growing tissues.

As a member of the family Thripidae, the adults of this thrips have two pairs of slender wings that bear marginal fringes of long cilia. In contrast to most members of this family, the setae on the longitudinal veins on the front pair of wings are unusually long and prominent. The body is dark brown but, in contrast to the Common greenhouse thrips, *Heliothrips haemorrhoidalis* that also has a head with reticulate sculpture, the internal pigment of the body is bright red, and the forewings have transverse light and dark coloured bands (Mound 1998).

In its native range, this thrips is particularly associated with *Impatiens* plants, but in greenhouses it has a wide host range and breeds readily on plant species from a wide range of families. It is considered a pest on Poinsettia (*Euphorbia pulcherrima*) as well as various Araceae such as *Deffenbachia* and *Syngonium* that are grown for their ornamental foliage, although it often causes little obvious damage. In the Netherlands it is reported as a pest of *Capsicum* crops grown in greenhouses, and establishes considerable populations on common greenhouse weeds such as *Cardamine hirsuta*. In Thailand, a considerable population was found breeding on the weed *Eichornia crassipes* (water hyacinth). Despite being usually bisexual, this thrips is reported to breed parthenogenetically (no partner required), with virgin females having been reported to produce both sexes (Oettingen & Beshear, 1994). This method of breeding, and the unusually wide host range, combined with the ability to develop considerable populations on certain plants without obvious damage to the leaves, increases the probability that the species will become established in further areas.

The insect is polyphagous and once established in a greenhouse *Echinothrips americanus* can be difficult to remove.

4.1.2 Life cycle

E. americanus has gained notoriety as a major floricultural pest. Within the preferred *E. americanus* breeding ground of greenhouses the thrips may breed continuously and have several generations per year. Female *E. americanus* deposits eggs separately in slits along the underside of leaves or along the stem. Developmental time of the egg depends upon both temperature and host species with warmer temperatures being associated with faster development. At 20°C the egg stage averaged 15.5 days and the immature took 18.4 days for a total of 33.9 days. Under warmer conditions development was faster; at 30°C the egg stage took 5.8 days and the immature only 5.6 days for a total of 11.4 days from egg to adult (Oetting and Beshear 1994). Development stage also varied with different host species. All stages were present throughout the year in the glasshouse. Adults and immature stages were not very active and would remain in the same area of the leaf for days if not disturbed.

Colonies of young larvae congregate on the underside of leaves and individuals are often covered with a watery globule of excrement. As the larvae feed, they develop through four instars, molting between each stage. The more mature larvae are typically found along leaf midribs or among dried-up foliage. After a larval stage of approximately 18 days, poinsettia thrips pupate. Adult thrips that emerge shortly thereafter are less voracious feeders than the larvae. Adults live 40 or more days and females may reproduce with or without mating. Males of this species are rarely found.

Figure 1a *Adult and larvae on the underside of leaf;* **Figure 1b** *Larvae. Image courtesy of Lance Osburne University of Florida.*

Figure 2 *Adult female. Image courtesy of Laurence Mound, ANIC, CSIRO*

The adult female *Echinothrips americanus* is about 1.6 mm long and the male about 1.3 mm long (Figure 2). The general body colour is dark brown with red between the abdominal segments. Segment 1 and 2 of the antenna are dark brown, and segments 3 and 4 are lighter with prominent setae on veins. Forewings are pale grey at base, middle and tip with light brown in between.

The egg is elongate and clear to white in colour.

Immediately after hatching the larvae are clear but they change to white and then become light or pale yellow after feeding. The second stage larvae become cream coloured before moulting pre-pupae.

Both pupa and pre-pupa are found on leaf tissue and move only when disturbed. Pre-pupa is white with short wing pads and antennae extend forward. The pupa is white with long wing pads with the antennae bent back over the body.

4.1.3 Dispersal

Poinsettia thrips run, crawl or jump and can move rapidly. Flight is the major method of dispersal and they can be dispersed aerially on wind currents. The major method of passive dispersal is by transport on affected fresh plant material.

4.2 Affected hosts

4.2.1 Host range

Poinsettia thrips have a wide host plant range and are extremely polyphagous. It prefers the plants from the Araceae and Balsaminaceae families, though it has been found on plants belonging to some 24 families (Vierbergen, 1998). In the USA the most common hosts are those belonging to the genera *Dendranthema, Euphorbia, Impatiens* and *Medicago* as well as some woody ornamentals, but the insect is confirmed to reproduce on at least 40 cultivated and 59 wild-growing different host plant species (Oetting et al., 1993). The most important host plants of *Echinothrips americanus* in England are those belonging to the genera *Syngonium* and *Dieffenbachia*, in the greenhouses it can also move to plants from the following genera: *Acalypha, Dracaena, Fatsia, Ficus, Hibiscus, Spathiphyllum* and *Chrysanthemum* (Dunn and O'Connor 1997; Collins, 1998; Scarpelli and Bosio, 1999; University of Florida website; University of Florida website). In the Netherlands this thrips represents an ever increasing threat for the sweet pepper in the greenhouses. Generally speaking, the host plant range of *Echinothrips americanus* is more like that of the thrips belonging to the subfamily Panchaetothripinae and less like that of the thrips belonging to the subfamily Thripinae. The only plant groups where this pest has not been found are ferns and needle-leafed trees (Vierbergen, 1997).

4.2.2 Current geographic distribution

Poinsettia thrips were originally described in Florida and are known to be native throughout much of eastern North America and elsewhere as a greenhouse pest (Vierbergen 1998; Mound and Marullo 1996). It is a relatively newly established pest in European greenhouses with the first interception at Brentford, UK in 1989 (Collins 1998). It spread rapidly across Europe between 1995 and 2004 and is currently reported in at least 19 countries (Vierbergen et al 2006; Varga and Fedor 2008). The species has been introduced to Hawaii and has become widely distributed by the horticultural trade throughout much of Europe, and parts of Asia. Current distribution of Poinsettia thrips is displayed in Table 2.

Table 2. *Current worldwide distribution of the Poinsettia thrips*

Continent	Countries
Asia	Thailand, Japan, Taiwan
Europe	Netherlands, Austria, Italy, Ireland, Sweden, Norway, Poland, Bulgaria, Croatia, England
North America	United States of America, Canada

4.2.2.1 POTENTIAL DISTRIBUTION IN AUSTRALIA

Based on climatic conditions, the Poinsettia thrips has the potential to become readily distributed through Australian glasshouses.

4.2.3 Symptoms

This species is likely to be detected only by direct observation of the black adults, because damage to the leaves of plants is sometimes minimal. This thrips feeds on leaf tissue and the damage is very similar to the damage caused by an attack of leaf-feeding mites with light chlorotic spots on the leaf. Their numerous but shallow punctures result in injured tissue with a shrunken appearance, and the light colour is a result of the cell components, including chlorophyll, being removed. Infested leaves will have numerous black specks on them that are faecal droppings of the thrips. It may be found feeding on both the upper and lower surfaces of leaves, as the insect lives on the leaf surface for development stages, but is usually more common on the lower surface. *E. americanus* can sometimes be found in flowers (Oetting et al 1993; Oetting and Beshear 1994; Collins 1998; Mound 2008). Even when present in high numbers *E. americanus* is infrequently observed on yellow sticky traps, assessment should therefore be made on leaf counts and observations directly on leaves.

4.3 Diagnostic information

An identification key to the seven known species of *Echinothrips* is available in Mound & Marrulo (1996). Four of these seven species are highly distinctive, but are not considered a quarantine concern:

Echinothrips subflavus Hood can be distinguished from the other members of the genus by its yellow body colour, because the other six species are all brown. This species lives on the needles of *Tsuga* in eastern North America.

Echinothrips asperatus Hood and ***E. pinnatus*** Hood are both known only from single female specimens collected in southern Brazil. These differ from other all other members of the genus in having distinctively broad, fringed apices to the major setae on the head, pronotum and forewings.

Echinothrips selaginellae Mound is known only from Costa Rica, living on one species of *Selaginella*, and is distinguished by the acutely pointed major setae on the forewing, and the lack of long setae on the pronotum.

The other three species in the genus are all polyphagous with extensive distributions in the Americas.

Adult *E. americanus* are both recognizable and distinguishable from other thrips by their appearance and structure. It is possible for the species to be discerned by their general appearance, including the dark brown body with red internal pigment, the slender antennae with at least two segments

largely yellow, the unusually slender forewings that have transverse light and dark bands and bear conspicuously long setae, and the bicoloured legs with brown femora and extensively yellow tibiae (Figure 3).

Figure 3 *Adult female, Echinothrips americanus Image courtesy of Laurence Mound, ANIC, CSIRO*

These characters contrast with those of the Greenhouse thrips, *Heliothrips haemorrhoidalis*, the only species in Australia with which *Echinothrips* might be confused. That species also has the head and pronotum reticulate, but has no red internal pigment, yellow legs, and paler forewings (Figure 4).

Figure 4 *Adult Heliothrips haemorrhoidalis Image courtesy of Laurence Mound, ANIC, CSIRO*

The immature or larvae stages of Poinsettia thrips are readily distinguished from those of other species of *Thripidae* by the following: their body colour is predominately yellow and eyes are red, the dorsal surface has no obvious sculpture, abdominal tergites each have three pairs of long, weakly fringed setae and the head has three pairs of long, weakly fringed setae.

Full diagnosis and identification to the species level requires an expert in thrips of the Thripidae family. A diagnostic protocol for Poinsettia thrips has been developed through the Subcommittee on Plant Health Diagnostic Standards (**www.daff.gov.au/sphds**).

The State Chief Plant Health Manager will select the diagnostic facilities to be used during a response to a Poinsettia thrips incursion. Contact details for a number of diagnostic facilities can be found in Section 9.2 (page 43).

4.4 Pest risk ratings and potential impacts

A pest risk analysis has been carried out on this pest, taking into account the entry, establishment and spread potentials, together with the economic and environmental impact of establishment. A summary of these ratings are shown in Table 3. Based on this information, Poinsettia thrips are considered a **medium-high** overall risk to Australia.

Table 3. *Pest risk ratings for Poinsettia thrips as determined in the Nursery and Garden IBP (Plant Health Australia, 2008)*

Potential or impact	Rating
Entry potential	Medium
Establishment potential	High
Spread potential	High
Economic impact	Medium
Overall risk	**Medium**

4.4.1 Entry potential

Rating: MEDIUM

A possible method of entry of Poinsettia thrips into Australia would be the importation of nursery plant stock. Evidence suggests that once introduced into the United Kingdom, Poinsettia thrips spread rapidly in greenhouses across Europe. Its rapid spread together with its broad host range shows Poinsettia thrips to be successful opportunists that may have been overlooked during import inspection, due to its small size and minimal signs of damage to the leaves.

Poinsettia thrips may also enter as a hitchhiker on plant material and transport machinery.

From this information, the entry potential has been rated as **medium.**

4.4.2 Establishment potential

Rating: HIGH

The wide host range of Poinsettia thrips together with suitable environmental conditions, would allow for the establishment of Poinsettia thrips in greenhouses and in many regions of Australia. Therefore the likelihood of establishment in Australia following entry is considered **medium**.

The similar climates to Eastern USA and Europe that are available in parts of Australia and the Poinsettia thrips presence for many host species would suggest that this species would readily establish. Thrips can have a high reproductive potential especially under greenhouse conditions and do not require males for reproduction.

4.4.3 Spread potential

Rating: HIGH

Natural physical barriers (e.g. deserts/arid areas) may prevent these pests spreading unaided but adults are capable of flight and adults and immature forms may spread undetected via the movement of vegetative host material. The relevance of natural enemies in Australia is not known.

Poinsettia thrips rapid spread across Europe, its broad host range and method of breeding (section 4.1.1), combined with the ability to develop considerable populations on certain plants without obvious damage to the leaves, increases the probability that the species will become established in further areas. The spread potential is considered **high**.

4.4.4 Economic impact

Rating: MEDIUM

The economic importance of the pest is determined by the damage it causes on the cultivated plants. Plant damage is more significant when Poinsettia thrips numbers are high. When in higher abundance it can be more easily detected due to the colour contrast between its body and plant tissue. Plant injury is caused primarily by direct mechanical damage caused by sucking. Plant lesions appear in most cases as light spots or silvering of leaves, thereby reducing the aesthetic features of ornamentals in the Netherlands plant market value is severely affected as a result of this cosmetic damage to ornamentals (Kaas 2001). The appearance of the plant would also suffer because of black faecal material on the leaves.

4.4.5 Environmental, amenity and human health impact

No environmental impacts are known for this species.

5 Pest management

5.1 Response checklist

The following checklist (Table 4) provides a summary of generic requirements to be identified and implemented within a Response Plan.

Table 4. *Checklist of requirements to be identified in a Response Plan*

Checklist item	Further information
Destruction methods for plant material, soil and disposable items	Sections 6.1.1 and 6.1.2
Disposal procedures	Section 6.1.5
Quarantine restrictions and movement controls	Section 6.3
Decontamination and property cleanup procedures	Section 6.5
Diagnostic protocols and laboratories	Sections 4.3 and 9.2
Trace back and trace forward procedures	Section 6.6
Protocols for delimiting, intensive and ongoing surveillance	Section 5.2
Zoning	Section 6.4
Reporting and communication strategy	See PLANTPLAN

A range of specifically designed procedures for the emergency response to a pest incursion and a general communication strategy refer to PLANTPLAN (Plant Health Australia, 2009). Additional information is provided by Merriman and McKirdy (2005)[5] in the Technical Guidelines for Development of Pest Specific Response Plans.

5.2 Surveys and epidemiology studies

Information provided in Section 5.2.1 to 5.2.3 provides a framework for the development of early detection and delimiting surveys for Poinsettia thrips in Australia.

Where Poinsettia thrips are found in a production nursery that is in close proximity to potential host trees and shrubs, periodically inspect nearby hosts for signs of thrips infestation by examining leaves closely. Infested sources within the production nursery may provide an opportunity for Poinsettia thrips to spread to trees and shrubs outside the production nursery.

Agricultural inspectors and other production nursery visitors should avoid moving infested plant material between production nurseries. Shoes, tools and vehicle tyres should be thoroughly washed of soil and then sanitised with a registered disinfectant. Extra precaution should be taken when working in areas known to be infested, including disposable overboots that may be used and disposed of on-site.

[5] Available on the PHA website (**www.planthealthaustralia.com.au/go/phau/biosecurity/general-biosecurity-information**)

5.2.1 Technical information for planning surveys

When developing surveys for Poinsettia thrips presence and/or distribution, the following characteristics of the pest provide the basic biological knowledge that impact on the survey strategy:

- Poinsettia thrips have a wide host range and share a number of similarities with other thrips. The larvae produce droplets of dark faecal material soiling and damaging the leaves similar to that produced by the larvae of the common Greenhouse Thrips, *Heliothrips haemorrhoidalis* (Oetting and Beshear 1994).
- Endemic host species in Australia are likely to be numerous and widely dispersed.
- The risk of pest movement on machinery, equipment and personal effects is high.
- Production nursery greenhouses and significant proportions of Australia have favourable climatic conditions for Poinsettia thrips spread and establishment.
- As Poinsettia thrips spread readily in a greenhouse or production nursery environment the tracing of plant material from one nursery to another needs to be taken into consideration.

5.2.2 Surveys for early detection of an incursion in a production nursery

Effective ways to monitor Poinsettia thrips in commercial production nurseries are:

- Poinsettia thrips are small (1.3 – 1.6 mm) and difficult to see.
- As the thrips (adult and larva) are small, detection is therefore dependent on careful visual inspection, preferably supplemented by use of a hands lens magnifier. The immature thrips are sluggish in their movements. Larval and pupal stages are pale yellow to orange in colour with faint brown areas that are not readily seen until an operator has experience in their identity (Mound 2008).
- Even with high numbers, *Echniothrips americanus* is infrequently seen on yellow sticky traps.
- The preferred method for detection of thrips species is to beat the leaves with a small heavy trowel over a clean plastic surface.
- Visual detection of leaves is not successful when the thrips are present in low population levels.
- Targeted surveillance should be focussed on high-risk areas. These include commercial propagators and production nurseries involved with the import and export of cut flowers and other nursery produce.

If an incursion of *Echniothrips americanus* is to be eradicated in a production nursery, it must be detected early, before the insect has had the opportunity to disperse to a large extent. It is therefore

necessary to consider pathways and plan surveys accordingly. Important points to consider when developing early detection surveys are:

- Awareness information should be targeted at people who are in regular close contact with potential hosts in high risk areas or movement vectors (e.g. production nursery operators).
- The greatest entry risk currently comes from importation of host plants or other goods. Therefore surveys at importing production nurseries and ports are required.
- Systematic and careful inspection of production nursery crops and propagative plant material is essential to prevent introduction of Poinsettia thrips and limit its spread within, and from infested production nurseries. Early detection of the pest, while at very low levels, will provide the best chance of eradication.
- An inspector must be trained to recognise the basic identification of all stages of Poinsettia thrips, including adults, eggs and larvae, as well as other endemic thrips of the Thripidae family for comparison (see Section 4.3). A production nursery layout map that includes approximate locations of known host species will be required to develop a strategy for surveys. A survey map should include species and cultivar names, locations, approximate quantity and sources of targeted plants within the area. During the survey walkthrough, record the date, observations, and sampling information directly onto the survey map. The recorded information should be reviewed and used to develop the most efficient survey strategy each time the production nursery is inspected.
- Note, the species is likely to be detected only by direct observation of the adults, because damage to the leaves of plants is sometimes minimal.
- As with all thrips species, the quickest method of discovering these insects on a plant is to beat the leaves with a small heavy trowel over a clean plastic surface. Visual inspection of leaves can be successful in discovering the presence of thrips, but is more dependent on operator efficiency, and is less likely to be effective when populations are low than a simple and careful beating method is needed (Mound 2008).
- New stock or cuttings of hosts should be monitored closely. Note also outside sourced plants on survey maps for weekly examination.

5.2.3 Delimiting surveys in the event of an incursion

- In the event of an incursion, information from delimiting surveys will be used in the decision-making process.
- The size of the survey area will depend on the size of the known infested area and the insect population size, as well as prevailing winds and movement of plant material during the period prior to detection.

- Thrips can fly and can readily spread long distances by floating with the wind or being transported on infested plants. New thrips introductions can pose serious threats and complicate identification of naturalised thrips.
- Initial surveys should be carried out in a 1.5 km radius of the initial detection.
- All potential host species (refer to Section 4.2 and 9.1) should be surveyed.
- If the incursion is in a populated area, publication and distribution of information sheets and appeals for public assistance may assist.

5.2.4 Collection and treatment of samples

Protocols for the collection, transport and diagnosis of suspect Emergency Plant Pests (EPPs) must follow PLANTPLAN (Plant Health Australia, 2009). Any personnel collecting samples for assessment should notify the diagnostic laboratory prior to submitting samples to ensure expertise is available to undertake the diagnosis.

All sample containers should be clearly labelled with the name, address and contact phone number of both the sending and receiving officers. In addition containers should be clearly labelled in accordance with the requirements of PLANTPLAN (Plant Health Australia, 2009). Containers should be carefully sealed to prevent loss, contamination or tampering of samples. The Chief Plant Health Manager will select the preferred laboratory. Additional labelling includes the identification of plant species/parts affected, location of nursery and affected plant within the nursery (preferably with a GPS reading) as well as symptoms and an image if available.

Refer to PLANTPLAN for packing instructions under IATA 650.

5.2.4.1 COLLECTION OF SPECIMENS

Sampling procedures

Samples can be collected by hand (by beating the leaves and collecting on a plastic surface). All life stages are found on the plant material. The eggs are deposited on the underside of leaves or along the stem, with young larvae congregating on the underside of leaves and more mature larvae found along leaf midribs or amongst dried-up foliage.

Adults of *Echinothrips* are easy to recognise and distinguish from other thrips at the appropriate magnification by their appearance and structure. If adults are absent the larvae of *Echinothrips americanus* should be collected as the larvae can be distinguished from those of other species of Thripidae (Mound 2008).

Sticky traps

Sticky traps have been used for the sampling of endemic thrips. However there is no overseas literature supporting the use of sticky traps for detection of Poinsettia thrips.

Number of specimens to be collected

Where possible, collect multiple specimens representative of all life stages of the population available. Adult thrips are preferred, as the adult life stage is the easiest with which to confirm identification.

Record the identity of the host plant where the thrips were collected. Record the location, preferably as GPS co-ordinates, or alternatively, a map reference or distance and direction from a suitable landmark. If the land is privately owned, record the owner's details including contact telephone numbers.

How to preserve insects

Specimens to be kept in a 1.5 ml vial in 60% ethanol as this has proved to be superior to 70% ethanol for the genetic analyses (DNA extraction) of various representatives of the Thysanoptera order (Trdan 2002). By keeping the specimen in ethanol, the original colour is better preserved and the specimen remains suitable for morphological analyses. Samples in ethanol are to be refrigerated at a temperature of 2-4^{o}C pending analysis.

How to transport insects

Vials containing the samples in a preservative should be sealed to avoid leakage and packed in a manner to minimise shock to the vials (i.e. with cushioning material in a strong box). It is important to ensure that vials are completely filled with preservative so as to remove excess air which, through movement of the vial, will allow agitation of the preservative and quickly degrade the specimen.

Live insects should be packaged in a strong, sealed container.

A word of caution:

- Where a quarantine situation occurs, special authority will be needed to remove live exotic insects from the quarantine area.
- Transport/airline regulations may preclude the transportation of ethanol. Contact the relevant transport authority or company for advice.

How to collect and send plant samples with eggs, larvae or pupae

Adults are the preferred stage for identification. However, if an adult Poinsettia thrip is not available for collection, the larvae can be used for identification (Mound 2008). Where these life stages are

attached to plant material, it may be appropriate to send the plant part with the insect attached to avoid damaging the sample. In this case, plant samples should be packed between sheets of dry newspaper (for stem etc.) or moist paper (for leaves) and sealed in a plastic bag. Each sealed bag should be placed in a second bag along with additional paper to absorb excess moisture. Bagged samples should then be placed in a non-crushable container with paper, bubble or foam to fill the remaining space and protect samples during transit.

Precaution

Overheating or desiccation of samples prior to despatch should be prevented. Samples may be stored in a fridge (4-10°C) for a few days if necessary.

Receipt

On receipt of the samples the diagnostic laboratory should follow strict quarantine and processing guidelines. In keeping with ISO 17025 refer to PLANTPLAN (Plant Health Australia, 2009).

5.2.5 Epidemiological study

The extent of infestation in a production nursery, on a property or within a region will depend on the initial population size and whether conditions have been favourable for the pest to spread from the initial location. Sampling should be based upon the origins of the initial suspect sample(s). Factors to consider will be:

- The proximity of other susceptible plants to the initial infestation source, including both current and previous crops. This will include crops in the production nursery or on the property with the initial detection and those on neighbouring properties.
- Machinery or vehicles that have been into the infested area or in close proximity to the infestation source.
- The extent of human movements into and around the infested area. A possible link to the recent importation of plant material from other regions should also be considered.
- The source of any production nursery stock propagation material.
- If any other crops have been propagated from the same source and/or distributed from the affected production nurseries.
- Depending on the temperature and environmental conditions Poinsettia thrips can have multiple generations per year.

- As evidenced by its rapid spread across Europe, Poinsettia thrips is a successful opportunist and easily overlooked during import inspection, due to minimal signs of damage when at low levels and its small size.

5.2.6 Models of spread potential

No models of spread potential have been developed for Poinsettia thrips.

5.2.7 Pest Free Area guidelines

Determination of Pest Free Areas (PFAs) should be completed in accordance with the International Standards for Phytosanitary Measures (ISPMs) 8 and 10 (IPPC, 1998a, 1999).

General points to consider are:

- Design of a statistical delimiting field survey for the presence of the insect on host plants (see Section 5.2 for points to consider in the design).
- Surveys should be completed as described in the BioSecure *HACCP* manual (Nursery and Garden Industry Australia, 2008), including monitoring processes (summarised in Table 5 and Table 6), indicator plants and weed monitoring.
- Surveys should also consider alternative hosts (see Sections 4.2.1 and 9.1) and not be limited to the primary infested host.
- Information (including absence of the pest) should be recorded.

Table 5. *Summary of monitoring processes for protected production areas as described in BioSecure HACCP Guidelines*

Wear protective clothing when handling suspect samples
Walk at random through the area in a zigzag pattern
Take at least 10 minutes to inspect 10-20 plants or plug trays per 100 m^2 of production area
Inspect the tops and bottoms or leaves, looking for any direct evidence of insects
Inspect the entire plant if it has less than 6 leaves, or from larger plants select six leaves from all parts of the plant (upper, lower, middle) and examine them individually
Inspect the length of all stems and branches for insects and symptoms
During individual plant inspection, strike the foliage over a white sheet of paper, or a paper or plastic plate to dislodge small insects for easier viewing
If any plants show suspect symptoms or evidence of eggs or larvae (refer to Section 4.2.3) take a sample (refer to Section 5.2.4) to be formally diagnosed (refer to Section 4.3)
Check for a problem that have occurred regularly in the past, until you are certain it is not present
Record on the 'Crop Monitoring Record' sheet the presence or absence of the pest
Routinely inspect growing areas and remove alternate hosts and reservoirs of the pest, including weeds, crop residues and old plants that will not be marketed

Additional information is provided by the IPPC (1995) in Requirements for the Establishment of Pest Free Areas. This standard describes the requirements for the establishment and use of PFAs as a risk management option for phytosanitary certification of plants and plant products. Establishment and maintenance of a PFA can vary according to the biology of the pest, pest survival potential, means of dispersal, availability of host plants, restrictions on movement of produce, as well as PFA characteristics (size, degree of isolation and ecological conditions).

Table 6. *Summary of monitoring processes for field production areas as described in BioSecure HACCP Guidelines*

Wear protective clothing when handling suspect samples
Pay particular attention to areas on the windward side, the sides bordering ditches, canals or other uncultivated areas and growing block centres
Place a flag or other marker at the entrance to the block or sampling area at the beginning of each inspection
Vary the entrance point in the sampling area (1 m to 3 m) for each subsequent sampling so that the same plants are not inspected each time
Walk at random through the area in a zigzag pattern
The scout should follow the same general pattern at each sampling
Make an effort to select those plants that appear less healthy for visual inspection
Take at least 10 minutes to inspect 10-20 plants or plug trays per 100 m^2 of production area
Inspect the tops and bottoms or leaves, looking for any direct evidence of insects
Inspect the entire plant if it has less than 6 leaves, or from larger plants select six leaves from all parts of the plant (upper, lower, middle) and examine them individually
Inspect the length of all stems and branches for insects and symptoms
During individual plant inspection, strike the foliage over a white sheet of paper, or a plastic or paper plate to dislodge small insects for easier viewing
If any plants show suspect symptoms or evidence of eggs or larvae (refer to Section 4.2.3) take a sample (refer to Section 5.2.4) to be formally diagnosed (refer to Section 4.3)
Check for a problem that have occurred regularly in the past, until you are certain it is not present
Record on the 'Crop Monitoring Record' sheet the presence or absence of the pest
Routinely inspect growing areas and remove alternate hosts and reservoirs of the pest, including weeds, crop residues and old plants that will not be marketed

5.3 Availability of control methods

5.3.1 General procedures for control

- Keep traffic out of affected areas and minimize movement in adjacent areas.
- Adopt best-practice property hygiene procedures to retard the spread of the pest.
- After surveys are completed, and permission has been obtained from the Chief Plant Health Manager or OCPPO, destruction of the infested plant material is an effective control.

- On-going surveillance of infested areas is required to ensure the pest is eradicated.
- Do not use any material from infested plants for propagation.

5.3.2 Chemical control

Poinsettia thrips can be controlled easily with insecticides but as a successful opportunist or invader it can be a problematic pest in greenhouses, where more environmentally acceptable means of pest control are being applied.

Unlike some other thrips species (*Thrips tabaci*, *Frankliniella occidentalis*) which are known to develop a resistance to insecticides rather quickly, *Echinothrips americanus* is known to be much less resistant and can be relatively easily controlled with most of the commonly used insecticides active against this insect (Oetting et al 1993; Oetting and Beshear 1994; Reynaud 1998; Vierbergen 1998).

Acephate and cyfluthrin were used successfully in Italy (Scarpelli and Bosio 1999), whilst heptenophos and malathion were found to be effective in England (Macdonald 1997).

Existing control programs may be effective for some hosts (e.g. broad spectrum pesticide applications) but not be effective for all hosts.

Any chemicals used for the eradication or control of Poinsettia thrips in Australia must be registered for use through the Australian Pesticides and Veterinary Medicines Authority (APVMA). For information regarding this process visit the APVMA website (**www.apvma.gov.au**).

5.3.3 Biological control

Biological control is still under investigation. In greenhouses in the Netherlands, some predators of *E. americanus* has been reported in association with various crops (Van Scheldt et al., 2002). These include three species of Aeolothripidae (*Aeolothrips tenuicornis, Franklinothrips orizabensis, F. vespiformis*), one species of Phytoseiidae (*Amblyseius limonicus*), two species of Anthocoridae (*Orius laevigatus, O. majusculus*), one species of Lygaeidae (*Geocoris punctipes*), two species of Miridae (*Dicyphus hesperus, Macrolophus caliginosus*), and one species of Chrysopidae (*Chrysoperla carnea*). Of these, *M. caliginosus* was considered to be the most effective at limiting population growth of *E. americanus*.

5.4 Market access impacts

Within the AQIS PHYTO database (**www.aqis.gov.au/phyto**), there is currently no additional phytosanitary statement required declaring Poinsettia thrips is not known to occur in Australia (as at March 2010). Should Poinsettia thrips be detected or become established in Australia, countries may require a specific declaration or supplementary measures upon export. Latest information can be found within PHYTO, using an Advanced search “Search all text” for *Echinothrips americanus.*

6 Course of action

Additional information is provided by the IPPC (1998b) in Guidelines for Pest Eradication Programmes. This standard describes the components of a pest eradication programme which can lead to the establishment or re-establishment of pest absence in an area. A pest eradication programme may be developed as an emergency measure to prevent establishment and/or spread of a pest following its recent entry (re-establish a PFA) or a measure to eliminate an established pest (establish a PFA). The eradication process involves three main activities: surveillance, containment, and treatment and/or control measures.

6.1 Destruction strategy

6.1.1 Destruction protocols

- General protocols:
    - No plant material should be removed from the infested area unless part of the disposal procedure.
    - Disposable equipment, infested plant material or growing media/soil should be disposed of by autoclaving, high temperature incineration or deep burial.
    - Any equipment removed from the site for disposal should be double-bagged.
    - Machinery used in destruction processes need to be thoroughly washed, preferably using a detergent or farm degreaser.

6.1.2 Decontamination protocols

Machinery, equipment and vehicles in contact with infested plant material or growing media/soil, or present within the Quarantine Area, should be washed to remove plant material and growing media/soil using high pressure water or scrubbing with products such as a degreaser or a bleach solution (1% available chlorine) in a designated wash down area. When using high pressure water, care should be taken not to spread plant material. High pressure water should be used in wash down areas which meet the following guidelines:

- Located away from crops or sensitive vegetation.
- Readily accessible with clear signage.
- Access to fresh water and power.
- Mud free, including entry and exit points (e.g. gravel, concrete or rubber matting).
- Gently sloped to drain effluent away.

- Effluent must not enter water courses or water bodies.
- Allow adequate space to move larger vehicles.
- Away from hazards such as power lines.
- Waste water, growing media/soil or plant residues should be contained (see Appendix 18 of PLANTPLAN [Plant Health Australia, 2009]).
- Disposable overalls and rubber boots should be worn when handling infested plant material or growing media/soil in the field. Boots, clothes and shoes in contact with infested plant material or growing media/soil should be disinfected at the site or double-bagged to remove for cleaning.
- Skin and hair in contact with infested plant material or growing media/soil should be washed.

Procedures for the sterilisation of plant containers and growing media are provided within the BioSecure *HACCP* Guidelines, however, in the event of a Poinsettia thrips incursion, additional or modified procedures may be required for the destruction of the pest. Any sterilisation procedure must be approved for use in the endorsed Response Plan.

6.1.3 Priorities

- Confirm the presence of the pest.
- Limit movement or people and prevent movement of vehicles and equipment through affected areas.
- Stop the movement of any plant material that may be infested with the pest.
- Determine the strategy for the eradication/decontamination of the pest and infested host material.
- Determine the extent of infestation through survey and plant material trace back and trace forward.

6.1.4 Plants, by-products and waste processing

- Any growing media/soil or infested plant material removed from the site should be destroyed by (enclosed) high temperature incineration, autoclaving or deep burial.
- As the pest can be mechanically transmitted, plant debris from the destruction zone must be carefully handled and transported for destruction.

- Infested areas or production nursery yards should remain free of susceptible host plants until the area has been shown to be free from the pest.

6.1.5 Disposal issues

- Particular care must be taken to minimize the transfer of infested plant material or insects from the area.
- Host material, including leaf litter, should be collected and incinerated or double bagged and deep buried in an approved site.

6.2 Containment strategies

For some exotic pest incursions where eradication is considered impractical, containment of the pest may be attempted to prevent or slow its spread and to limit its impact on other parts of the state or country. Containment is currently being considered for inclusion within the Emergency Plant Pest Response Deed (EPPRD). The decision on whether to eradicate or contain the pest will be made by the National Management Group, based on scientific and economic advice (see Section 3, page 7).

6.3 Quarantine and movement controls

Consult PLANTPLAN (Plant Health Australia, 2009) for administrative details and procedures.

6.3.1 Quarantine priorities

- Plant material and growing media/soil at the site of infestation to be subject to movement restrictions
- Machinery, equipment, vehicles and disposable equipment in contact with infested plant material or growing media/soil, or present in close proximity to the site of infestation to be subject to movement restrictions

6.3.2 Movement controls

Movement controls need to be put in place to minimise the potential for transport of the pest, and this will apply to all plant material, growing media and other items within the quarantined area.

Movement of people, vehicles, equipment and plant material, from and to affected properties or areas, must be controlled to ensure that the pest is not moved off-property. Movement controls can be achieved through the following, however specific measures must be endorsed in the Response Plan:

- Signage to indicate quarantine area and restricted movement into and within these zones.
- Fenced, barricaded or locked entry to quarantine areas.
- Movement of equipment, machinery, plant material or growing media/soil by permit only. Therefore, all non-essential operations in the area or on the property should cease.
- Where no dwellings are located within these areas, strong movement controls should be enforced.
- Where dwellings and places of business are included within the Restricted and Control Areas movement restrictions are more difficult to enforce, however limitation of contact with infested plants should be enforced.
- If a production nursery is situated within the Restricted Area, all nursery trading must cease and no material may be removed without permission, due to the high likelihood of pest spread. Movement restrictions would be imposed on both host and non-host material.
- Residents should be advised on measures to minimise the inadvertent transport of Poinsettia thrips from the infested area to unaffected areas.
- Clothing and footwear worn at the infested site should either be double-bagged prior to removal for decontamination or should not leave the site until thoroughly disinfected, washed and cleaned.
- Plant material or plant products must not be removed from the site unless part of an approved disposal procedure.
- All machinery and equipment should be thoroughly cleaned down with a high pressure cleaner (see Section 6.1.2) or scrubbing with products such as a farm degreaser or a 1% bleach (available chlorine) solution, prior to leaving the affected area. Machinery should be inspected for the presence of insects and if found, treatment with insecticide may be required. The clean down procedure should be carried out on a hard surface, preferably a designated wash-down area, to avoid mud being re-collected from the affected site onto the machine. When using high pressure water, care should be taken to contain all plant material and mud dislodged during the cleaning process

6.4 Zoning

The size of each quarantine area will be determined by a number of factors, including the location of the incursion, biology of the pest, climatic conditions and the proximity of the infested property to other infested properties. This will be determined by the National Management Group during the production of the Response Plan. Further information on quarantine zones in an Emergency Plant Pest (EPP) incursion can be found in Appendix 10 of PLANTPLAN (Plant Health Australia, 2009). These zones are outlined below and in Figure 2.

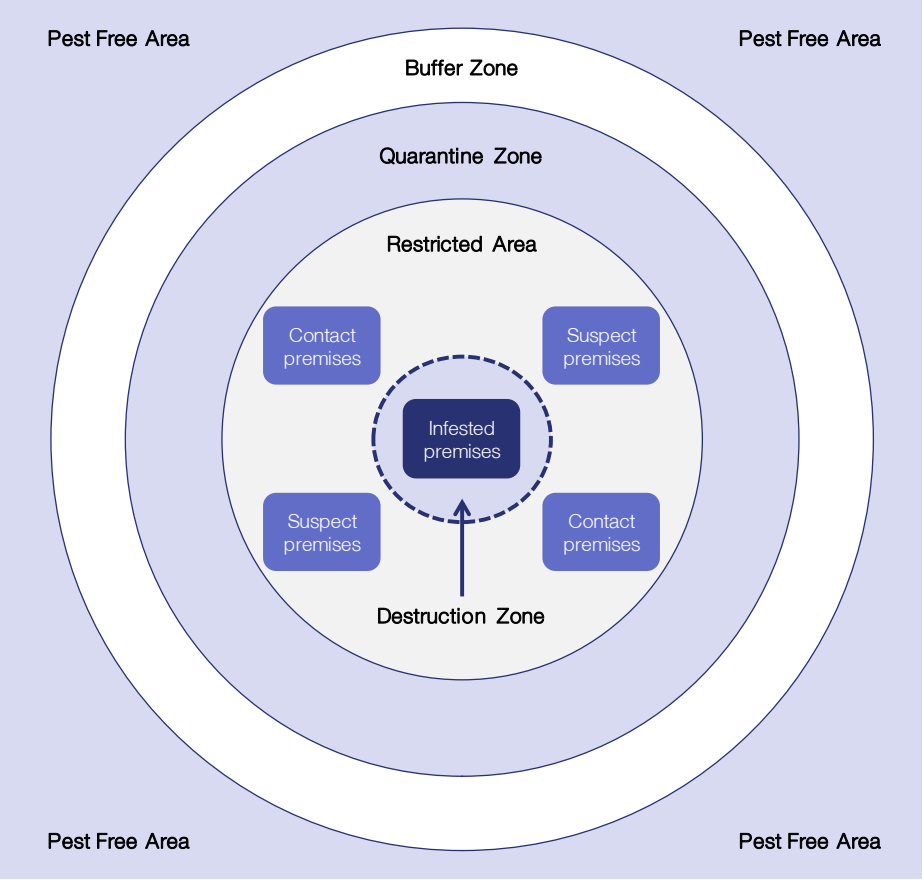

Figure 2. *Schematic diagram of quarantine zones used during an EPP incursion (not drawn to scale)*

6.4.1 Destruction Zone

The size of the destruction zone (i.e. zone in which the pest and all host material is destroyed) will depend on the ability of the pest to spread, distribution of the pest (as determined by delimiting surveys), time of season (and part of the pest life cycle being targeted) and factors which may contribute to the pest spreading.

All host plants should be destroyed after the level of infestation has been established. The delimiting survey will determine whether or not neighbouring plants are infested and need to be destroyed.

Non-host plant material within this zone may be destroyed, based on recommendations in the Response Plan. The Destruction Zone may be defined as contiguous areas associated with the same management practices as, or in contact with, the infested area (i.e. the entire production nursery, property or area if spread could have occurred prior to the infection being identified).

Particular care needs to be taken to ensure that plant material (including non-hosts) is not moved into surrounding areas.

6.4.2 Restricted Area

The Restricted Area is defined as the zone immediately around the infested premises and suspected infested premises. The Restricted Area is established following initial surveys that confirm the presence of the pest. The Restricted Area will be subject to intense surveillance and movement control with movement out of the Restricted Area to be prohibited and movement into the Restricted Area to occur by permit only. Multiple Restricted Areas may be required within a Control Area.

6.4.3 Quarantine Zone

The Quarantine Zone is defined as the area where voluntary or compulsory restraints are in place for the affected property or properties. These restraints may include restrictions or movement control for removal of plants, people, growing media/soil or contaminated equipment from an infested property.

6.4.4 Buffer Zone

A Buffer Zone may or may not be required depending on the incident. It is defined as the area in which the pest does not occur but where movement controls or restrictions for removal of plants, people, soil or equipment from this area are still deemed necessary. The Buffer Zone may enclose an infested area (and is therefore part of the Control Area) or may be adjacent to an infested area.

6.4.5 Control Area

The Control Area is defined as all areas affected within the incursion. The Control Area comprises the Restricted Area, all infested premises and all suspected infested premises and will be defined as the minimum area necessary to prevent spread of the pest from the Quarantine Zone. The Control Area will also be used to regulate movement of all susceptible plant species to allow trace back, trace forward and epidemiological studies to be completed.

6.5 Decontamination and property clean up

Decontaminant practices are aimed at eliminating the pest thus preventing its spread to other areas.

6.5.1 Decontamination procedures

General guidelines for decontamination and clean up:

- Refer to PLANTPLAN (Plant Health Australia, 2009) for further information.
- Keep traffic out of affected area and minimize it in adjacent areas.
- Adopt best-practice property hygiene procedures to retard the spread of the pest between growing areas/fields and adjacent properties.
- Machinery, equipment, vehicles in contact with infested plant material or growing media/soil present within the Quarantine Zone, should be washed to remove growing media/soil and plant material using high pressure water or scrubbing with products such as a degreaser or a bleach solution in a designated wash down area as described in Section 6.1.2.
- Only recommended materials are to be used when conducting decontamination procedures, and should be applied according to the product label.
- Infested plant material should be disposed of by autoclaving, high temperature (enclosed) incineration or deep burial.

6.5.2 General safety precautions

For any chemicals used in the decontamination, follow all safety procedures listed within each MSDS.

6.6 Surveillance and tracing

6.6.1 Surveillance

Detection and delimiting surveys are required to delimit the extent of the outbreak, ensuring areas free of the pest retain market access and appropriate quarantine zones are established.

Initial surveillance priorities include the following:

- Surveying all host growing properties and businesses in the pest quarantine area.

- Surveying all properties and businesses identified in trace-forward or trace-back analysis as being at risk.
- Surveying all host growing properties and businesses that are reliant on trade with interstate or international markets which may be sensitive to Poinsettia thrips.
- Surveying production nurseries selling at risk host plants.
- Surveying other host growing properties and backyards.

6.6.2 Survey regions

Establish survey regions around the surveillance priorities identified above. These regions will be generated based on the zoning requirements (see Section 6.4), and prioritised based on their potential likelihood to currently have or receive an incursion of this pest. Surveillance activities within these regions will either allow for the area to be declared pest free and maintain market access requirements or establish the impact and spread of the incursion to allow for effective control and containment measures to be carried out. Detailed information regarding surveys for Poinsettia thrips have been outlined elsewhere in this plan (refer to Section 5.2).

Steps outlined in Table 7 form a basis for a survey plan. Although categorised in stages, some stages may be undertaken concurrently based on available skill sets, resources and priorities.

Table 7. *Phases to be covered in a survey plan*

Phase 1	• Identify properties that fall within the buffer zone around the infested premise • Complete preliminary surveillance to determine ownership, property details, production dynamics and tracings information (this may be an ongoing action)
Phase 2	Preliminary survey of host crops in properties in buffer zone establishing points of pest detection
Phase 3	Surveillance of an intensive nature, to support control and containment activities around points of pest detection
Phase 4	Surveillance of contact premises. A contact premise is a property containing susceptible host plants, which are known to have been in direct or indirect contact with an infested premises or the pest. Contact premises may be determined through tracking movement of materials from the property that may provide a viable pathway for spread of the pest. Pathways to be considered are: • Items of equipment and machinery which have been shared between properties including bins, containers, irrigation lines, vehicles and equipment • The producer and retailer of infested material if this is suspected to be the source of the outbreak • Labour and other personnel that have moved from infested, contact and suspect premises to unaffected properties (other growers, tradesmen, visitors, salesmen, crop scouts, harvesters and possibly beekeepers) • Movement of plant material and growing media/soil from controlled and restricted areas
Phase 5	Surveillance of production and retail nurseries, gardens and public land where plants known to be hosts of the pest are being grown
Phase 6	Agreed area freedom maintenance, post control and containment

6.6.3 Post-eradication surveillance

The period of pest freedom sufficient to indicate that eradication of the pest has been achieved will be determined by a number of factors, including growth conditions, the previous level of infestation, the control measures applied and the pest biology.

Specific methods to confirm eradication of Poinsettia thrips may include:

- Monitoring of sentinel plants that have been grown at the affected sites. Plants are to be grown *in situ* under quarantine conditions and monitored for symptoms or other indications of Poinsettia thrips presence.
- If symptoms or suspect insects are detected, samples are to be collected and stored and plants destroyed.
- Targeted surveys for Poinsettia thrips should be undertaken within the Quarantine Zone to demonstrate pest absence.
- Alternate non-host crops should be grown on the site and any self-sown plants sprayed out with a selective herbicide.

7 Technical debrief and analysis for stand down

Refer to PLANTPLAN (Plant Health Australia, 2009) for further details

The emergency response is considered to be ended when either:

- Eradication has been deemed successful by the lead agency, with agreement by the Consultative Committee on Emergency Plant Pests and the Domestic Quarantine and Market Access Working Group
- Eradication has been deemed impractical and procedures for long-term management of the pest risk have been implemented

A final report should be completed by the lead agency and the handling of the incident reviewed.

Eradication will be deemed impractical if, at any stage, the results of the delimiting surveys lead to a decision to move to containment/control.

8 References

Collins DW (1998) Recent interceptions of *Echinothrips americanus* Morgan (Thysanoptera, Thripidae) imported into England. *Entomology. Mon. Mag*. 134, 4p.

Dunne R, O'Connor JP (1997) *Echinotrips americanus* (Thysanoptera: Thripidae) New to Ireland. The Irish Naturalists' Journal 25, 11/12, 412-413.

IPPC (1995) Requirements for the Establishment of Pest Free Areas. International Standards for Phytosanitary Measures (ISPM) No. 4.

IPPC (1998a) Determination of pest free status in an area. International Standards for Phytosanitary Measures (ISPM) No. 8.

IPPC (1998b) Guidelines for Pest Eradication Programmes. International Standards for Phytosanitary Measures (ISPM) No. 9.

IPPC (1999) Requirements for the establishment of pest free places for production and pest free production sites (ISPM) No.10.

Kaas JP (2001) Scouting for thrips- the development of a time saving sampling program for *Echinothrips*. Proceedings of Experimental and Applied Entomology, NEV Amsterdam 12, 85-89.

Macdonald O (1997) Thripsnet (network on exchange of the information on thrips), pers.comm. Nov 24.

Merriman P, McKirdy S (2005) Technical guidelines for the development of pest specific response plans, Plant Health Australia.

Mound LA (2008) Diagnostic protocol for *Echinothrips americanus* the Poinsettia thrips produced and endorsed through SPHDS.

Mound lA, Kibby G (1998) Thysanoptera. An identification guide. 2nd edition. CAB International, Wallingford 70p.

Mound LA, Marullo R (1996) The Thrips of Central and South America: An introduction. *Memoirs on Entomology, International* 6, 1-488.

Nursery and Garden Industry Australia (2008) Biosecure *HACPP*: guidelines for managing biosecurity in nursery production.

Oetting RD, Beshear RJ (1994) Biology of the greenhouse pest *Echinothrips americanus* (Thysanoptera: Thripidae). *Zoology (Journal of Pure & Applied Biology)* 4, 307-315.

Oetting RD, Beshear RJ, Liu T-X, Braman SK, Baker JR (1993) Biology and identification of thrips on greenhouse ornamentals. Univ. Ga., *Research Bulletin*, 414, 20p.

Plant Health Australia (2009) PLANTPLAN Australian Emergency Plant Pest Response Plan. Version 1. (**www.planthealthaustralia.com.au/plantplan**).

Plant Health Australia (2008) Industry Biosecurity Plan for the Nursery and Garden Industry (Version 2). Plant Health Australia. Canberra, ACT.

Reynaud P (1998) *Echinothrips americanus.* Un nouveau thrips des serres importe en France. *Phytoma* 507, 36-38.

Scarpelli F, Bosio G (1999) *Echinothrips americanus* Morgan, nuovo tisanottero delle serre. *L'Inf. Agrar*. LV 2, 59-61.

Trdan S (2002) Thrips in Slovenia. In: Thrips, plants tospovirusess: the millenial review, 7th Int. Symp. Thysanoptera, Reggio Calabria, Jul 02-07. 2001. 7p.

Van Schelt J, Hoogerbrugge H, van Houten Y, Bolckmans K (2002) Biological control and survival of *Echinothrips americanus* in pepper. In: Integrated Control in Protected Crops, Temperate Climate. IOBC/wprs Bulletin 25 (1) 285-288.

Varga L, Fedor PJ (2008) First interception of the greenhouse pest *Echinothrips americanus* Morgan 1913 (Thysanoptera: Thripidae) in Slovak Republic. *Plant Protection Science* 44, (4) 155-158.

Vierbergen G (1997) Amerikaanse trips. Nieuwe bleager in paprika. Groenten + Fruit/Glasgroenten 7, 12-13.

Vierbergen G (1998) *Echinothrips americanus* Morgan, a new thrips in Dutch greenhouses (Thysanoptera: Thripidae). *Proc. Sect. Exp. Appl. Entomol. Neth. Entomol. Soc.* (NEV) 9, 155-160.

Vierbergen G, Cean M, Szeller IH, Jenser G, Masten T, Simala M (2006) Spread of two thrips pests in Europe: *Echinothrips americanus* and *Microcephalothrips abdominalis* (Thysanoptera: Thripidae). *Acta Phytopathologica et Entomologica Hungarica* 41, 287-296.

8.1 Related Websites

Australian Pesticide and Veterinary Medicine Authority (**www.apvma.gov.au**)

Center of Invasive Species and Ecosystem Health – Bugwood Network (**www.bugwood.org**)

CAB Compendium (**www.cabicompendium.org**)

Pest and Disease Image Library (PADIL) (**www.padil.gov.au**)

University of Florida website, **http://mrec.ifas.ufl.edu/lso/entomol/ncstate/thrips4.htm**

University of Minnesota website, **http://www.entomology.umn.edu/cues/inter/inmine/Thripf.html**

9 Appendices

9.1 Appendix 1: Genera of plants from which *Echinothrips americanus* has been recorded

Table 8. *List of taxa known to be hosts of Echinothrips americanus. Table taken from Mound 2008.*

Agavaceae: Cordyline
Apiaceae: Arracacia
Araceae: Anthiurium, Cryptocoryne, Deffenbachia, Homalomena, Philodendron, Spathiphyllum, Syngonium
Asteraceae: Chrysanthemum, Dendranthema, Polymnia
Balsaminaceae: Impatiens
Betulaceae: Betula
Brassicaceae: Cardamine
Euphorbiaceae: Euphorbia, Acalypha
Fabaceae: Cassia, Desmodium, Mimosa, Phaseolus
Liliaceae: Aspargus, Veratrum
Magnoliaceae: Magnolia
Malvaceae: Hibiscus
Moraceae: Ficus
Myricaceae: Myrica
Myrtaceae: Psidium
Onagraceae: Ludwigia
Orchidaceae: Bletilla
Oxalidaceae: Oxalis
Passifloraceae: Passiflora
Poaceae: Bambusa, Hordeum
Pontederiaceae: Eichornia
Primulaceae: Lysimachia
Rosaceae: Prumus, Rubus
Rubiaceae: Coffea
Solanaceae: Capsicum
Urticaceae: Pilea
Vitaceae: Cissus

9.2 Appendix 2: Resources and facilities

Table 9 provides a list of diagnostic facilities for use in professional diagnosis and advisory services in the case of an incursion.

Table 9. *Diagnostic service facilities in Australia*

Expert	State	Details
Dr Laurence Mound	ACT	Black Mountain Laboratories Clunies Ross Street, Black Mountain ACT 2601 GPO Box 1700, Canberra ACT 2601 Ph: (02) 6246 4280

Facility	State	Details
DPI Victoria – Knoxfield Centre	Vic	621 Burwood Highway Knoxfield VIC 3684 Ph: (03) 9210 9222; Fax: (03) 9800 3521
DPI Victoria – Horsham Centre	Vic	110 Natimuk Rd Horsham VIC 3400 Ph: (03) 5362 2111; Fax: (03) 5362 2187
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