Nursery levy at work: Building Resilience & Biosecurity Capacity

Contingency Plan for

Southern Red Mite, *Oligonychus ilicis*

Queensland Department of Agriculture and Fisheries

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1 Purpose and background of this contingency plan

This plan is specifically written to assist in the preparedness of a detection of *Oligonychus ilicis*, southern red mite (SRM), in Australia. The plan focuses on very early stages of a detection as if SRM is present in Australia outside of protected cropping the likelihood of eradication is considered very low. Therefore, the focus is on detection at a production nursery. While the plan is written for SRM, many aspects will be relevant for other spider mite species and potentially could be used as a companion resource following the detection of such species.

SRM was detected in two nurseries in northwestern Sydney in the late 1990s. It was reportedly eradicated (Anonymous 2006) even though evidence suggested that it had been present for at least 12 months (Knihinicki et al. 1999). As such, any detections (particularly in the greater Sydney area) should be treated carefully with detailed enquiries as to how long the infestation has been observed.

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 & Garden Industry Australia (NGIA). In the event of an incursion, operations not covered by the NGIA (e.g. retail outlets) will not be eligible for Owner Reimbursement Costs, as defined in the Emergency Plant Pest Response Deed, if affected by actions carried out under an approved Response Plan.

2 Impact of southern red mite

Oligonychus ilicis is recorded on about 30 plant species from many different plant families. Woody ornamental plant species are damaged most, but some agriculturally significant species are also damaged, e.g. coffee, rice, pear. Given that some species reported as being a host include prominent Australian native plants, the impact of this pest if it were to become naturalized in Australia is unknown.

3 Critical tasks

Initial delimiting surveillance is critical for any detection of exotic spider mites, SRM is no exception. If SRM is found to be present outside of a production nursery or other protected cropping environment the chance of eradication falls drastically. The view taken here is that destruction of plant material should not be undertaken unless surveillance has shown that it is not present in the general environment around the IP. Management actions can be put in place to stop the spread of all spider mites at IPs until such surveillance has been completed.

4 Australian nursery industry

The Australian nursery industry is a significant and diverse horticultural sector with total greenlife sales valued at $2.29 billion annually[1]. The industry employs approximately 27,000 people in approximately 1,777 businesses[1]. The industry is located predominantly along the Australian coastline and in major inland regions servicing urban and production horticulture. It is estimated that 1.618 billion plants were sold nationally in the 2015/2016 year and the production area covered 6,229 Ha (outdoor) and 1,273 Ha (indoor)[1].

5 Pest information/status

5.1 Pest details

Common names:	Southern red mite (SRM) Coffee red mite Plane tree spider mite
Scientific name:	*Oligonychus ilicis* (McGregor)
Synonyms:	*Tetranychus ilicis* *Paratetranychus ilicis*
Taxonomic position:	Kingdom, Animalia Phylum, Arthropoda Class, Acari Order, Trombidiformes Family, Tetranychidae Sub-family, Tetranychinae

[1] https://www.greenlifeindustry.com.au/Attachment?Action=Download&Attachment_id=2170

5.2 Pest description

Adults are about 0.4mm in length (including legs) and are reddish brown to deep purplish-red in colour. They often have a pale patch in the centre of their back and have lighter coloured legs. They are more translucent towards the front end of the body. They are similar in appearance to the red, overwintering form of two spotted mite (however, *T. urticae* eggs are white) and other red *Tetranychus* species (that often have pale coloured eggs). They are also very similar to *O. coffeae*, which also has a wide host range. Distinguishing between these two species (and other species from this genus present in Australia) requires expert examination of slide-mounted specimens (Knihinicki et al. 1999).

Females are slightly larger than males and have a more rounded body shape posteriorly; males have a relatively slender abdomen posteriorly and are slightly paler than females. Eggs are reddish brown and spherical. Eggs are normally laid on the upper leaf surface, but overwintering eggs are mainly laid on the lower leaf surface (though may sometimes be laid on the upper leaf surface) (Hamilton 1957). Eggs hatch into larvae that have six legs and are relatively pale, but otherwise appear very similar to adults. There are two nymphal stages that have eight legs and become progressively darker and larger.

5.3 Life cycle and population dynamics

SRM has a lifecycle similar to many other spider mites. Numerous, overlapping generations occur each year. SRM tends to be most abundant, with highest populations occurring during spring and autumn (Denmark et al. 2012; Mague and Streu 1980). However, during favourable conditions of relatively mild summers and winters, populations will continue without any diapause or aestivation (Franco et al. 2008; Hamilton 1957). Studies of SRM survival and fecundity tend be highest between 21 and 27°C resulting in greatest intrinsic rates of increase (Childs et al. 1984; Mague and Streu 1980). Regardless of the season, populations will persist and increase under favourable climatic conditions, generally between 15.5-30°C (Childs et al. 1984; Mague and Streu 1980). Some report that SRM populations peak during mild, humid winters (Denmark et al. 2012). Populations can seem to disappear in spring as new growth develops.

If present in a relatively cool climate, large numbers of overwintering eggs are laid on the undersides of leaves (Childs et al. 1984), and perhaps the bark of stems (Sylvia and Averill 1999). Eggs did not show signs of development at 14°C (Childs et al. 1984), therefore temperatures at or below this temperature probably induce overwintering. There is also a high negative relationship between rainfall and population density, even under favourable temperatures (Franco et al. 2008; Pedro Neto et al. 2010); control measures are not normally required during rainy seasons (Jeppson et al. 1975). Large numbers of overwintering eggs can lead to high populations by late spring and summer (Mathysee and Naegele 1952).

The development time of SRM on coffee and holly at 25°C from egg to adult is about 12-16 days (Mague and Streu 1980; Polanczyk et al. 2011). Generations can therefore be completed within 2 weeks under favorable conditions. Where overlapping generations occur under these conditions, populations can double within about 5 days (Reis et al. 1997). Differences between studies exist. For example SRM was shown to complete its lifecycle in about 5-7 days between 15-30°C on holly in another study (Childs et al. 1984). Females can lay about 15-35 eggs over their adult lifespan of about 5-17 days, depending on host plant and temperature (Mague and Streu 1980; Reis et al. 1997; Polanczyk et al. 2011; Childs et al. 1984). Temperatures above 30°C reduce longevity and survival dramatically (Polanczyk et al. 2011).

SRM is haplo-diplo parthenogenetic. This means that unfertilized eggs become male individuals, fertilized eggs become female (Calsa and Sauer 1952).

5.4 Dispersal

SRM is wind-borne with mixed reports of whether they balloon on silk threads; they have been reported to balloon under certain conditions (Calsa and Sauer 1952), but not observed by another study (Mague and Streu 1980). It is not known if there is variation across populations or if it requires particular environmental conditions to induce ballooning. In any case, assume that ballooning occurs unless the population is specifically studied and shown to not balloon. Like all spider mites, individuals can easily hitch-hike on people and equipment and will spread to neighbouring plants if leaves are touching or if blown by wind.

5.5 Host range

SRM feeds on many woody ornamental species, mainly on foliage. There appears to be geographic variation in plant species damaged by SRM. This may be as a result of *O. ilicis* being part of a species complex that is not well understood. Regardless, in eastern USA it's been noted as a pest of azalea, camellia, holly, cranberries and conifers. In California it has been noted as a pest of walnuts and sycamore. In Brazil it is a pest of coffee and in Japan as a pest of tea, rice, laurel, holly and boxwood (Beard 2018). While overlap no doubt exists be aware that some plants may not be damaged in Australia and additional host plant species probably will be damaged.

Table 2. List of known host plants. Species in bold probably represent primary host plants.
(Denmark et al. 2012; Sylvia and Averill 1999; Childs et al. 1984; Beard 2018; Knihinicki et al. 1999)

Common name	Scientific name
Boxwood	*Buxus* spp.
Camellia	***Camellia japonica***
Tea	***Camellia sinensis***
Pecan	*Carya illinoensis*
Leatherleaf	*Chamaedaphne calyculata*
Camphor tree	*Cinnamonum camphora*
Summersweet/sweet pepperbush	*Clethra alnifolia*
Cleyera	*Cleyera* sp.
Coffee	*Coffea arabica*
Cotoneaster*	*Cotoneaster* sp.
Quince	*Cydonia oblonga*
Elaeagnus/silverthorn	*Elaeagnus pungens*
Loquat*	*Eriobotrya japonica*
Erica	*Erica* sp.
Eucalyptus*	*Eucalyptus* spp.

Common name	Scientific name
Strawberry	*Fragaria sp.*
Silky oak	*Grevillea robusta*
Hibiscus	*Hibiscus* spp.
Holly	***Ilex* spp.**
Ixora	*Ixora* sp.
English walnut	*Juglans regia*
Juniper	*Juniperus* sp.
Sheep laurel	*Kalmia angustifolia*
Laurel or bay leaf	*Laurus nobilis*
Doghobble	*Leucothoe* sp.
Rice	*Oryza* sp.
Oxalis	*Oxalis*
Photinia/red tip	*Photinia* spp.
Spruce	*Picea* sp.
American sycamore*	*Platanus occidentalis*
Chokeberry	*Prunus virginiana*
Guava	*Psidium guajava*
Pyracantha*	*Pyracantha coccinea*
Pear*	*Pyrus communis*
Oak*	*Quercus* sp.
Deer grass/meadow beauty	*Rhexia* sp.
Azalea/Rhododendron	***Rhododendron* spp.**
Rose apple	*Syzygium jambos = Eugenia*
Cranberry	*Vaccinium macrocarpon*
Viburnum	*Viburnum* spp.

* Some early reports of SRM on certain hosts may be in error due to misidentifications (Mague and Streu 1980; Beard 2018).

5.6 Damage and symptoms

There are mixed reports as to whether SRM usually feeds on the upper or lower leaf surface. Some indicate that it usually feeds on the lower leaf, moving to the upper leaf as populations increase (Denmark et al. 2012). Most studies indicate that SRM mainly feeds on the upper leaf surface (Calsa and Sauer 1952; Franco et al. 2008; Fahl et al. 2007; Jeppson et al. 1975; Sylvia and Averill 1999). Choice tests on strawberry indicated that SRM prefers the upper leaf surface and did not lay eggs on the lower surface under no-choice conditions (Fadini et al. 2007). Despite this SRM may be observed on both surfaces. They move to small succulent stems as populations increase. Like all spider mites, SRM feeds on chlorophyll and other cell contents causing mesophyll collapse, graying and stippling. SRM feeding also can reduce photosynthetic rate, particularly under high populations (Fahl et al. 2007).

Individuals spin silk and lay it across the leaf surface that can cause dust, mite exuviae (their cast-off skins) and other organic material to accumulate on the leaf surface. As a result, leaves lose luster and appear bronzed or dull in colour. The level of bronzing or colour loss is proportional with the amount of SRM feeding and can also vary across host plants (Fahl et al. 2007; Hamilton 1957). Bronzing is most likely to occur along the midrib of upper leaves first, then along veins and will eventually spread to the entire leaf.

On large trees, leaves relatively low in the canopy may be damaged first, compared to those higher up (Jeppson et al. 1975; Mague and Streu 1980), though sometimes they are distributed evenly through the canopy (Franco et al. 2008). Exuviae can sometimes be more noticeable than living mites.

Large populations can result in severe leaf drop and unsalable nursery plants (Childs et al. 1984; Denmark et al. 2012). However, coffee studies indicate that SRM feeding does not lead to leaf abscission (Fahl et al. 2007), at least at levels of damage examined. It is noted that for an economic spider mite pest, plants can tolerate a relatively high amount of damage before leaf drop occurs (Jeppson et al. 1975).

Damage is more likely to occur in dry weather and on water stressed plants (Jeppson et al. 1975) and may be more likely to cause leaf abcision. Damage can result in reductions of plant vigour and reduced growth (Mague and Streu 1980).

Older damage can appear as very small brown scars on the upper leaf surface (Sylvia and Averill 1999). Damage is almost always patchy but can cover an entire crop (Tuelher et al. 2014).

5.7 Current geographic distribution

SRM was described from the USA but is suggested that it may originate from the ‘Far East’ (Pritchard and Baker 1955). The current distribution of SRM includes much of the northern hemisphere including Italy, Japan, Korea, The Netherlands and the USA. It is also present in South America including Brazil and Paraguay.

As indicated in Section 1, SRM was detected at two nurseries in the greater Sydney region in the late 1990s. It has been declared eradicated from Australia (Anonymous 2006).

5.8 Diagnostic information

Oligonychus ilicis is in the *O. ununguis* species group; all of these species have a ventrally directed aedeagus. Males are required to distinguish between species, females can be virtually impossible to separate (Beard 2018). The species group has been further broken into subgroups; *O. ilicis* has been placed into the *bicolor* subgroup (Pritchard and Baker 1955) based on having only 3 tactile setae proximal to duplex setae on tarsus I. Unfortunately, type specimens of other species (not placed into the bicolor subgroup) have been shown to also have the same character. Furthermore there is variation in the literature on certain characters amongst closely related species (Beard 2018). Therefore, Beard (2018) suggested that there probably have been a great deal of misidentifications over the last 60 years. Caution should be used when identifying specimens using only morphology.

It is recommended to use the Lucid key produced by Beard (2018). Then it is recommended to consult with Jenny Beard and Owen Seeman at the Queensland Museum, or perhaps other spider mite experts if they are unavailable, to confirm the identification morphologically.

It is also recommended to sequence three gene regions (COI, ITS and 28S) for molecular identification as per Matsuda (2012). Construct a phylogenetic tree and use molecular and morphological characters to obtain the best possible identification. Given that SRM can sometimes co-occur with other spider mite species it would be ideal to rear mites, preferably from multiple single, mated females each of which is reared separately. Offspring from multiple iso-female lines can then be used to make a confident identification using both morphology and molecular data. If culturing mites is not possible for quarantine reasons, be careful of ambiguous or conflicting evidence.

In addition, it is worth keeping in mind that gene sequences available for SRM are from populations in Japan only. Evidence suggests that there is significant morphological variation across individuals within the species that was not captured by Matsuda (2012). It may be worthwhile assuming that cryptic species occur in *O. ilicis* and closely related species until such a time as more detailed studies are completed from populations across many geographic regions indicate otherwise.

5.9 Pest management

5.9.1 Detection and monitoring

The two most important methods to detect SRM are direct visual observation (looking for the damage) and plant beating. These same methods will detect other spider mites and other arthropod pests and predators.

Direct observation involves looking for damage, as described in the section above. Once damage has been observed a hand lens should be used to confirm the presence of spider mites. If spider mites are observed determine if they are the right colour, i.e. that they have reddish nymphs, adults *and* eggs. If in doubt, collect samples for slide mount identifications. It may also be possible to observe evidence of past spider mite infestations by detecting damage and cast off skins of nymphs and adults. Morphological species level identifications cannot be made without male and female individuals. Therefore, collect as many individuals as is feasible.

Where no discernable damage can be seen, plant beating can be used to detect very low populations of spider mites. Plant beating involves gently, but firmly, hitting foliage against a beating tray (which can be a folder, bucket or plastic plate). The beating tray should be a single colour; white or black is preferable as this will allow moving organisms to be more visible. Beating plants is a relatively efficient way of monitoring for insects and mites that can be knocked from plants, including spider mites and predatory mites, aphids, thrips, lady beetles, small caterpillars, whiteflies and a variety of other insects. Caste of skins may also be detected by observant inspectors.

5.9.2 Chemical control

Early management of SRM was generally using organophosphate, organochlorine and Sulphur based products. Early research indicated that long residual products applied early in the season (when populations were low) reduced populations for the entire season, compared to short residual products (Calsa and Sauer 1952; Mathysee and Naegele 1952).

Late applications applied after populations were relatively high were difficult to manage with pesticides.

Studies show that plants treated with certain pesticides can increase populations growth rates significantly compared to untreated plants. The mechanism for this population increase may vary with active ingredient. Mites on carbaryl-treated (a carbamate product – group 1A) plants did not increase mite numbers or fecundity on a physiological basis, suggesting that the increase may have resulted from suppressed predator populations on treated plants (Mague and Streu 1980). In contrast, SRM on leaf discs sprayed with deltamethrin (a synthetic pyrethroid – group 3A) reduced survival rate by about 60% and increased the development of immatures. However, progeny of individuals that survived the application increased their oviposition by about 30% compared to untreated individuals (Oliveira 1998). Similar results have been obtained for other synthetic pyrethroid active ingredients (Cordeiro et al. 2013; Oliveira 2000).

Following the detection of SRM in the Sydney area, research was completed on potential insecticides for its control. Results indicated that aldicarb, bifenthrin, chlorpyrifos, dicofol, omethoate, propargite, tau-fluvalinate and tebufenpyrad controlled Australian SRM at the rate recommended for *Tetranychus urticae* (two-spotted mite) (Herron and Rophail 2000). The active ingredients abamectin, chlorfenapyr, dimethoate, fenbutatin oxide and maldison did not kill all SRM and therefore may not be effective under field conditions. They concluded that Australian SRM detected in the 1990s probably had some pesticide resistance.

5.9.3 Biological control

Where predator populations are conserved, populations of SRM can be kept relatively low and may not cause economic loss or noticeable damage (Mague and Streu 1980). A number of predators have been recorded feeding on SRM overseas, mainly mites from the family Phytoseiidae and beetles from the genus *Stethorus*. Most research has focused on phytoseiid predators to manage SRM. Results indicate that some predators are better able to feed on SRM in the presence of their webbing, others can have much reduced rates when spider mite webbing is present (Franco et al. 2010).

In the USA, biocontrol of SRM is generally with predatory mite, *Neoseiulus fallacis*, and the ladybeetle, *Stethorus punctillum*. Most predators commercially available in Australia are not marketed as being predators of SRM in countries where it occurs. Those species that are considered effective overseas are not commercially available in Australia. To our knowledge, the Australian commercial predators *Typhlodromips montdorensis* and *Typhlodromus occidentalis* have not been tested against SRM overseas. *Neoseiulus californicus* and *Phytoseiulus persimilis* are not recommended for control of SRM.

5.10 Pest risk ratings and potential impacts

5.10.1 Entry potential: High

SRM was detected in Sydney in the late 1990s. Therefore, a pathway for SRM entry has occurred and potentially could reoccur. The most likely pathway for entry of SRM is as a hitchhiker on plant material (particularly imported nursery stock). The risk of re-entry is therefore considered **high**.

5.10.2 Establishment potential: Medium

It was estimated that SRM was present in Australia for at least 12 months, therefore it definitely has the ability to establish in Australia. SRM has a wide host range of many woody ornamental plants that are commonly grown in Australian gardens.

Much of southern Australia has suitable climatic conditions and host plants for establishment. While northern regions of Australia may not be favourable for populations to build to economic levels, it is possible that SRM could still survive at relatively low levels.

Overall, the likelihood of SRM establishment in Australia following entry is **Medium**.

5.10.3 Spread potential: High

Spider mites are easily spread as hitchhikers and on nursery plants. This can occur easily when populations are relatively low as very little damage may be visible. They are also spread on people and by wind and many host plant species exist that are widely distributed. Therefore, the spread potential of SRM in Australia is **high**.

5.10.4 Economic impact: Medium

SRM is damaging to a number of ornamental and horticultural crops around the world, many of which are found in Australia. It is likely that if SRM became naturalized in Australia other plant species would be reported as hosts that SRM had not previously encountered. With that said, most species impacted already have other spider mite species that sometimes cause damage; management actions against naturalized species are likely to manage SRM. Therefore, the economic impact is considered **medium** in Australia.

5.10.5 Environmental impact: Low

Very few Australian native species are known hosts of SRM. While it is likely that some would be more strongly impacted than others, naturally occurring predators of spider mites are likely to assist in natural environments being relatively resilient to SRM damage. Therefore, the environmental impact of SRM in Australia is considered **Low**.

5.10.6 Overall risk: Medium

Based on the above individual ratings the combined overall risk is considered to be **medium**.

6 Surveillance and collection of samples

6.1 Surveillance

Given that most hosts are ornamental species it is likely that detection of SRM will occur in urban areas or in production nurseries, which are often situated in urban or semi urban areas. It is therefore likely that other host plants will be present in the area. The exact size of the initial area of surveillance should be altered depending on the frequency of primary hosts (in particular camellias, rhododendrons, azaleas and holly) in the area. A staged approach is recommended depending upon the situation. However, if there are many primary host plants in the region a relatively small area can be surveyed initially, whereas larger areas are recommended if few host plants are present.

Since spider mites can go undetected for long periods of time do not assume that the infested area is restricted to a small area; spread a wide net targeting high risk sites in the wider region. This should occur regardless of surveillance around IPs. High risk sites include those that have large numbers of primary host plants (camellias, rhododendrons or azaleas), particularly that have large amounts of traffic from the public.

6.1.1 Public, council and botanic gardens

Homeowners with a large collection of these plants, which may be traced via camellia, rhododendron and azalea enthusiast clubs and organisations or observed directly.

6.1.2 Retail and production nurseries

A minimum of 100m around the IP should be surveyed. Detailed observations and beating should be completed on primary hosts. Other woody plants should also be surveyed for SRM within 100m by plant beating. All plants within 5-10m of suspect SRM infestations should be surveyed carefully.

If SRM is not detected within 100m it is recommended to assess high risk areas within 500-1000m of the IP and survey highest risk areas first, e.g. hot spots of primary host plants and high risk sites mentioned above.

If SRM is detected within 100m additional surveillance should be completed to better ascertain the degree of spread. Widespread detections around IPs indicate that SRM probably has been present for a relatively long period of time, a wider net, with less intense surveillance is recommended. Very limited detections around IPs may indicate a new introduction for which more detailed surveillance is worthwhile.

Data is not available to show if plants not listed in Table 2 are hosts or non-hosts. All plants listed as hosts in Table 2 should be surveyed as a priority, other woody plants, however, also need to be monitored to take into account the possibility that it is a host of SRM. Any spider mites found that are red *and* have red eggs should be treated as suspicious for SRM and result in samples being submitted for identification.

Monitoring should include visual inspections for mites, their damage and cast off-skins and plant beating. Refer to the pest description and damage and symptoms sections above.

6.1.3 Monitoring by nursery producers

Monitoring and managing spider mites are part of normal production nursery business. A pest management plan for mites, including spider mites, has been produced for the production nursery industry and covers a range of cultural, biological and chemical control options. In the event that a production nursery falls within a quarantine zone, it is recommended to avoid growing primary host plants of SRM, this will reduce the risk of populations of SRM becoming establishing at the nursery.

To facilitate trade, monitoring will need to be conducted on all woody plant species to show that SRM is not present. It is recommended to manage all spider mite populations on all hosts throughout the nursery in a very proactive fashion.

6.2 Activities for public awareness following a detection

There are a range of activities that would be useful in the event that a response was required. Public awareness campaigns could involve the following:

On-line or app reporting tools such as MyPestGuide should be established and promoted to allow submission of reports of suspected SRM detections.

Factsheets to provide information on the pest, symptoms, impacts and reporting mechanisms (note that a nursery factsheet is available)

Media releases to describe the impact of the pest, surveillance programs and activities within the response program.

Awareness material should focus on clubs/societies for primary host plants including:

http://www.rhododendron.com.au/ and state/regional based societies

http://camelliasaustralia.com.au/ and state/regional based societies

Advise the public not to treat plants themselves and not to take samples. Advise the public to report any suspicious mites.

Broader awareness campaigns should consider literature (brochures and factsheets) in several languages, depending on the communities affected.

6.3 Stakeholder engagement

SRM is an obligate plant pest. Most hosts are woody, ornamental plant species that will impact only production nurseries, home and public gardens. However, some plants have been recorded as hosts that have significant horticultural industries in Australia, notably the pear industry. Other industries that may be hosts include cranberry, walnut, pecan, and rice.

High risk stakeholders include those that move host plants that may contain mites at low levels, which can go easily undetected without close inspection. These stakeholders include:

- Landscapers, production and retail nurseries
- Local council, particularly in public parks etc.
- State or federal government, particularly if the infested area includes state/national forests or other restricted access areas. This is in relation to records of *Eucalyptus* as a host.
- Relevant community groups, e.g. groups that maintain community gardens, Land Care groups, gardening groups (particularly those that move plants)
- Organisers of local markets that may have plant retailers

6.4 Collection of samples

Samples should be collected whenever spider mites are observed that have red adults *and* red eggs. Refer to the detection and monitoring section above for more details.

To untrained staff, male and female individuals can be difficult to distinguish. Both males and females are required to make a morphological identification to species level. It is therefore recommended to collect as many individuals as possible into 70% or to collect leaf material into secure zip-lock bags so that trained staff can slidemount the best individuals. It is also recommended to collect some individuals into 95-100% ethanol for molecular testing.

7 Course of action – immediate response to a detection

For 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 2019).

7.1 Tracing

Detection and delimiting surveys are required to determine the extent of the outbreak, ensuring areas free of the pest retain market access and appropriate quarantine zones are established. Forward tracing should focus on movement of primary host plants via nursery trading, natural spread and hitchhiking on people. Since spider mites can be moved considerable distances via wind and low-level populations can be difficult to detect, high risk sites in the greater area should be surveyed regardless of the distance from IPs. These include:

- Public, council and botanic gardens with collections of primary host plants
- Homeowners with a large collection of these plants, which may be traced via camellia, rhododendron and azalea enthusiast clubs and organisations or observed directly.
- Retail and production nurseries selling primary host plants
- Market vendors and hobbyists selling primary host plants
- Other woody host plants in the area and environmental areas should also be investigated in the local area. Note that low populations are likely to be normal in environmental areas, therefore plant beating should be the primary surveillance method, followed by direct observation when spider mites are actually detected.

For trace-backs, focus should include:

- Talking to nursery staff and home gardeners responsible for the management or care of primary host plants to determine how long spider mite damage consistent with SRM has occurred on primary host plants.
- Mother stock plants or plant suppliers.

If SRM is detected in home gardens on plants not considered to be a primary host plant then enquire into the source of *any* plants that have been purchased in the last 6 months.

7.2 Quarantine and movement controls

If SRM is found to be present in a very localised area and not present on environmental plants or in urban areas, a quarantine zone of not more than 500m should be considered. If SRM is found greater than 500m away at a site that has no direct link to IPs it seems likely that it is widespread and eradication unlikely.

If quarantines are to be put in place then movement controls should be placed on the following items moving out of the control area.

All plants listed in Table 2, particularly camellias, rhododendrons, azaleas and holly.

Any other plant species shown to be a host of SRM in Australia (given that this could be virtually any plant, one would have to consider movement restrictions on all woody plants or even all nursery stock).

7.3 Treatment strategy

There are many products that have a general registration for *Tetranychus* spider mites but very few products with a general mite or spider mite usage suitable to be applied against an SRM in a commercial nursery setting (Table 3). Pesticide efficacy data generated by Herron and Rophail (2000) indicate that SRM found in Australia in the late 1990s is likely to have been resistant. They also indicate that overseas SRM is showing signs of resistance to a number of products. Their research indicated that aldicarb, bifenthrin, chlorpyrifos, a diafenthiuron derivative dicofol, omethoate, propargite, tau-fluvalinate and tebufenpyrad would be suitable to control SRM at rates normally used to control two-spotted mite.

Table 3. Active ingredients registered against spider mites that can be used against SRM

Active ingredient	Example trade name	Mode of action group	Usage	Other notes	Recommendations for use
Emamectin	Proclaim	6	Non-food nursery stock	PER81707	Not recommended. Resistance is likely.
Petroleum oil	Caltex summer oil	NA	Non-food nursery stock	PER81707	No data, but resistance is unlikely. Is likely to enhance control in combination with other products
Diafenthiuron	Pegasus	12A	Non-food nursery stock	PER81707	Limited data available, but is likely to be effective.
Bifenthrin	Garden Insect Killa	3A	Home garden usage only		Some data overseas indicates that SRM is resistant to bifenthrin. Other data indicates that it is effective.
Dimethoate	Dimethoate	1B	Ornamentals (some host restrictions apply)		Not recommended. Resistance is likely.

It is suggested to submit applications for emergency 'shelf' permits that can be used in the event that SRM is detected in Australia:

- Tebufenpyrad for use in home garden, parks etc and production nurseries
- Propargite for use in home garden, parks etc and production nurseries
- Diafenthiuron for use in home garden, parks etc
- Oils for use in home garden, parks etc

It is recommended to apply one or more of the above pesticides as soon as plants are suspected to be infested with SRM (and after a sample has been collected). A follow up application with product/s from a different mode of action group should be completed within 3 days. Plants should be carefully monitored 7 and 14 days after the second application.

These recommendations should be modified depending on the exact situation. It is recommended to complete an evaluation of detection rates of SRM using both direct observation and plant beating on a variety of plants. Modify the method of follow-up surveillance based on these results.

7.4 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. The decision on whether to eradicate or contain the pest will be made by the National Management Group, based on scientific and economic advice.

8 Technical debrief and analysis for stand down

Refer to PLANTPLAN (Plant Health Australia, 2019) 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.

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. This should be strongly considered if SRM is ever detected in natural environments.

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Appendix 1: Important nursery industry contacts

The nursery industry is probably the most widely distributed industry in the country. Therefore, it is recommended to contact the state and national body to get the most current information. General contact details provided below.

Australia and NT Website: https://www.greenlifeindustry.com.au/ Email: info@greenlifeindustry.com.au	**Western Australia** Website: https://www.ngiwa.com.au/ Email: reception@ngiwa.com.au
South Australia Website: https://ngisa.com.au/ Email: admin@ngisa.com.au	**NSW and ACT** Web: https://www.ngina.com.au/ Email: info@ngina.com.au
Queensland Website: https://www.ngiq.asn.au/ Email: info@ngiq.asn.au	**Victoria** Website: https://www.ngiv.com.au/ Email: ngiv@ngiv.com.au
Tasmania Website: https://www.ngitas.com.au/ Email: admin@ngitas.com.au	

Appendix 2: Resources and facilities – diagnostic service facilities in Australia

The diagnostic facilities below should be contacted prior to sending any samples to ensure the availability of all necessary equipment and reagents to complete the tests required.

Crop Health Services	VIC	AgriBio Specimen Reception Main Loading Dock, 5 Ring Road La Trobe University, Bundoora VIC 3083 Ph: 03 9032 7515; Fax: 03 9032 7064
DPI New South Wales – Elizabeth Macarthur Agricultural Institute	NSW	Woodbridge Road Menangle NSW 2568 PMB 8 Camden NSW 2570 Ph: 02 4640 6327; Fax: 02 4640 6428
SARDI Plant Research Centre – Waite Main Building, Waite Research Precinct	SA	Hartley Grove Urrbrae SA 5064 Ph: 08 8303 9400; Fax: 08 8303 9403
Biosecurity Queensland, Department of Agriculture and Fisheries (DAF)	QLD	Ecosciences Precinct Dutton Park Q 4102 Ph: 07 3404 6999; Fax: 07 3844 4529
Department of Agriculture and Food, Western Australia (AGWEST) Plant Laboratories	WA	3 Baron-Hay Court South Perth WA 6151 Ph: 08 9368 3721; Fax: 08 9474 2658
Department of Primary Industry and Resources	NT	Plant Industries Division BAL Building, Berrimah Farm, Makagon Road, Berrimah NT 0828 Ph: 08 8999 2261; Fax: 08 8999 2312
Department of Primary Industries, Parks, Water and Environment	TAS	GPO Box 44 Hobart Tasmania 7001 Ph: 1300 368 550