
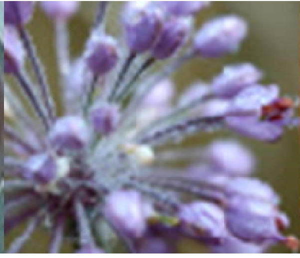


National Onion
Industry Biosecurity Plan

Appendix 2: Pest Risk Reviews

Pest Risk Reviews

The following Pest Risk Reviews relevant to the Potato Industry have been commissioned by PHA and are included in this appendix:

ONION INDUSTRY BIOSECURITY PLAN

Pest Risk Review

COMMON NAME:	**Onion Botrytis leaf blight**
SCIENTIFIC NAME:	*Botrytis squamosa* Walker (teleomorph: *Botryotinia squamosa*) (Mycetae: Hyphomycetes: Moniliaceae)
SYNONYMS:	*Sclerotinia squamosa*

The scientific and technical content of this document is current to the date published and all efforts were made to obtain relevant and published information on the threat. New information will be included as it comes to light, or when the document is reviewed.

Prepared by Suzy Perry

Contact: Debra Eaton, Plant Health Australia.

PRR (ADAPTED FROM HORTGUARD^{TM} AND BIOSECURITY AUSTRALIA) – FEBRUARY 2007

Background

Botrytis leaf blight of onion (*Allium cepa*) is caused by the fungus *Botrytis squamosa* (teleomorph: *Botryotinia squamosa*). The disease kills foliage and spreads so rapidly that it is also referred to as 'blast' (Delahaut and Stevenson, 2004). Characteristic symptoms of the disease include leaf spots or lesions and maceration of leaf tissue resulting in leaf dieback and blighting. Foliage may be severely injured resulting in substantial reductions in bulb size and yield.

Part of plant/commodity affected

Botrytis leaf blight affects onion foliage.

Biology

Symptoms

The symptoms of Botrytis leaf blight include leaf spots (lesions), dieback and blighting of the onion foliage and sometimes the outer scales of the bulb. The lesions are whitish in colour, from 1-5 mm in length and most are surrounded by greenish-white halos that appear water-soaked when first formed (Lorbeer and Andaloro, 1983). The centres of the lesions usually become sunken, straw coloured, and may develop a characteristic slit that is oriented lengthwise in the lesion. Heavily infected leaves die in 5 – 12 days. Older onion leaves are more susceptible than younger leaves to lesion formation and blighting. Under favourable environmental conditions (high rainfall, extended periods of leaf wetness, high relative humidity, and moderately warm temperatures between 12 and 25°C), the disease results in reduced onion bulb growth and yield (Lorbeer and Andaloro, 1983). Severely infected onion fields often take on a yellowish cast as the result of coalescing lesions and tip dieback.

The symptoms of Botrytis leaf blight are often confused with other diseases or problems including: (1) Botrytis leaf fleck caused by *B. cinerea* and characterised by small superficial flecks on the leaves; (2) ozone injury, characterised by irregular areas with tiny necrotic flecks that lack water-soaked margins; (3) Leaf tip dieback caused by hot and dry weather, water stress or combinations of these factors; (4) rain and hail injury which causes pale green to silvery spots and bruises irregular in size and shape and (5) herbicide injury which causes pock marks (Lorbeer and Andaloro, 1983).

Identification

B. squamosa is characterised by tall, slender, hyaline or pigmented conidiophores, branched irregularly in the upper portions, apical cells enlarged or rounded, bearing clusters of conidia simultaneously on short denticles, conidia 14-23 X 11-16 µm, hyaline or grey in mass, single-celled, ovoid and black irregular sclerotia often present. Diagnostic morphology of *B. squamosa* can be found in the Pest and Disease Image Library (PaDIL http://www.padil.gov.au).

Life history

The most common type of disease inoculum is conidia, which are produced in abundance in cool, wet conditions on blighted leaves and onion debris. The conidia are dispersed mainly by wind. Long term survival of the fungus is by way of mycelium on decaying onion tissues, sclerotia embedded in decaying bulb or leaf tissues or in soil after the onion tissue has completely decomposed. Sclerotia are produced on infected onion bulbs left in the field or in cull piles or on mother bulbs stored for seed production. These sclerotia produce conidia that infect the leaves on sprouted onion bulbs and plants. Sclerotia on the surface of the soil also produce conidia that can infect the leaves of nearby plants. Conidia usually infect onion tissue through wounds then after germination the fungal mycelium penetrates the tissue of old flower petals, dying foliage and dead bulb scales. The fungus is not seed transmitted.

The sclerotia produce ascospores as a result of sexual reproduction which can serve as inoculum for the disease but are more important as a source of new genetic variants of the fungus. When *Botrytis* spp. produce sexually-derived ascospores, this portion of their life cycle is referred to as *Botryotinia* (Raid and Kucharek, 2006). *Botrytis* refers specifically to the portion of the fungal life cycle during which the spores (conidia) are produced asexually.

Control of Botrytis leaf blight relies on sanitation and fungicide application. Sanitation includes destroying cull piles, volunteer onions, and diseased onion tops at harvest. Because sanitation is only partially effective and resistant cultivars are not available, most growers manage the disease by spraying protectant fungicides or combinations of systemic and protectant fungicides. Crop rotation for at least 2 to 3 years is essential to prevent inoculum build-up and to reduce the risk of severe epidemics.

Dispersal

Botrytis leaf blight is most commonly spread by wind-dispersed conidia. The disease can also be spread by the movement of contaminated plant debris and soil. Sources of inoculum include nearby onion plantings, onion debris in fields and workers.

Host range and distribution

Host range

Botrytis squamosa is pathogenic only to *Allium* spp. and is most important on onion (*Allium cepa*).

Distribution

Botrytis leaf blight occurs in many onion growing regions in Europe (Belgium, Bulgaria, Czech Republic, France, Germany, Italy, Netherlands, Poland, and the United Kingdom), Asia (China, Hong Kong, Japan, and North Korea), Africa (Mauritius), North America (Canada, Quebec), South America (Brazil) and the Oceania (Australia, New Caledonia and New Zealand).

Potential distribution in Australia

Botrytis leaf blight is cosmopolitan in the temperate onion growing regions of the world and could potentially establish in onion growing regions of Australia.

Pest risk analysis

The following risk analysis for Botrytis squamosa *is based on the methodology in Biosecurity Australia's guidelines on Import Risk Analysis for Plants and Plant Products (2001).*

Entry potential

Entry potential: Rating = High

The entry potential for *B. squamosa* is considered a high risk. The fungus could potentially be introduced on contaminated foliage or infected bulbs of onion plants imported into Australia.

Establishment potential

Establishment potential: Rating = Medium

The establishment potential of *B. squamosa* once the pathogen is introduced into Australia is a medium risk. Once introduced, the fungus would need to come in contact with onion host plants to become established.

Spread potential following establishment

Spread potential following establishment: Rating = Medium

B. squamosa could spread within an infested onion field and to neighbouring fields by airborne conidia which are the primary form of inoculum in epidemics. Long distance spread of the pathogen to unaffected growing regions is by the movement of infected plants and bulbs. Effective disease control relies on sanitation, the application of fungicides and crop rotations as disease resistant onion cultivars are not yet available.

Economic impact

Economic impact: Rating = High

Botrytis leaf blight could potentially devastate onion production in Australia.

Environmental impact

Environmental impact: Rating = Low

The introduction of *B. squamosa* is unlikely to impact the environment as the fungus specifically attacks onion. Although, the application of fungicides to control the Botrytis leaf blight could affect the environment.

Conclusions

Overall risk: Rating = Moderate - High

References

Delahaut, K. and Stevenson, W. (2004). Onion disorders: Botrytis leaf blight, leaf fleck and neck rot. Fact Sheet A3803. University of Wisconsin-Extension, Cooperative Extension. Published 2004. Available online: http://learningstore.uwex.edu/pdf%5CA3803.pdf

Lorbeer, J.W. and Andaloro, J.T. (1983). Onion-Botrytis Leaf Blight (*Botrytis squamosa* Walker). Fact Sheet 737.10. Cooperative Extension, New York State, Cornell University. Published September 1983. Available online: http://vegetablemdonline.ppath.cornell.edu/factsheets/Onion_Botrytis.htm

Raid, R. and Kucharek, T. (2006). 2006 Florida Plant Disease Management Guide: Onion. Fact Sheet PDMG-V3-42. Department of Plant Pathology, 2006 Florida Plant Disease Management Guide, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Revised: January 2006. Available online: http://edis.ifas.ufl.edu

ONION INDUSTRY BIOSECURITY PLAN

Pest Risk Review

COMMON NAME:	**Lesser bulb fly**
SCIENTIFIC NAME:	*Eumerus strigatus* (Fallén) (Diptera: Syrphidae)
SYNONYMS:	*Eumerus aeneus* (Meigen) *Eumerus lunulatus* (Meigen) *Paragopsis strigatus* (Fallén) *Pipiza strigatus* (Fallén) onion bulb fly; lesser narcissus bulb fly; small narcissus fly

The scientific and technical content of this document is current to the date published and all efforts were made to obtain relevant and published information on the threat. New information will be included as it comes to light, or when the document is reviewed.

Prepared by Suzy Perry

Contact: Debra Eaton, Plant Health Australia.

PRR (ADAPTED FROM HORTGUARD™ AND BIOSECURITY AUSTRALIA) – FEBRUARY 2007

Background

The lesser bulb fly *Eumerus strigatus* attacks *Allium* spp. including onion, shallot and garlic; ornamental bulbs including amaryllis, iris, lily, narcissus, and hyacinth; and several vegetables such as parsnip, potato and cabbage. Up to 30 percent losses have been reported in onion; up to 25 percent of some varieties of narcissus; and 10 percent of hyacinths have been infested by lesser bulb flies in some countries. The larval (maggot) stage of the fly scrapes away the bulb tissue and tunnels into the bulb. The infested bulbs begin to decay and the interior of the bulb fills with a semi-liquid mass. The bulb may be killed completely, or damaged so that growth in the following year is affected.

Part of plant/commodity affected

The lesser onion bulb fly attacks the plant bulb.

Biology

Symptoms

The main damage is caused by the maggot stage of the lesser bulb fly. The maggots burrow into the plant bulb which consequently begins to decay and the bulb fills with a semi-liquid mass. The plant may die, or be damaged so that growth in the following year is stunted.

Identification

Adult lesser bulb flies are 5 to 9 mm long, dark blue with a metallic bronze sheen. They have three pairs of greyish white crescents on the abdomen and yellowish hairs at the tip. The thorax has 2 lengthwise pale stripes.

The eggs are about 0.72 mm long and 0.24 mm wide, slender and pointed on one end. They are usually laid in small clusters.

The larvae are approximately 7 to 10 mm long when fully grown and slightly flattened (2.5 mm wide and 1.8 mm high). They are white to greyish yellow in colour, wrinkled and covered with minute spines. The breathing tube is brick red or brown and they have a fleshy tubercle on either side of the breathing tube.

The pupa develops within the last larval skin, which becomes a tough protective covering about 6 to 8 mm long, 3 mm wide, and 2.8 mm high (the puparium). The puparium is light grey to reddish brown, but when the maggot pupates in the soil, the puparium is completely covered with fine particles of soil.

Life history

Lesser bulb flies overwinter as larvae (maggots) in bulbs. In the United States, Canada, and the United Kingdom, the first generation of flies emerges in April and May. These flies live about 3 weeks. The second generation emerges in midsummer, and a small third generation emerges in late summer. Female lesser bulb flies crawl down into cracks in the soil and lay eggs near, on or under the dead skin covering the bulbs. Some eggs are laid on the leaves at the neck of the bulbs and some are laid on the soil surface. Females lay their eggs singly or in small masses of 2 to 40. More than 100 eggs have been found around one bulb. The eggs hatch in 5 to 10 days. Newly hatched maggots emerge from the pointed end of the egg. Ten to 30 maggots may develop in a bulb. The tiny maggots usually attack the base of the bulb although sometimes only the upper portion of the bulb is infested. Infested bulbs begin to decay and the interior of the bulb fills with a semi-liquid mass. Although the maggots can successfully attack a healthy bulb, the maggots cannot complete their development in the absence of certain decay organisms. Bulbs infested with stem nematodes (*Tylenchus dipsaci* Kuehn) or infected with a root rot fungus are especially vulnerable to attack. After about 30 days, the maggots mature and some of them crawl to the surface where they pupate inside the last larval skin. One to 4 weeks later, adult flies emerge from the puparia. If a source of nectar is available and temperatures are not extreme, some of the lesser bulb flies may live up to 36 days.

Dispersal

Adult flight is the main means of natural dispersal of the onion fly. The pest is spread long distances by the movement of infested onion or ornamental bulbs containing maggots or soil containing pupae.

Host range and distribution

Host range

The lesser bulb fly attacks *Allium cepa* (onion); *Allium sativum* (garlic); *Amaryllis* spp. (belladonna lily); *Brassica oleracea* var. *capitata* (cabbage); *Calla elliottiana* (water arum); *Cyrtanthus* spp. (fire lily); *Galtonia* spp. (summer hyacinth); *Gladiolus* spp. (gladiolus); *Hippeastrum* spp. (amaryllis, barbados lily); *Hyacinthus* spp. (hyacinth); *Iris* spp. (iris); *Narcissus* spp. (daffodil); *Lilium* spp. (lily, lilium); *Proiphys* spp. (proiphys); *Pastinaca sativa* (parsnip); *Solanum tuberosum* (potato); *Scilla* spp. (bluebell); *Sprekelia formosissima* (jacobean lily); and *Tulipa* spp. (tulip) (Biosecurity Australia, 2000).

Distribution

The lesser bulb fly is widely distributed in Europe and North America including Canada; China; France; Japan; New Zealand; Romania; Sweden; Taiwan; United Kingdom; USA; and the former USSR (Biosecurity Australia, 2000).

Potential distribution in Australia

The lesser bulb fly could potentially establish in the onion and ornamental bulb growing regions of Australia.

Pest risk analysis

The following risk analysis for Eumerus strigatus *is based on the methodology in Biosecurity Australia's guidelines on Import Risk Analysis for Plants and Plant Products (2001).*

Entry potential

Entry potential: Rating = High

The entry potential for the lesser onion fly is considered a high risk. *E. strigatus* would most likely be introduced by infested bulbs containing maggots, or eggs or pupae attached to bulbs. Less likely means of introduction are by adult flies surviving transportation. *E. strigatus* is believed to have been spread by trade to Japan and has been intercepted by quarantine inspection at the Australian border (Biosecurity Australia, 2000).

Establishment potential

Establishment potential: Rating = High

The establishment potential of *E. strigatus* once the pest is introduced into Australia is a high risk as suitable host plants (mainly onion and ornamental bulb species) are present.

Spread potential following establishment

Spread potential following establishment: Rating = High

The main means of short distance spread of the lesser onion fly is by adult flight and long distance spread is by the movement of infested bulbs.

Economic impact

Economic impact: Rating = High

E. strigatus is reported as causing up to 25-30% losses of onion over a five year period in the former USSR and a 10-15% yield loss of late-maturing onion varieties in Romania (Biosecurity Australia, 2000). The lesser bulb fly can also attack ornamental bulbs and some root vegetables.

Environmental impact

Environmental impact: Rating = Low

The introduction of *E. strigatus* is unlikely to impact the environment as the pest specifically attacks onion and ornamental bulb species.

Conclusions

Overall risk: Rating = High

References

Biosecurity Australia. 2000. Non-routine import risk analysis (IRA) on ornamental bulbs from the Netherlands, the United Kingdom, Israel and New Zealand. Draft IRA report. Appendix 2: Data sheets for quarantine pests. Available online: http://www.daffa.gov.au/__data/assets/pdf_file/22103/bulbdatasheets.pdf

ONION INDUSTRY BIOSECURITY PLAN

Pest Risk Review

COMMON NAME:	**Onion fly**
SCIENTIFIC NAME:	*Delia antiqua* (Meigen) (Diptera: Anthomyiidae)
SYNONYMS:	*Hylemya antiqua* *Phorbia antiqua*

The scientific and technical content of this document is current to the date published and all efforts were made to obtain relevant and published information on the threat. New information will be included as it comes to light, or when the document is reviewed.

Prepared by Suzy Perry

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PRR (ADAPTED FROM HORTGUARD™ AND BIOSECURITY AUSTRALIA) – FEBRUARY 2007

Background

The onion fly or onion maggot (*Delia antiqua)* is a serious pest of onion (*Allium cepa*) in the United States and Canada. The larvae (maggots) damage the host plant with their hooked mouth parts when entering the base of the stem to feed on the bulb. The resultant damage causes young onion seedlings to wilt and die, and older plants wilt then subsequently die in warm weather. The onion fly also introduces and spreads fungal and bacterial pathogens causing the onset of rot. If left uncontrolled, the onion maggot can prevent the production of a marketable crop. More recently, in the United States and Canada, insecticide resistance in many populations has made control of this pest difficult.

Part of plant/commodity affected

The onion maggot attacks the onion bulb and foliage.

Biology

Symptoms

The main damage is caused by the maggot stage of the onion fly. The maggots eat the lateral roots then tunnel into the taproot and the base of the stem to feed on the bulb. Affected seedlings wilt, then become flaccid and die (Adalora and Eckenrode, 1983). On older plants, the leaves appear yellow and wilted, and when pulled will break below the rotting stem. Older plants become stunted and eventually die. Feeding and burrowing by the onion maggots also introduces and spreads fungal and bacterial pathogens, causing the onset of rot. Smaller bulbs may be completely hollowed out, and larger bulbs which contain feeding cavities will rot in storage. In the field, most of the damage from onion maggots appears in patches of dying plants, rather than single plants, since the adults lay their eggs in batches.

Identification

Onion flies are slightly smaller and more slender than houseflies, with longer legs and their wings overlap when at rest (Andalora and Eckenrode (1983). The adult fly is 6-7 mm long, yellowish grey in color with 5 dark stripes on the thorax, yellowish wings, black legs and antennae. An adult female fly is seldom found in the onion host plant as it flies to the plant only to lay its eggs.

The eggs are about 1.5 mm in length, dull white, elongated and longitudinally striped. They are laid singly or in groups of 15-20 on the soil near the stem of the host plant, or on the young leaves and neck of the onion plant, or sometimes between the scales of the bulb.

The larvae (maggots) are white and approximately 8 mm in size when fully grown. The maggots body tapers towards the front where they have conspicuous dark feeding hooks used to bore into the lower stem of the onion and feed on the bulb. The larvae penetrate the tissue between the leaf shoots or at the base of the roots and feed on the decomposing tissues.

The pupae are about 7 mm X 2.5 mm, light to dark-brown in color, ringed and ovoid. The pupae are most often found in the soil near the base of the plant.

Life history

The onion fly overwinters as pupae with broods emerging in spring and summer. The adult female fly lays eggs approximately 7 to 10 days after emergence. A female may survive for 2 to 4 weeks during which she will lay about 150 – 200 eggs in successive cycles at intervals of 15 days. Between the egg-laying periods, the female does not remain in the onion crop. Eggs are laid singly or in clusters of 15 to 20 on the soil near the stem of the host plant, occasionally on the young leaves and neck of the onion plant and sometimes between the scales of the bulb. Eggs hatch into maggots 2-3 days after being laid.

The larvae (maggots) penetrate the onion tissue between the leaf shoots or at the base of the roots and feed on the decomposing tissues. The life span of the larvae is temperature dependent and is approximately 45 days at 15°C and 17 days at 25-30°C. A larva develops through three larval instars then towards the end of its development leaves the host plant and buries itself in the ground about 5-10 cm deep to pupate.

Pupal development takes between 15 to 25 days. The first and second generation pupae remain in the soil for 2-4 weeks before adult emergence. Third generation larvae overwinter in the soil and emerge the following spring.

Dispersal

Adult flight is the main means of natural dispersal of the onion fly. The pest is spread long distances by the movement of infested onions containing maggots or soil containing pupae.

Host range and distribution

Host range

The onion fly attacks *A. cepa* (onion), *A. porrum* (leek) and *A. ascallonicum* (shallot).

Distribution

D. antiqua has been recorded from Europe (Austria, Belgium, Britain, Bulgaria, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Malta, Montenegro, Netherlands, Norway, Poland, Portugal, Romania, Sweden, Switzerland, Serbia), Asia (Cyprus, India, Iran, Israel, Japan, Korea, Manchuria, Turkey), the USSR, Africa (Egypt), North America (Canada, Mexico, USA), and South America (Brazil, Colombia) (CABI, 1981).

Potential distribution in Australia

The onion fly could potentially establish in the temperate onion growing regions of Australia. The pest favours cool wet weather for development.

Pest risk analysis

The following risk analysis for Delia antiqua *is based on the methodology in Biosecurity Australia's guidelines on Import Risk Analysis for Plants and Plant Products (2001).*

Entry potential

Entry potential: Rating = High

The entry potential for the onion fly is considered a high risk. *D. antiqua* would most likely be introduced by infested onion plant or bulbs containing maggots from countries where the pest is known to occur. Less likely means of introduction are by adult flies or soil containing pupae.

Establishment potential

Establishment potential: Rating = Medium

The establishment potential of *D. antiqua* once the pest is introduced into Australia is a medium risk. Once introduced, the onion fly would need to come in contact with onion host plants to become well established.

Spread potential following establishment

Spread potential following establishment: Rating = Medium

The main means of short distance spread is by adult flight and long distance spread of the onion fly is by the movement of infested onion bulbs.

Economic impact

Economic impact: Rating = High

The onion fly or maggot may be particularly devastating in cooler onion growing areas. In some areas of the United States and Canada, control of *D. antiqua* has become difficult because the pest has developed resistance to many of the insecticides used (Ritcey and Chaput, 1998). Currently there are no commercial onion varieties with resistance to the onion maggot.

Environmental impact

Environmental impact: Rating = Low

The introduction of *D. antiqua* is unlikely to impact the environment as the pest specifically attacks onion, leek and shallot. Although, the application of insecticides to the onion maggot may affect the environment.

Conclusions

Overall risk: Rating = High

References

Andalora, J.T. and Eckenrode, C.J. (1983). Insects of onion: onion maggot. Fact Sheet 750.50. New York State Agricultural Experiment Station, Cornell University, Ithaca, NY. Published February 1983. Available online: http://www.nysipm.cornell.edu/factsheets/vegetables/onion/om.pdf

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Ritcey, G. and Chaput, J. (1998). Onion maggot control. Fact Sheet 00-017. Ontario Ministry of Agriculture, Food and Rural Affairs. Published July 1998. Available online: http://www.omafra.gov.on.ca/english/crops/facts/00-017.htm

ONION INDUSTRY BIOSECURITY PLAN

Pest Risk Review

COMMON NAME:	**Bulb mite**
SCIENTIFIC NAME:	*Rhizoglyphus setosus* Manson (Acari: Astigmata: Acaridae) *Rhizoglyphus callae* Oudemans (Acari: Astigmata: Acaridae)
SYNONYMS:	

The scientific and technical content of this document is current to the date published and all efforts were made to obtain relevant and published information on the threat. New information will be included as it comes to light, or when the document is reviewed.

Prepared by Suzy Perry

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Background

Bulb mites of the genus *Rhizoglyphus* (Claparède) (Acari: Acaridae) are important pests of many crops and ornamentals. Members of this genus are distributed worldwide and currently some 13 species have been described as agricultural pests. Most of the damage caused by the bulb mite occurs at the bulb, roots and other subterranean structures of plants. Severely infested plants may be small and stunted and have few or no roots. Heavily damaged plants lose their roots and collapse. Damage is most serious to seedling onions.

Despite their economic importance and broad distribution, the systematics of the genus *Rhizoglyphus* remains in a state of confusion and is in need of a comprehensive revision (Diaz *et al*., 2000). In addition, the field biology and ecology of these mites is not well understood, and methods for sampling, monitoring, and loss assessment are limited. Management of bulb mites is complicated by their short generation time, high reproductive potential, broad food niche, interactions with other pests and pathogens, and unique adaptations for dispersal (Diaz *et al*., 2000).

Part of plant/commodity affected

Bulb mites attack bulbs, roots and other subterranean structures of plants.

Biology

Symptoms

Most of the damage caused by the bulb mite occurs at the bulb, roots and other subterranean structures of plants. The mites penetrate the bulb via the neck, from where they then spread to the outermost scales. Damaged bulbs exhibit brown rotting tissue externally around the neck. The leaves may be delayed in development and appear abnormal. In the damaged tissue thousands of mites and eggs may be seen with the naked eye. Severely infested plants may be small and stunted and have few or no roots. Heavily damaged plants lose their roots and collapse. Damage is most serious to seedling onions.

Mites will injure apparently healthy plant tissue, but infestations develop faster when bulbs are also infected with *Fusarium* or other fungi (Lindquist, 2000). They may attack bulbs infected with such fungi in preference to healthy bulbs. This mite can also feed on a variety of dead and living plant, seeds, dead arthropods, nematodes fungi and manure (Biosecurity Australia, 2000).

Identification

Adult bulb mites are 0.5 to 9 mm long, shiny white and smooth. Adults have four pairs of legs and other appendages which are reddish brown.

The egg is white, translucent, ellipsoidal and approximately 0.12 mm long.

The larva is 0.15 to 0.25 mm long, white and oval with three pairs of legs and without genital suckers.

The protonymph is approximately 0.4 mm long, oval with four pairs of legs. This stage has two genital suckers, whereas the tritonymph has three or four suckers.

The deutonymph or hypopus is 0.2 to 0.3 mm long, brown, oval, convex on top and flattened below.

The tritonymph is approximately 0.5 mm long and does not have a distinct genital aperture.

Life history

Bulb mites usually occur in groups or colonies rather than isolated individuals. Development occurs through 5 or 6 stages, all of which are present throughout the year. The developmental stages are egg (0.12 mm long), larva (0.15 to 0.25 mm long), protonymph (0.4 mm long), hypopus or heteromorphic deutonymph, tritonymph (0.5 mm long) and adult (0.5 to 0.9 mm long) (Lindquist, 2000). Hypopi (plural of hypopus), also called heteromorphic deutonymphs, form when there is overcrowding or the area in which they are feeding deteriorates. This is a non-feeding stage that can attach itself to a visiting insect and be carried elsewhere to begin life anew. This is known as phoresy, and contributes to the widespread distribution of the bulb mite (Lindquist, 2000).

Populations of the bulb mite can increase rapidly. Under optimum conditions, females can live up to 40 days and produce 700 eggs; males can live for up to 73 days (Straub and Eckenrode, 1996). It is estimated that under field conditions, a generation can be completed in approximately four weeks. No pesticides are registered for suppression of this pest on onion. Because it has such a wide host range, most crop rotations will not manage it. Although the mite probably exists at some level in most soil environments, it is believed that economic damage occurs when some disruption, such as reduction of natural enemies, or a sudden infusion of organic matter in the form of green mulch allows the resident population to increase to damaging levels.

Dispersal

Bulb mites are spread by insects or other animals to which they attach, or by the movement of infested soil or plant material. They are often shipped long distances on bulbs, corms and tubers.

Host range and distribution

Host range

Bulb mites are polyphagous on many bulb-, corm- or tuber-forming plants. Members of the genus *Rhizoglyphus* attack *Allium* spp. (onion); *Beta* spp. (beet); *Caladium* spp.; *Capsicum* spp. (pepper, chilli); *Citrus* spp.; *Curcuma domestica* (turmeric); *Dacus carrota* (carrot); *Dioscorea* spp. (yams); *Freesia* spp. (freesia); *Gladiolus* spp. (gladiolus); *Hyacinthus* spp. (hyacinth); *Hypomoea* spp., *Iris* spp. (iris); *Lilium* spp. (lily, lilium); *Lolium longiflorum* (rye grass); *Oryza sativa* (rice); *Narcissus* spp. (daffodil); *Secale cereale*; *Solanum* spp.; *Solanum tuberosum* (potato); and *Tulipa* spp. (tulip) (Biosecurity Australia, 2000).

Distribution

Members of this genus are distributed worldwide; currently some 13 species have been described as agricultural pests.

Potential distribution in Australia

Members of the genus *Rhizoglyphus* are present in Australia, however, classification of this genus in Australia and worldwide is in a state of confusion and is in urgent need of clarification. It is likely that many species remain undescribed and that currently described species may be incorrectly classified (Biosecurity Australia, 2000). It is likely that *R. setotus* and *R. callea* would become established in Australia if they were introduced as suitable host plants (mainly onion, ornamental bulb species, and potato) are widely available.

Pest risk analysis

The following risk analysis for Rhizoglyphus setosus *and* Rhizoglyphus callae *is based on the methodology in Biosecurity Australia's guidelines on Import Risk Analysis for Plants and Plant Products (2001).*

Entry potential

Entry potential: Rating = High

The entry potential for the bulb mite is considered a high risk. Worldwide, *Rhizoglyphus* species are a frequent pest of commercial shipments of bulbs (Biosecurity Australia, 2000).

Establishment potential

Establishment potential: Rating = High

The establishment potential of the bulb mite once the pest is introduced into Australia is a high risk as suitable host plants (mainly onion, ornamental bulb species, and potato) are widely available. The bulb mite can persist in the soil feeding on a range of organic matter.

Spread potential following establishment

Spread potential following establishment: Rating = High

Rhizoglyphus spp. can be spread by members of the soil biota e.g. beetles and transported in infested soil and plant material (Biosecurity Australia, 2000).

Economic impact

Economic impact: Rating = High

Rhizoglyphus spp. are important pests of onion and ornamental bulbs. Yield losses from this pest can be up to 50% in severely affected fields.

Environmental impact

Environmental impact: Rating = Low

The introduction of *Rhizoglyphus* spp. is unlikely to impact the environment.

Conclusions

Overall risk: Rating = High

References

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