Field Guide To

Cream Gold Onion Disorders & Their Control

In Tasmania

Tasmania

DEPARTMENT *of*
PRIMARY INDUSTRIES
and FISHERIES

HRDC

HORTICULTURAL RESEARCH &
DEVELOPMENT CORPORATION
The Research Arm of the
Australian Horticultural Industries

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CONTENTS

INTRODUCTION

This guide is intended to provide a practical reference for the preliminary identification of onion disorders commonly encountered in the field. It is best used in conjunction with crop monitoring which can be achieved by regularly walking through the crop. Any disorders can then be evaluated on the spot and later brought to the attention of the appropriate field officer for confirmation.

Relevant background information and general control strategies follow photographs and descriptions for most of the disorders presented in this guide. Since chemical control recommendations change from time to time, they have not been included in this guide - contact your local field officers or chemical suppliers for the most effective current chemical control, and any changes to management strategies. The guide also covers some post-harvest disorders as these can affect the value of the crop, and many of these problems arise from conditions in the field.

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DAMPING OFF

Pythium spp FUNGUS

SYMPTOMS

* Sudden wilt and death
* Rapid drying of leaf tissue
* Infected plants rapidly disintegrate, making detecting this disease difficult

WHEN TO LOOK

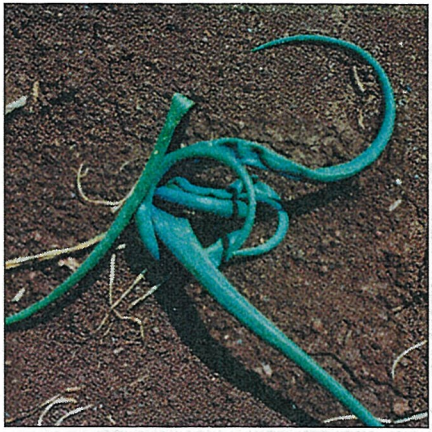
* Germination to 3 leaf stage
* When seedlings encounter conditions that cause slow emergence

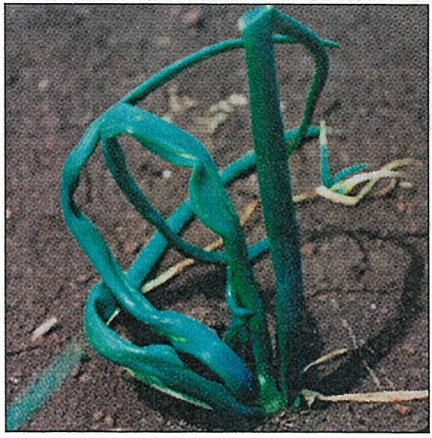
USEFUL INFORMATION & CONTROL

* Occurs in cold, wet, poorly drained soils, in areas of compaction
* Seed treatment with fungicide is important for control

BLOAT NEMATODE

Ditylenchus dipsaci NEMATODE





SYMPTOMS

* Patches of infection
* Leaves stunted and distorted
* Premature bulbing evident with 'crinkling' of bulb tissues
* Bulbs bloated and misshapen, skins cracked, dry scales

WHEN TO LOOK

* Germination to lifting

CONTROL

* The nematode is capable of surviving in infested soil for many years and will also infect a number of other hosts
* Red clover may act as an alternative host
* Known infested paddocks should be avoided for onion production as losses are likely to more serious in future crops
* Good hygiene practices are needed to prevent spread to other paddocks, which is by the movement of infested soil
* Treatment of soil with nematicides before planting may be needed if sowing into ground known to have a history of infestation

ROOT KNOT NEMATODE

Meloidogyne spp NEMATODE

SYMPTOMS

* Seedlings unthrifty, stunted, uneven emergence, wilt and death
* Roots beaded/knotted or swollen

WHEN TO LOOK

* Germination to lifting

USEFUL INFORMATION & CONTROL

* The symptom of swollen or beaded roots is very distinctive and unique to this disorder
* Rarely causes any economic loss
* Pre-plant treatment of soil with nematicide if necessary

ONION WHITE ROT

Sclerotium cepivorum FUNGUS

SYMPTOMS

* Onion plants wilting or dying out in patches or rows
* Leaves pale straw colour

* Early infection results in wilt and death of seedlings
* Seedlings or bulbs easily pulled from soil with damaged, or even no roots
* White mould below soil often with round black sclerotia (round black resting bodies, 0.5mm in diameter)

Onion white rot (cont.)

* Infection at later growth stages will destroy roots and growing points resulting in small bulbs or hollow rotten shells
  - sclerotia common at this stage, sometimes with very large sclerotia (as in the lower photograph)

WHEN TO LOOK

* Germination to lifting

USEFUL INFORMATION & CONTROL

* Sclerotia survive for at least 20 years in the soil and are readily spread with soil on machinery, animals, erosion wash, etc
* Hygiene practices are needed to prevent movement of infested soil
* It should be recognised that once an outbreak has been recorded on a property it is likely that the disease will move to other paddocks, so precautions should be taken to protect future crops
* Sclerotia germinate to infect onion roots directly, gradually growing up towards the base plate and decaying the growing point of the bulb
* Disease is favoured by cold, wet conditions, with autumn and winter crops more at risk than spring sown
* Severe losses in known infested areas can be avoided by planting crops in September
* Registered fungicide applications reduce losses in slight to moderately infested paddocks
* Severely infested paddocks should not be used for onions
* The first appearance of a small patch can be managed by removal of diseased plants and infested soil to a depth of 150mm, and burying them at a site where the infested material will not be exposed
* Small patches could be fumigated
* Small patches left untreated act as a source of disease that will be spread during cultivation

BACTERIAL SOFT ROT

Pseudomonas spp & *Erwinia* spp BACTERIA

SYMPTOMS

* Leaves wet and slimy, then softening/breakdown of bulb scales
* May smell sour or vinegary
* May develop rapidly on leaves and move into the neck region, and then rot inner scales
* Cutting bulb open reveals characteristic slimy rot

WHEN TO LOOK

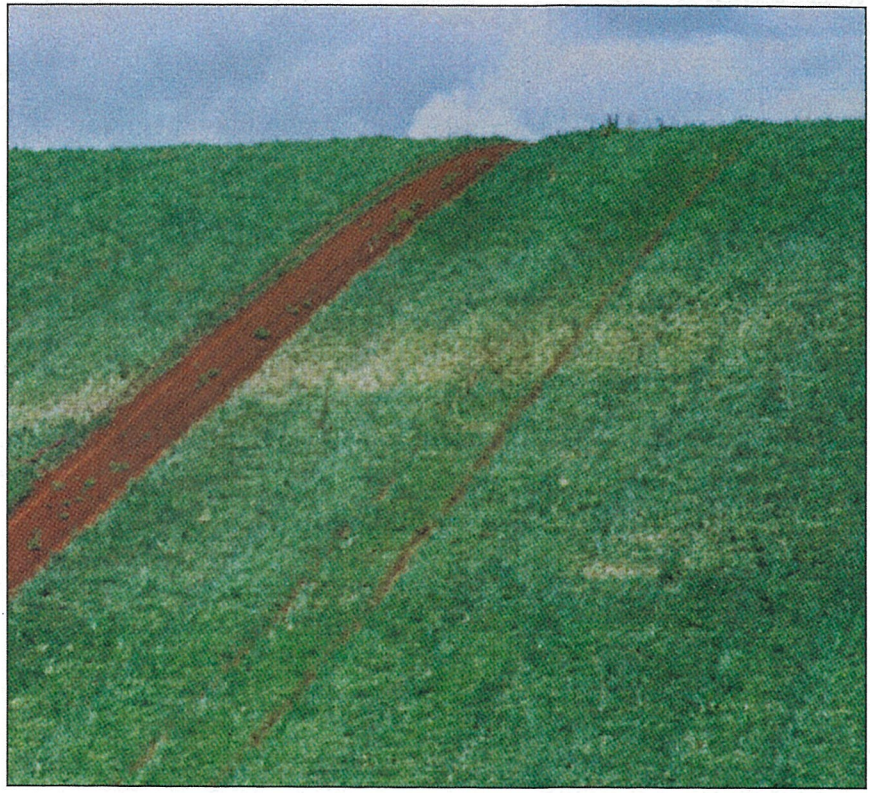
* 4 leaf to harvest and also in storage

USEFUL INFORMATION & CONTROL

* Bacteria generally infect as secondary pathogens of damaged leaf tissue
* Free water and high humidity are needed for infection and disease development
* Damage may be initiated by wind-blast, hail, frost, machinery, etc
* Infected plants should be removed where possible to prevent infection entering the bulb where it creates a hidden quality problem during packing
* Excessive nitrogen and irrigation (which promotes lush top growth and raises the humidity in the onion canopy) increases the risk of disease
* Weed control should be maintained at effective levels to reduce humidity levels within the canopy
* The application of registered copper fungicides to crops known to have been damaged or at risk from damage may be beneficial

DOWNY MILDEW

Perenospora destructor FUNGUS



SYMPTOMS

* Patches affected
* Leaves yellow with or without a very fine granular appearance (spores)
* Leaves shrivel, may wilt or become slimy
* Masses of violet-grey spores appear as a felt on leaves at advanced stages

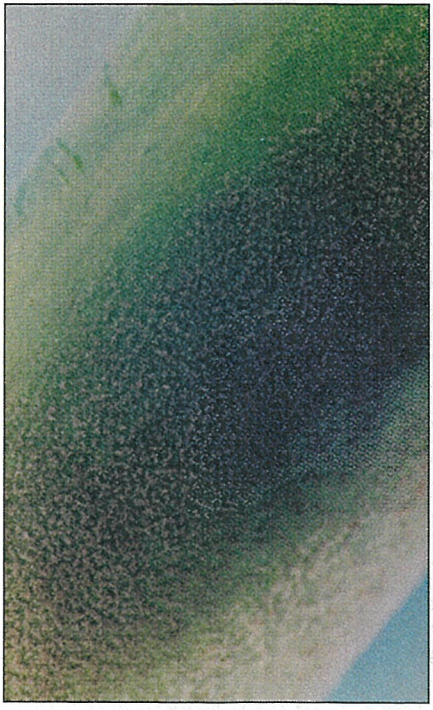
WHEN TO LOOK

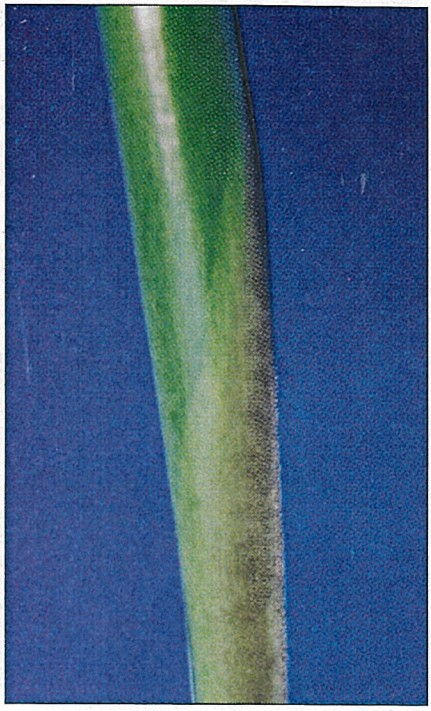
* 4 leaf to top senescence

USEFUL INFORMATION & CONTROL

* Mildew can occur in any year but requires specific conditions for production of spores and leaf infection
  - a relative humidity of greater than 95% within the canopy from 3.00am until 10.00am EST for spore production and infection (spore production will only occur in the dark)
  - no or only light rain during the same period
  - mean daily temperature must be below 22° C
  - temperatures between 10 and 13° C favour disease
  - heavy rain or water droplets damage spores as they develop

Downy mildew (cont.)



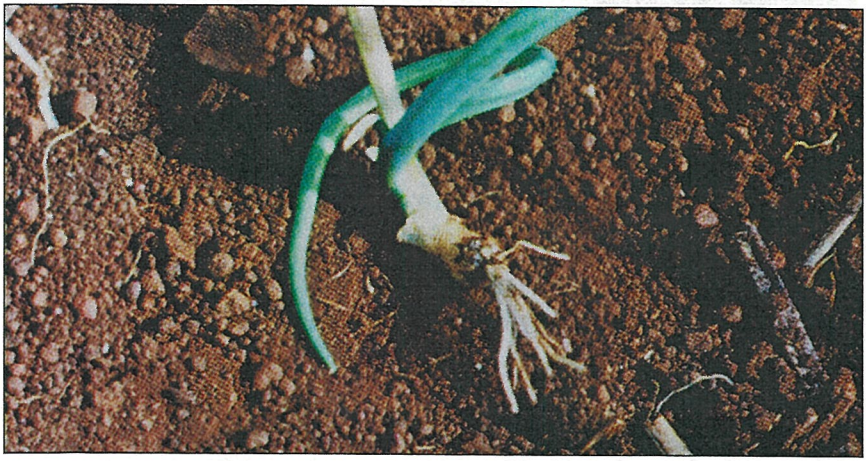


* There is a latent period of 9 - 16 days between leaf infection and the development of symptoms and the characteristic violet-grey spores
* The disease is capable, under ideal conditions, of destroying all green leaf tissue within four cycles of the disease, severely affecting bulb size and yield
* Some districts, because of their topography and microclimate and prevailing weather conditions are more prone to mildew infection
* Close rotations (less than four years) and crops grown adjacent to older or the previous season's crop (which act as reservoirs of disease) promote early disease
* Disease is carried over in bulbs and on crop residues

* Cultural practices to reduce humidity levels within the canopy can help to reduce the likelihood of mildew in the crop
  - row orientation should be parallel to the prevailing wind to ensure air flow through the crop for as long as possible
  - lower crop densities reduce canopy density and humidity
  - an easterly paddock aspect ensures that leaves dry early to deprive the fungus of the conditions it requires for leaf infection
  - good weed control reduces humidity within the canopy
* Growers should plan to spray early when conditions are right for infection, particularly if they are in a recognised mildew risk area
* A maximum of four eradicant sprays per season can be used and only in blocks of two sprays to prevent the build up of fungus resistance to these fungicides
* Once a protectant schedule is started, it must be maintained at regular intervals in accordance with the manufacturers instructions on the label
* Good coverage is essential for maximum control
* Use of a wetter/spreader is recommended but this will not compensate for inadequate leaf coverage and canopy penetration
* Once a regular irrigation schedule has started, protectant fungicides must be timed to be applied on either the day irrigation begins or the day before
* Crops are most at risk of infection in the 24 hours after irrigation or rain, once the canopy has closed
* Spraying must cease one week before lifting
* Downy mildew cannot be controlled effectively by aerial fungicide application

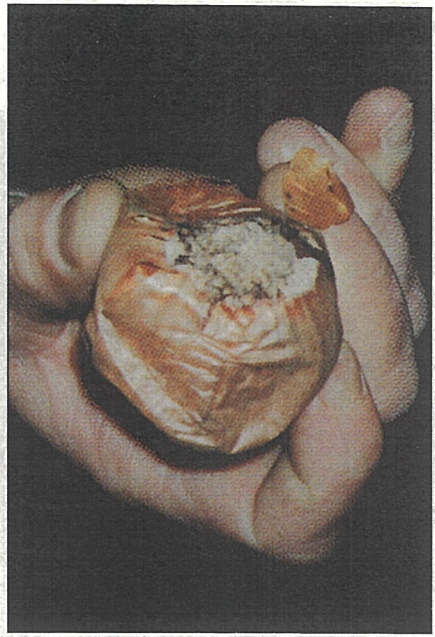
FUSARIUM ROT

Fusarium spp FUNGUS



SYMPTOMS (also see Pink Root)

* During early onion growth stages, leaves curl but remain firm
* Lesion or split on one side of developing bulb, sometimes with white or pinkish/orange mould, often with soil attached



* At later onion growth stages, base plates may split, sometimes associated with pink roots
* Bulbs in store may have a profuse white-pink mould on base plate of affected onions, usually associated with mechanical damage

WHEN TO LOOK

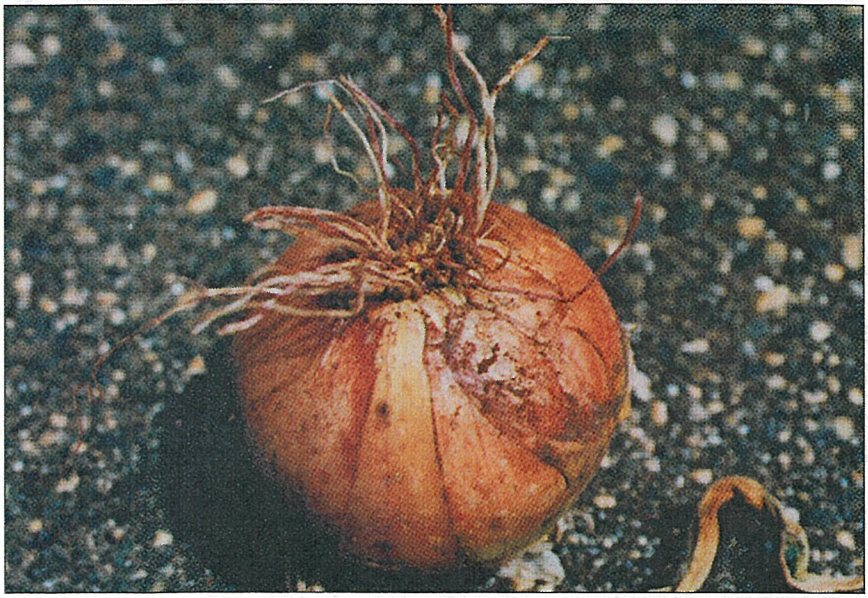
* 3 leaf to harvest and in storage

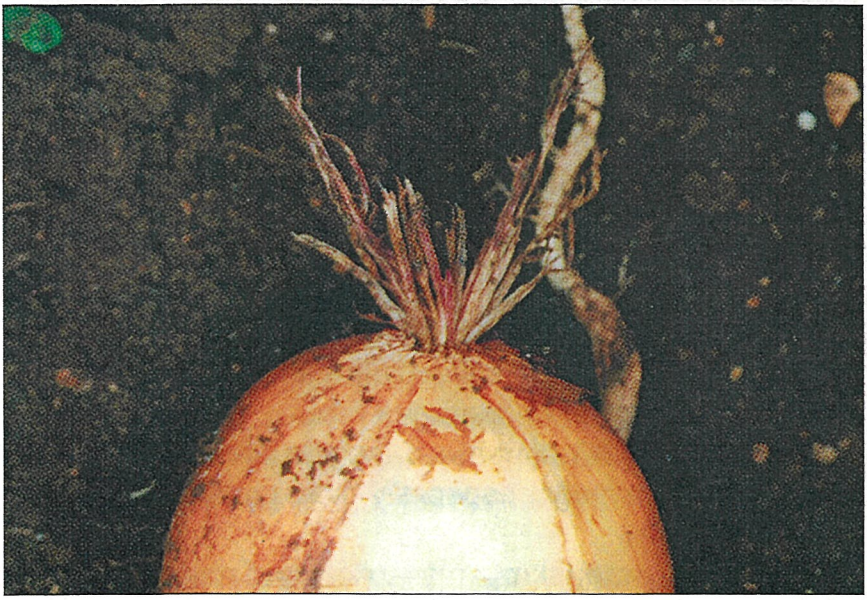
USEFUL INFORMATION & CONTROL

* Not generally a significant problem and occurs as a secondary invader of damaged tissue
* Important sources of damage include insect attack and mechanical damage, especially base plate damage following lifting
* Secondary bacterial rots may follow and rot the bulb

PINK ROOT

Pyrenochaeta terrestris & *Fusarium* spp complex FUNGI





SYMPTOMS (also see Fusarium Rot)

* Pink/mauve roots which shrivel and turn brown
* Plants easily pulled
* Small black round structures (pycnidia) may be visible on roots, if caused by *Pyrenochaeta terrestris*
* Reduction in bulb size and yield
* Severely affected plants have symptoms similar to nutrient deficiency, drought or Onion white rot infection

WHEN TO LOOK

* Germination to lifting

USEFUL INFORMATION & CONTROL

* Fusarium spp infection can also cause roots to turn pink
* For *Pyrenochaeta terrestris*
  - Only roots are affected
  - Commonly seen close to lifting
  - Most serious in warmer growing areas
  - Mild infections are often not detected
  - Soil-borne disease spread by the movement of infested soil/water
  - Lives for several years in the soil
  - Wide host range
  - 4-5 year rotations without host species which include all Alliums, maize and sorghum, will greatly reduce disease levels in the soil

BOTRYTIS NECK/BULB ROT

Botrytis allii FUNGUS

SYMPTOMS

* Rapid death at emergence, associated with grey mould on stems
* Indications of infection during growth stages once plants have successfully emerged can be difficult to find, but consist of small patches of grey/brown spores either on dying leaf tissue or on split scales
  - The most likely place to see evidence of field infections are along irrigation runs at damp spots, where bulb scales are split

* Symptoms of infection can be detected post lifting, prior to harvest, but it is likely that most infections will remain symptom free at this stage
  - inspection of curing onions may reveal a grey mould beneath outer scales, often in the neck region

Botrytis neck/bulb rot (cont.)

* Characteristic storage symptoms occur two months after harvest, even though infection occurred in the field
  - softening/breakdown of bulb
  - breakdown generally confined to neck or base plate
  - grey/brown spores and/or large flat, black sclerotia (resting bodies, 0.5 to 1 cm in diameter) may be evident in mouldy area

WHEN TO LOOK

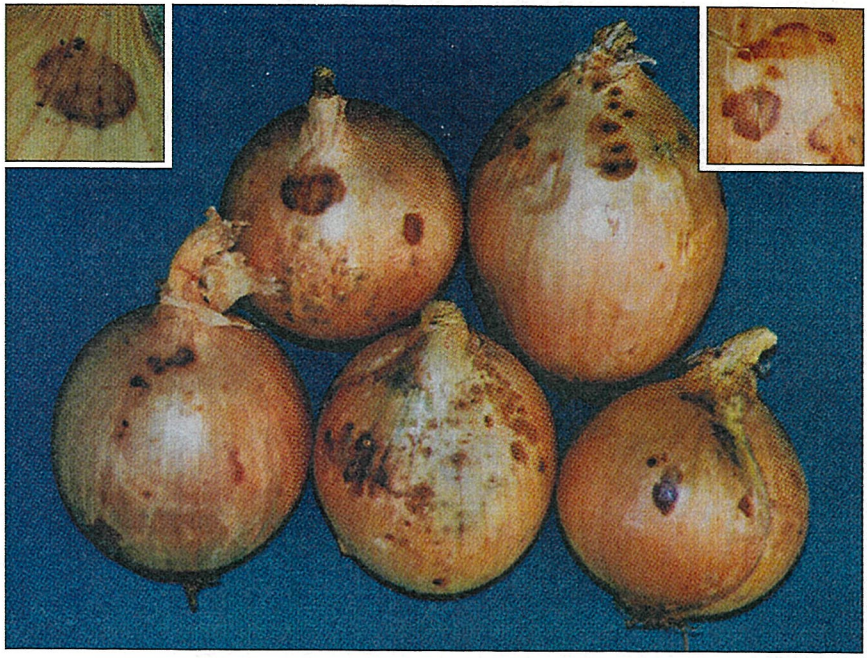
* All stages of growth - but neck rot symptoms mostly occur in storage

USEFUL INFORMATION & CONTROL

* Field infection may occur throughout the growing season
* Infected seed increases the risk of disease
* Seed dressings are important for control
* Infection is air-borne and spores produced on crop residue, unharvested bulbs, cull piles and older infected crops can infect nearby crops
  - Crops less than 200m from the infection source are most at risk
  - Crop debris should be destroyed, removed or deep buried as soon after harvest as possible to prevent infestation of any adjacent, newly sown or emerging onion crops
* Crop rotations of at least four years are required to prevent disease carryover
* Disease is favoured by persistent showery weather which allows spores to be produced and leaf infection to occur
* Rapid curing of lifted onions can prevent movement of the fungus from infected leaves into the neck region of bulbs
* Windrowed onions should be spread in a manner likely to promote rapid and thorough drying
* Supplementary drying of bulbs at 23 - 25° C in store may be required when seasonal conditions do no favour field curing
* Onions with excessively thick necks (favoured by over fertilisation/over-watering) are more difficult to cure rapidly and are more likely to be affected
* Bulb damage at lifting, harvesting and during handling should be avoided to prevent infection
* Fungicide spray programs may be needed

BROWN STAIN

Botrytis cinerea FUNGUS



SYMPTOMS

* Circular brown stains on the outer scale, occasionally extending to the second scale

WHEN TO LOOK

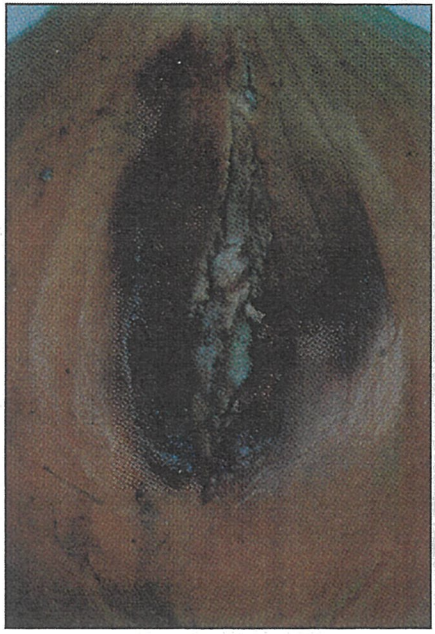
* Bulbing to harvest

USEFUL INFORMATION & CONTROL

* Infection occurs in the field by airborne spores
* Due to wide host range, clean up of crop residues needed
* Favoured by moist conditions, particularly in windrows
* Bulbs do not usually rot except if bacteria enter stain
* Stained scales often peel off during handling

BOTRYTIS SOIL LINE ROT

Botrytis allii & *Botrytis* spp FUNGUS



SYMPTOMS

* A dark lesion occurs penetrating several scales which often split

WHEN TO LOOK

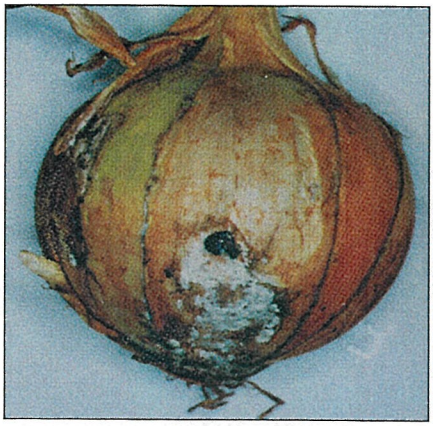
* Bulbing to harvest

USEFUL INFORMATION & CONTROL

* Other rots commonly follow infection
* Lesions are usually associated with contact with soil
* Worse on transplanted onions and during cool wet weather
* There may be several *Botrytis* species causing these symptoms

BULB ROT

Botryotinia porri or *Sclerotinia* spp FUNGUS



SYMPTOMS

* White mycelium (white cottony growth) with large black, flat sclerotia (resting bodies, 0.5 to 1 cm in diameter)
* Sclerotia may be embedded in scales, which can be flaky
* Watery lesion on outer scales may be visible

WHEN TO LOOK

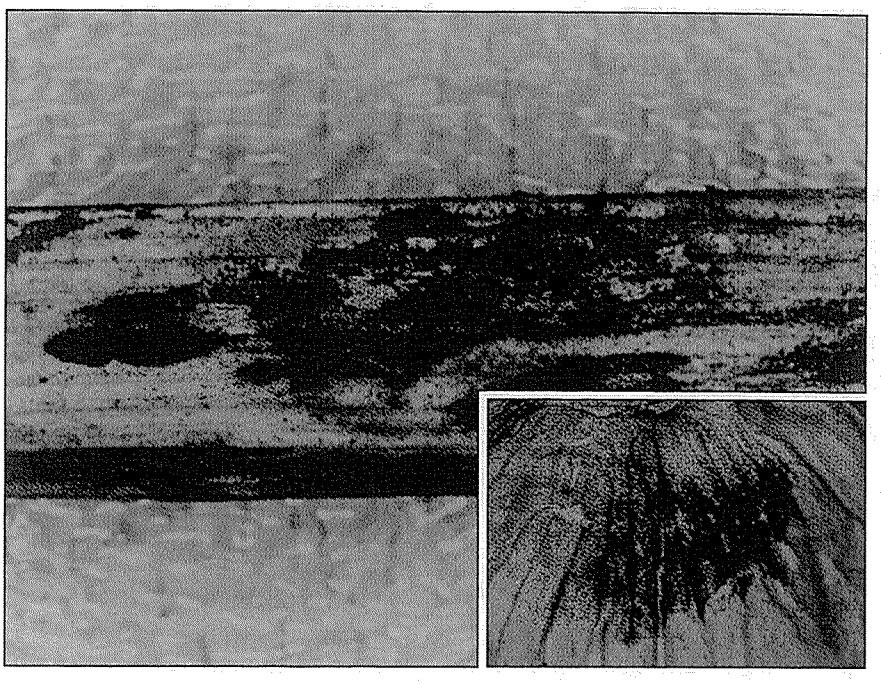
* Bulbing to harvest

USEFUL INFORMATION & CONTROL

* This disease is thought to be caused by either *Botryotinia porri* or a *Sclerotinia* species
* The importance of this disease is not known in Tasmania, but both pathogens have caused localised problems in other parts of the world
* Both pathogens are favoured by prolonged cool moist conditions
* Cleaning up crop residue and 4-5 year rotations are likely to be important

STEMPHYLIUM LEAF MOULD

Stemphylium spp FUNGUS



SYMPTOMS

* Yellow tips or dying leaf tissue become blackened with a dark mould

WHEN TO LOOK

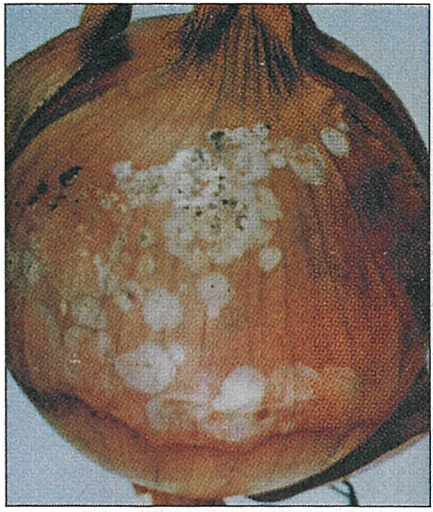
* Any time tissue is damaged, especially bulbing to harvest

USEFUL INFORMATION & CONTROL

* Generally occurs as a secondary invader of injured tissue, caused mainly by Downy mildew , but also by herbicide burn, frost and wind damage
* Control by treatment of primary cause, particularly by controlling Downy mildew and avoiding herbicide burn

PENICILLIUM BLUE MOULD

Penicillium spp FUNGUS



SYMPTOMS

* The first sign of the presence of this disease are pale spots on onion skins
* The next stage is a powdery green/blue mould on outer scales, not generally associated with breakdown

WHEN TO LOOK

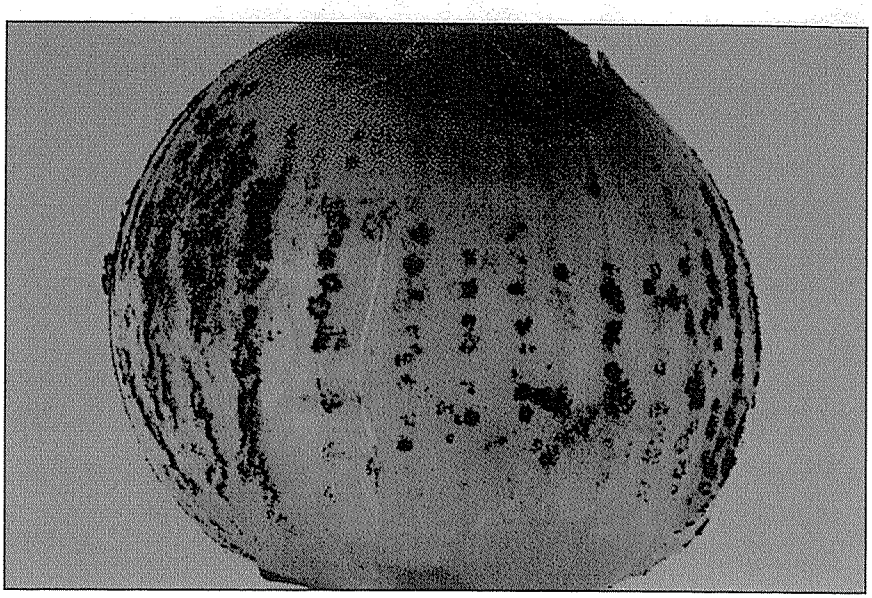
* Lifting to storage

USEFUL INFORMATION & CONTROL

* Infection occurs in the field and is common on bulbs windrowed under humid conditions or in close contact with moist soil
* Develops further in store under humidities of greater than 85% and temperatures 20 - 25° C
* Good ventilation and airflow in store prevents spore formation which is the source of the blue powder

ASPERGILLUS BLACK MOULD

Aspergillus niger FUNGUS



SYMPTOMS

* Superficial, powdery mould on outer scales, not generally associated with breakdown
* Black powdery mould which looks like soot

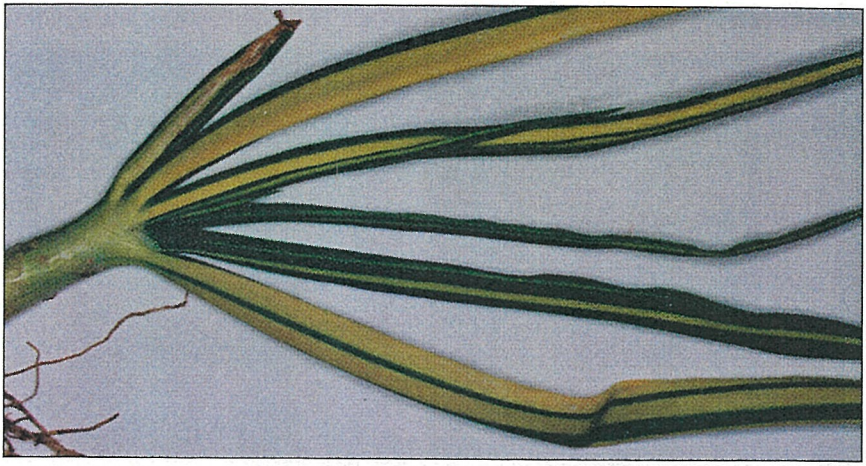
WHEN TO LOOK

* Storage

USEFUL INFORMATION & CONTROL

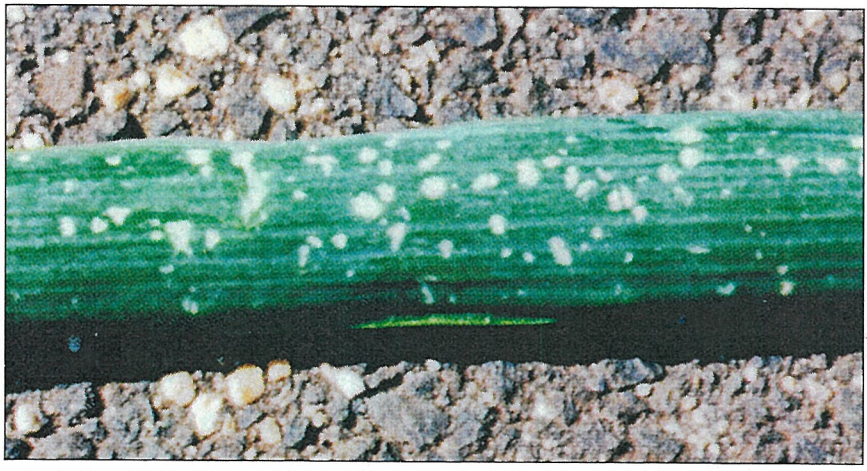
* Can be seed-borne, especially in seed lines grown in warmer areas of Australia
* Infection occurs in the field and develops in store
* Favoured by temperatures around 30° C, so generally worse in artificially cured bulbs
* Not normally a problem in Tasmania

GENETIC VARIATION



* These striped leaves are not caused by a virus, but are due to a natural genetic mutation that results in variegated leaves

HAIL DAMAGE



* White indented spots on leaves, typically only on one side of the leaf, facing the prevailing hail storm

RING SPOT

Ring Spot VIRUS

SYMPTOMS

* This distinctive symptom of brown rings on onion leaves is thought to result from infection with a ring spot virus

WHEN TO LOOK

* All growth stages

USEFUL INFORMATION & CONTROL

* The virus is transmitted by insects, such as thrips, which may live on weeds or other suitable volunteer plants
* Patches of infection typically occur close to areas of weeds such as next to fence lines
* This disorder is not known to cause any economic damage on onions

ONION THRIPS

Thrips tabaci INSECT

SYMPTOMS

* Thrips leave small, thin brown rasp holes in the leaf surface as they suck the plant sap
* Silvery streaks form on the leaf as a result of the damage
* Thrips are yellow/brown and 1-2mm long

WHEN TO LOOK

* 4-8 leaf stages from December to March

USEFUL INFORMATION & CONTROL

* Onion thrips feed on numerous plant species and are able to fly or blow to new vegetation
* Thrips become economically important on onions when mean daily temperatures rise above 14.5 C (December to March), but only reduce yield when present during bulb formation (4 - 8 leaf stages)
* For every 10 thrips (adults and juveniles) on each plant, the weight of the bulb is reduced by 4 grams
* Thrip infestations during bulb fill (9 leaf and later) have little impact on yield
* Rain and irrigation reduces populations
* Insecticides are available to kill thrips
* Repeat sprays of insecticides are needed to kill newly hatched juveniles
* Care should be taken to avoid damage to bees

LUCERNE FLEA

Sminthuris viridis INSECT

SYMPTOMS

* Chews numerous tiny pits in seedling onions
* Grow up to 3mm long, are yellow-green and jump when disturbed

WHEN TO LOOK

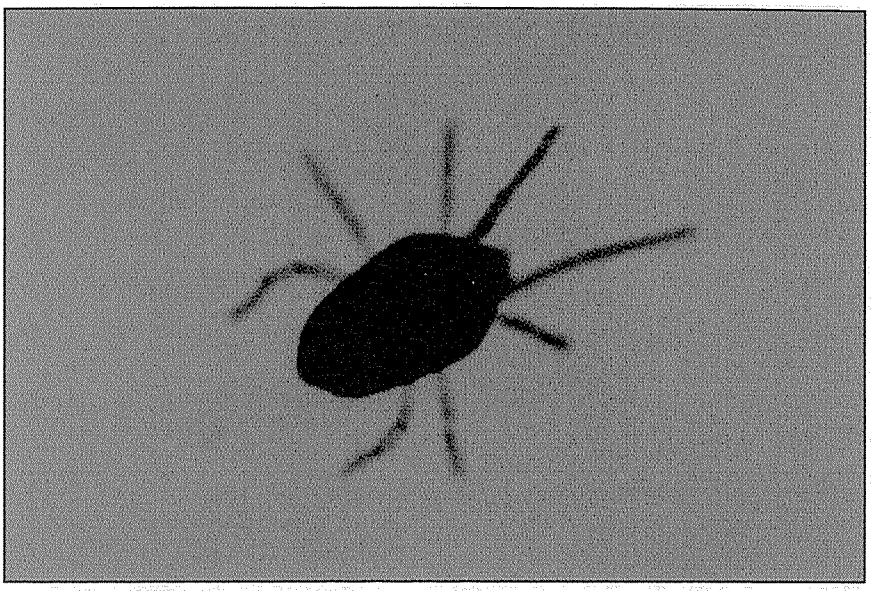
* All growth stages, but most active in autumn and spring

USEFUL INFORMATION & CONTROL

* Feeds in autumn and spring preferring clover in pastures
* Large populations can survive cultivation to attack new crops
* Short fallows and reduced cultivation after pasture increase insect survival
* Early autumn rains trigger eggs to hatch before cold winter weather reduces numbers.
* Insecticides may be needed

RED-LEGGED EARTH MITE

Halotyoleus destructor INSECT



SYMPTOMS

* Sucks sap from leaf tissues leaving tiny silvery or bronze spots
* Pinhead size black body with reddish legs

WHEN TO LOOK

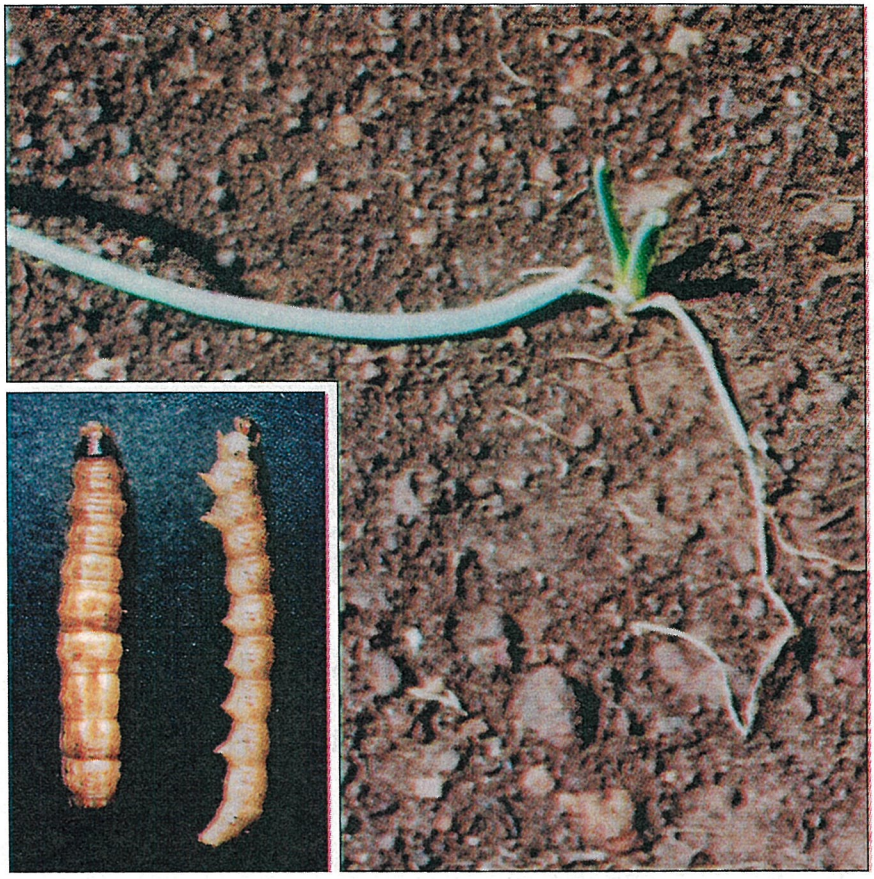
* All growth stages but most active in autumn and spring

USEFUL INFORMATION & CONTROL

* Prefers clover in pastures and has a similar life cycle to the Lucerne flea
* Mites run actively on the soil surface unlike the Lucerne flea
* Cold weather will also reduce mite populations
* Insecticides may be needed

CUTWORM

Agrotis spp INSECT



SYMPTOMS

* Cutworms are smooth, dark grey caterpillars with a dirty cream underside which can be found around damaged plants in the soil
* They curl up when handled
* Seedlings are lopped at the feeding site
* Grubs hide in surface soil by day and emerge at night to feed

WHEN TO LOOK

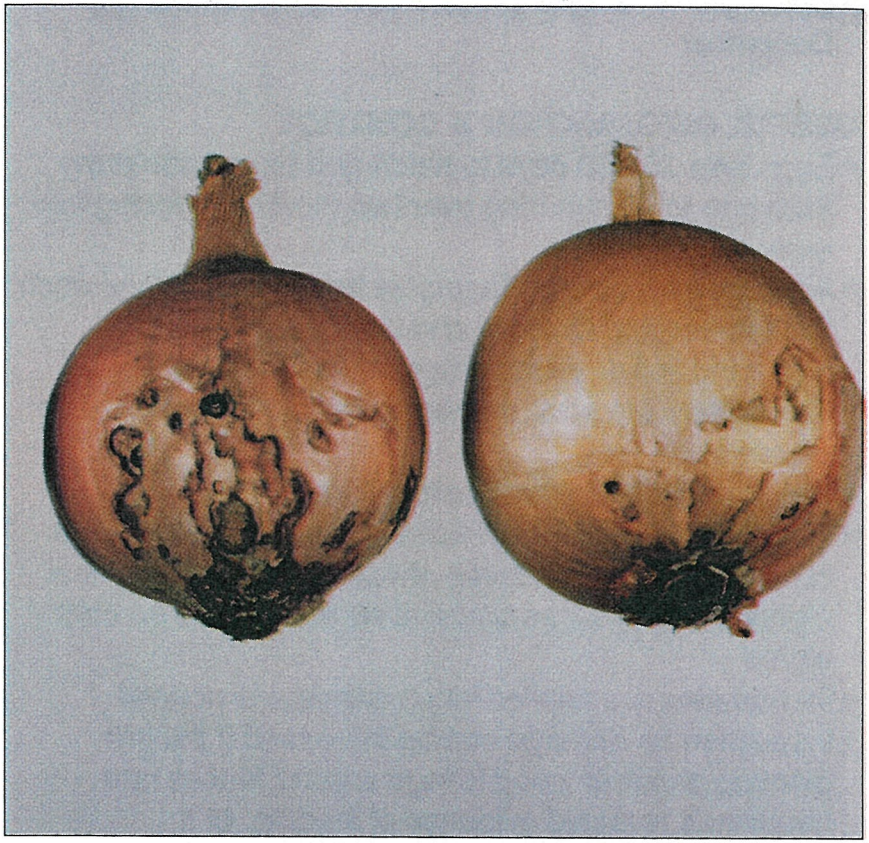
* Check weed foliage around fences and headlands prior to planting for evidence of feeding
* Onion growth stages present during November and December

USEFUL INFORMATION & CONTROL

* Eggs take 15 - 30 days to hatch and larvae can grow from one to 40 mm long over two months in spring and early summer
* Adult moths blow into Tasmania from the mainland each September and October and lay eggs on recently cultivated soil or young crops or weeds
* Caterpillars are most damaging by late November/mid December
* Wet weather kills young caterpillars
* There are several insecticides registered for cutworm control in onions but these should not be applied until nights are warmer as caterpillars do not feed on cold nights
* Insecticides are applied when damage is noticed
* Inspection for damage can be increased if the pre planting check of weed foliage around fences and headlands revealed evidence of feeding, or if outbreaks are forecast
* Incorporation of insecticides into soil reduces their efficacy

WHITE FRINGED WEEVIL

Graphognathus leucoloma INSECT

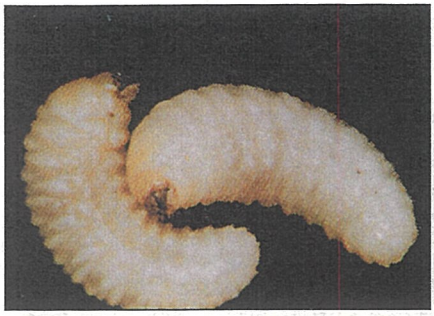


SYMPTOMS

* Roots chewed off, resulting in wilting or death
* Characteristic symptoms are loss of roots and holes in the bulb

WHEN TO LOOK

* Germination to lifting

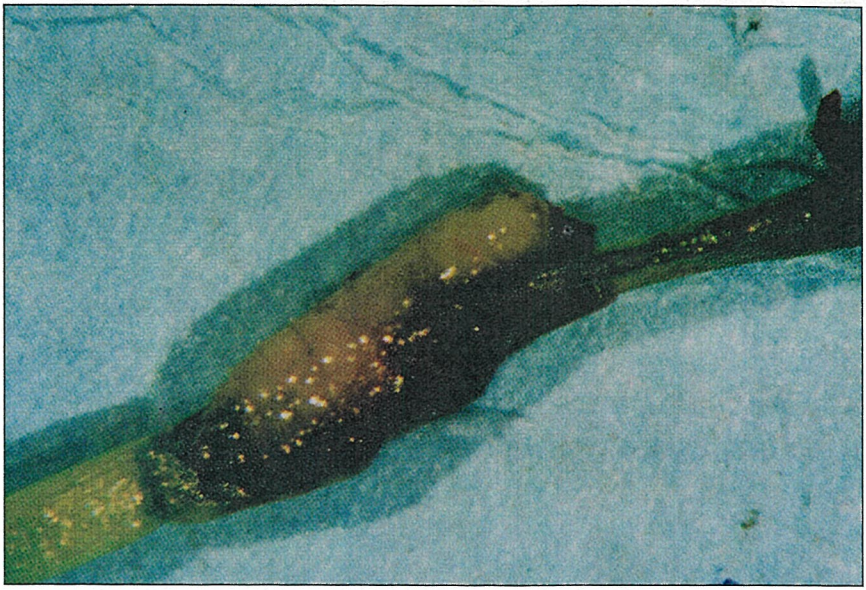


USEFUL INFORMATION & CONTROL

* Grubs are creamy white, up to 13mm long, legless and banana shaped
* Grubs live in the soil
* Insecticides can be used to kill the adult beetles which live on the surface, but it is difficult to reach the grubs in the soil
* Grubs hatch in autumn, and grow for 12 months or more
* Adults are wingless, long-lived and active walkers and climbers in late summer
* The adult weevil is spread by the movement of soil, farm produce or as 'hitchhikers' on vehicles, containers and machinery
* The rotation of favoured hosts (poppies, potatoes, peas, beans, onions and lucerne) with unsuitable hosts (grass, corn and cereals) will limit population build-up by starving the larvae and denying egg-laying sites to adults
* In pastures it feeds on clover and broad-leaf weeds with tap roots
* Volunteer host plants should be controlled as these provide refuge for the insect and allow it to spread to neighbouring crops
* Fumigation of soil may be required if large populations establish

ONION MAGGOT

Delia platura INSECT



SYMPTOMS

* Roots eaten and plant base colonised

WHEN TO LOOK

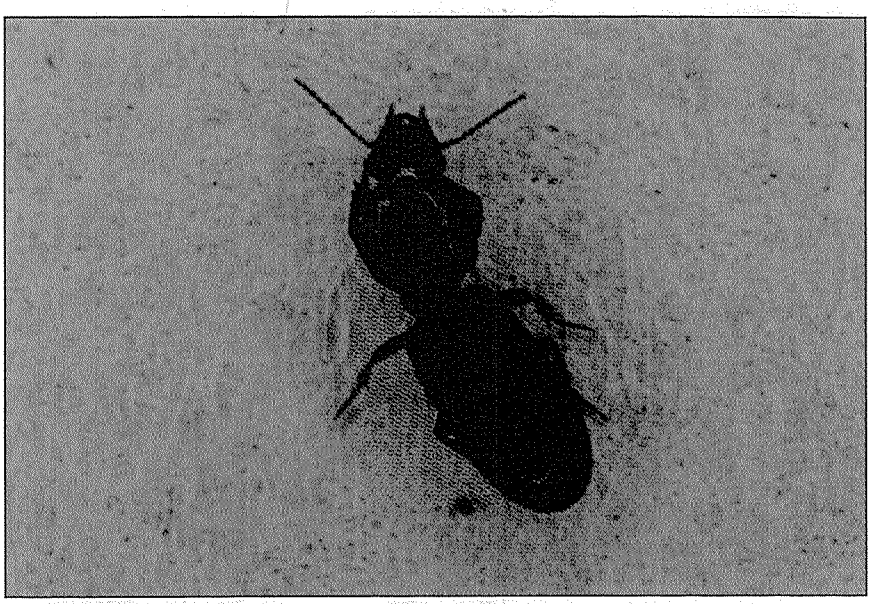
* Germination and early growth

USEFUL INFORMATION & CONTROL

* Adult fly is grey and the size of a house fly
* Maggot is creamy white, up to 10mm long
* Cocoon is brown
* Occur in presence of fresh organic matter that is still decaying
* Early seed bed preparation free of organic matter aids control
* Insecticides before sowing if needed, or at "Burnoff"

STRAWBERRY BEETLE

Clivina spp INSECT



SYMPTOMS

* Damaged roots

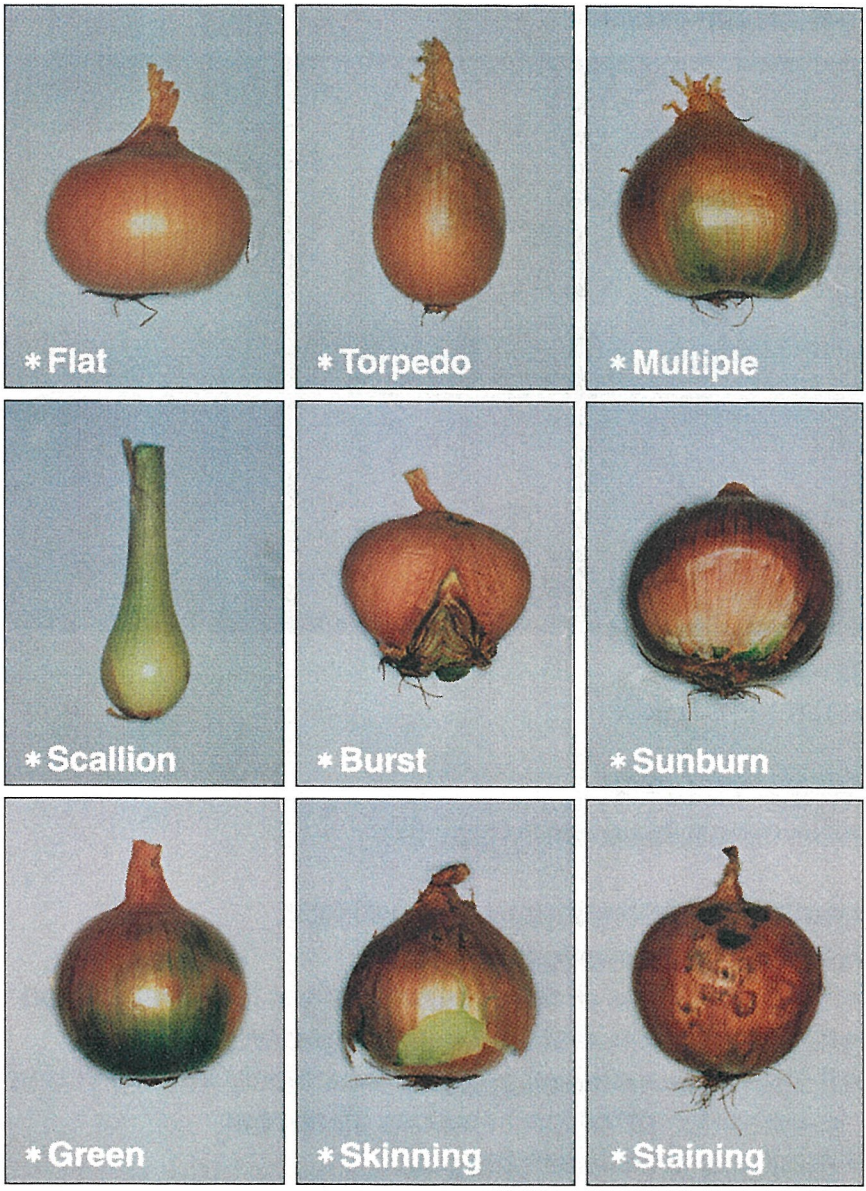
WHEN TO LOOK

* Germination and early growth

USEFUL INFORMATION & CONTROL

* A shiny black beetle 8mm long
* The importance of this insect is not yet fully understood
* It has been associated with damaged crops
* It may be a beneficial predator which only attacks young crops when other food sources disappear
* Adult and larva live in the soil
* Insecticides may be beneficial, although they need to be applied so as to penetrate the soil

SHAPES & SKINS



* Any of these would result in a reduction of the crop value

USEFUL INFORMATION & CONTROL

FLAT & TORPEDO
* Influenced by cultivar and seasonal growing conditions

MULTIPLE
* More likely to occur in low density plantings, but cultivar choice is also important

SCALLION
* Cultivar choice and late nitrogen application involved

BURST
* Due either to Fusarium rot or late applications of nitrogen

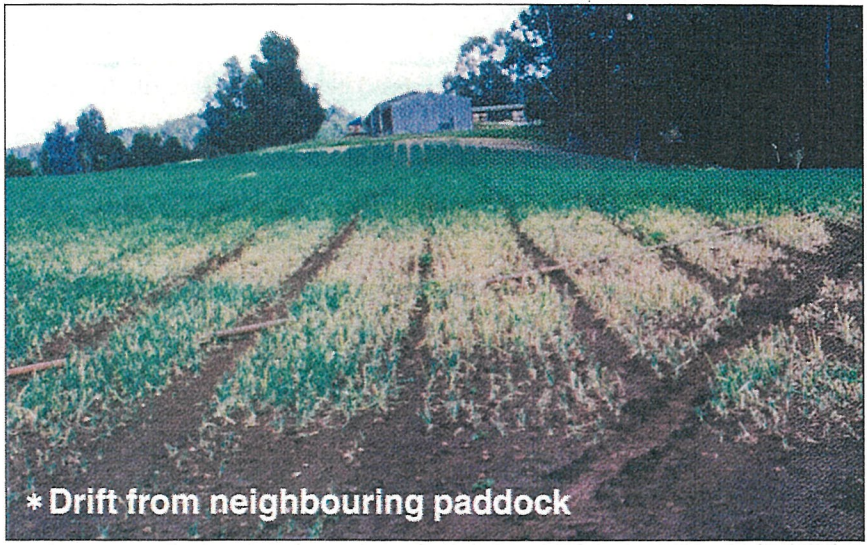
SUNBURN
* Exposure to very intense sun during curing results in a flattened side of an onion associated with bleached tissue

GREEN
* Results from late applications of nitrogen, or exposure to excessive light during late growth stages and curing

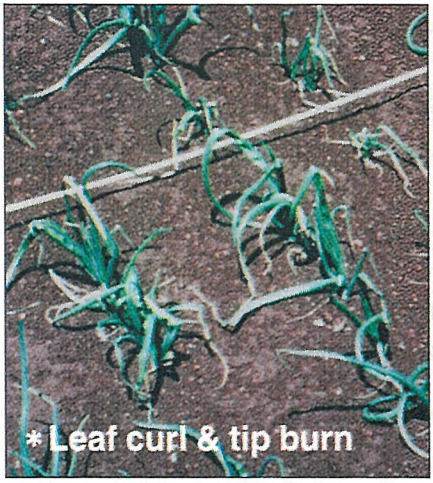
SKINNING
* Seasonal conditions, cultivar and management practices may contribute to reducing skin number and thickness

STAINING
* Results from contact of bulb with wet soil and also associated with Brown stain disease (*Botrytis cinerea*)

HERBICIDE DAMAGE



* Drift from neighbouring paddock



* Leaf curl & tip burn

* Leaf curl & burn

* Herbicide damage is easily confused with tip burning caused by wind or frost
* Any damage provides an entry point for diseases such as Botrytis neck rot, Bacterial soft rot, Downy mildew and Stemphylium leaf mould

OTHER DISORDERS

SPROUTING

* Roots or shoots begin to sprout from drying bulbs, often associated with excessive moisture or exposure to light

BOLTING

* Triggered by weather conditions (particularly cold spells late in the season), time of sowing and cultivar choice

SANDBLASTING

* Plants can be damaged or even completely destroyed by sand blowing onto leaves
* Appropriate soil conservation measures needed

FROST HEAVING

* Onions can be pushed out of the ground during severe frosts

SLUGS & SNAILS

* Importance varies depending on the season, but can be very damaging if not controlled

ONION SMUT *Urocystis cepulae* FUNGUS

* Not present in Tasmania, but is a quarantinable disease present in some mainland states
* Dark lines of spores develop within leaf or scale tissue
* Plants can be stunted
* As the disease progresses, raised blackened blister like lesions develop
* Any suspected infections should be reported immediately
* Strict quarantine measures must be observed to prevent this disease coming into Tasmania