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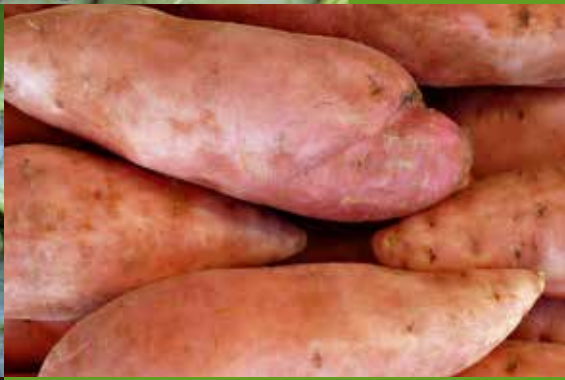

Pests, Diseases and Disorders of Sweetpotato

A FIELD IDENTIFICATION GUIDE

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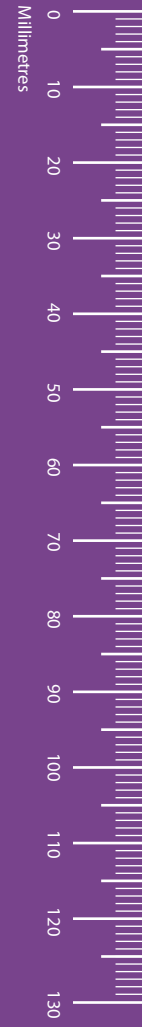

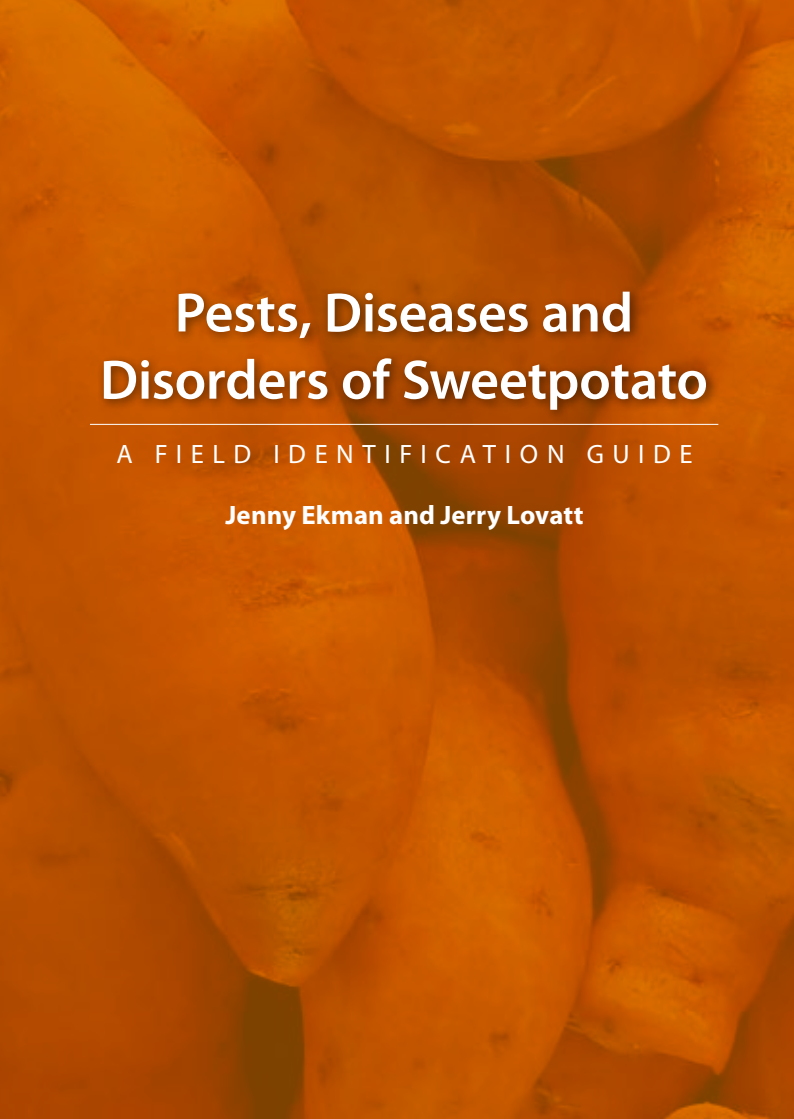

Pests, Diseases and Disorders of Sweetpotato

A FIELD IDENTIFICATION GUIDE

Jenny Ekman and Jerry Lovatt

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Further information

Please note that all sizes are approximate and eggs are only described if easily seen.

Further information on sweetpotato can be found on the online resource keys.lucidcentral.org under Sweetpotato DiagNotes.

Abbreviations

CPSU	California Polytechnic State University at San Luis Obispo
DAFWA	Department of Agriculture and Food WA
IPNI	International Plant Nutrition Institute
LSU AgCentre	Louisiana State University Ag Centre
MAF	Ministry of Agriculture and Food
NCSU	North Carolina State University
NSW DPI	NSW Department of Primary Industries
OMAFRA	Ontario Ministry of Agriculture, Food and Rural Affairs
PaDIL	Pest and Disease Image Library
QDAF	Qld Department of Agriculture and Fisheries
UQ	University of Queensland
USDA ARS	United States Department of Agriculture Agricultural Research Service
WSU	Washington State University

Contents

Insects

Aphid — cotton

Aphis gossypii

DESCRIPTION

Nymph: Pale, dusky green to orange, wingless and with rounded body shape.

Adult: May be yellowish, green or black, oval shaped and 1–2 mm long. Resembles green peach aphid.

DAMAGE

Sucks sap from the young shoots, causing leaf distortion and stunting. Sooty mould grows on the excreted honeydew, reducing photosynthesis. Aphids can transmit feathery mottle virus.

MOST COMMON

Cool, dry conditions. Female aphids can produce several live young a day, so numbers can increase rapidly if conditions are suitable.

Cotton aphids showing pale nymphs, darker adults and brown and yellow winged forms (T Brevault)

Aphid — green peach

Myzus persicae

DESCRIPTION

Nymph: Yellowish to green.

Adult: Wingless adults are pale yellow to green and around 2 mm long. Winged females have black heads with dark red eyes and patterned bodies.

DAMAGE

Causes leaf distortion through feeding, reducing plant vigour.

MOST COMMON

During warmer months on a large range of host plants.

Green peach aphid adults and nymphs

Cluster caterpillar (tropical armyworm)

Spodoptera litura

DESCRIPTION

Egg: Laid in groups of 5–50, usually covered with fluffy white material.

Caterpillar: Initially grey-green and feeds in a group, but separate as they grow. Mature caterpillars are 30–40 mm long and smooth skinned. They are distinctively patterned with thin yellow stripes and conspicuous dark spots and triangles. Larvae tend to curl into a ball if disturbed.

Adult: Patterned brown, cream and grey moth with wings held in a tent over the body.

DAMAGE

Caterpillars skeletonise leaves.

MOST COMMON

Spring to autumn in Queensland.

Feeding windows, an early sign of cluster caterpillar activity, and a mature caterpillar with ragged feeding damage

Convolvulus hawk moth

Agrius convolvuli

DESCRIPTION

Egg: Smooth, pale green eggs 1 mm across are laid singly on leaves.

Caterpillar: Initially green with white markings but becomes dark olive or brown with variable patterning as it matures. Up to 120 mm long at maturity. Pupae overwinter in the soil.

Adult: Large (60 mm long) moth with brown and grey patterned wings. Distinctive black, pink and white bands on abdomen.

DAMAGE

Larvae feed on leaves.

MOST COMMON

The wet season in northern Australia and summer in NSW and Victoria. Adults are active at dusk and strongly attracted to light.

Egg (note tiny parasitoid wasp on lower surface), caterpillar (P Meininger) and adult moth (D Descuens)

Cricket — black field

Teleogryllus commodus

DESCRIPTION

Nymph: Similar to adult, but with less developed wings.

Adult: Stout, black cricket with large head, short wings and powerful rear legs. Females have long ovipositor. Males make distinctive chirruping call at dusk.

DAMAGE

Not usually a major pest, but may cause damage by eating plant roots near the surface. Can also damage irrigation by chewing on drip tape.

MOST COMMON

Active during warmer months. Crickets usually hide in cracks or burrows during the day and come out at night to feed.

Adult black field cricket

Cricket — mole

Family Gryllotalpidae

DESCRIPTION

Egg: Laid inside vertical underground chambers guarded by the mother.

Nymph: Similar to adult, but with less developed wings.

Adult: Brown, roughly cylindrical cricket 30–40 mm long with muscular appearance. Forelegs are adapted for digging and the head and thorax are reinforced with thickened covers. Hind legs are small compared to other crickets. Females are capable flyers.

DAMAGE

Eats plant roots, both above and below ground, reducing plant vigour and causing holes in storage roots. Also chews drip tape, causing leaks.

MOST COMMON

Urban areas and well watered grasslands. Most active during warmer months, when males dig special resonating burrows and produce a distinctive loud, vibrating call at dusk.

Mole cricket (Wikicommons)

Curl grub (white grub, cane grub, peanut scarab)

Heteronyx spp., *Heteronychus* spp.

DESCRIPTION

Larvae: Whitish C-shaped grub, generally up to 35 mm long with a brown head and six legs. The rear end sometimes has a dark grey tinge.

Adult: Peanut scarabs are brown and 7 mm long. African black beetles are black and 10–15 mm long. Generally known as cockchafers, they are all stout bodied, glossy beetles.

DAMAGE

Larvae feed on plant roots and storage roots, chewing large holes. These provide an entry point for diseases. Adults can cause minor damage by chewing on foliage.

MOST COMMON

Larvae are mainly active during winter and spring. Adult beetles emerge in late spring and summer, particularly after heavy rains.

A type of adult beetle: the brown cockchafer (P Chew) and damage to a sweetpotato (OMAFRA)

African black beetle larvae and adult (PaDIL)

Dried fruit beetle

Carpophilus spp.

DESCRIPTION

Larvae: Tiny cream-coloured grub.

Adult: Small (2–3 mm long), oval-shaped black to brownish beetles. Several different species can infest sweetpotato.

DAMAGE

Larvae and adult beetles feed on storage roots that have been damaged by other insects (eg sweetpotato weevil) or disease. Do not usually infest sound roots but can be a contamination problem.

MOST COMMON

During summer, especially if other pests are not adequately controlled.

Dried fruit beetle and damage to a storage root

Earwig — black field

Nala lividipes

DESCRIPTION

Nymph: Similar to adult but lighter in colour and with less developed wings and pincers.

Adult: Dark brown to black with slender flattened body up to 15 mm long and beaded antennae. Obvious pair of pincers at the end of the body which are curved in males and straighter in females. Darker and smaller than other earwig species.

DAMAGE

Usually a minor pest that feeds on decaying plant material. However, they can also eat young plants and upper parts of roots.

MOST COMMON

In heavy, black soils and moist conditions. Nymphs tend to emerge during spring.

Adult male black field earwig (D Rentz)

Earwig — brown

Labidura truncata

Beneficial insect

DESCRIPTION

Nymph: Similar to adult but smaller and lighter coloured.

Adult: Light brown, flattened and segmented body up to 35 mm long with dark brown patches and dark eyes. Large pincers on the tail, which are curved in males and straighter in females.

BENEFIT

Attacks caterpillars and moth pupae, such as heliothis.

MOST COMMON

Any time of year.

Adult (top, J Wessels QDAF) and nymph brown earwigs

Flea beetle

Xenidia sp.

DESCRIPTION

Larvae: Small, whitish grub that lives in the soil.

Adult: Small, black beetle around 3 mm long with metallic sheen. Powerful back legs allow it to jump quickly if disturbed.

DAMAGE

Larvae feed on the storage roots, causing shallow dugout channels with a random, squiggly appearance. Adults feed on the leaves. Initially may scar the upper surface, but can result in small, distinct holes and even defoliation.

MOST COMMON

In spring.

Adult flea beetle (L) and flea beetle damage to young shoots (J Lovatt QDAF)

Gall mite

Eriophyes spp.

Exotic pest

DESCRIPTION

Tiny mites, barely visible with the naked eye. Galls are caused by chemicals injected into the plant during feeding. All life stages develop within the gall, until adults emerge to feed at new sites, creating new galls into which they lay eggs.

DAMAGE

Galls are obvious on leaves and stems, causing severe distortion and loss of yield. Gall mite is a serious pest in PNG and has spread rapidly, mainly through infected planting materials. Using clean planting material reduces the risk of spread.

MOST COMMON

Not currently in Australia.

Gall mite infested sweetpotato in PNG (J Lovatt QDAF)

Giant northern termite

Mastotermes darwiniensis

DESCRIPTION

Immatures: Similar to adults but smaller.

Adult: Varies in appearance between 'castes'. Workers are creamy to semi-transparent and up to 10 mm long. Soldiers are larger at 13 mm long with light brown bodies, brown head and large black mandibles. The dark brown 'kings and queens' are the largest form, being 15 mm long with a 65 mm wingspan.

DAMAGE

Colonies tunnel into storage roots. Damage may go unnoticed until harvest.

MOST COMMON

Any time of year.

Giant northern termite workers and soldier (B Thistleton NT DPIF) and damage to a storage root (M Neal NT DPIF)

Green vegetable bug

Nezara viridula

DESCRIPTION

Egg: Neat rafts of over 100 creamy to golden barrel-shaped eggs are laid on leaf undersides.

Nymph: Initially dark red and orange, then green with distinctive black, white and red patterning.

Adult: Green, shield-shaped bug around 15 mm long.

DAMAGE

Young shoots are damaged by sap sucking. Usually a minor pest.

MOST COMMON

Spring and summer.

Newly hatched nymphs with egg raft (E Finkle), nymph (A Ryland) and adult bug (S McDougall NSW DPI)

Ladybird

Coccinella transversa, Hippodamia variegate

Beneficial insect

DESCRIPTION

Nymph: Black with coloured markings and 'crocodile like' appearance, up to 6 mm long.

Adult: Most are brightly coloured, dome-shaped beetles 3–5 mm long with distinctive spots and stripes on their outer wing covers.

BENEFIT

Both adults and larvae are active predators of aphids, thrips, moth eggs and mites.

MOST COMMON

Late spring to autumn.

Ladybird larvae feeding on aphids (J Duff QDAF) and adult white collared and transverse ladybirds

Leafhopper (jassid)

Austroasca spp.

DESCRIPTION

Nymph: Similar to the adult but wingless. Habit of moving sideways if disturbed.

Adult: Look like tiny cicadas; torpedo-shaped and ranging in colour from yellowish to green and mottled brown. They jump away quickly if disturbed.

DAMAGE

Feeding leaves speckled yellow tracks on the leaves. Usually a minor problem.

MOST COMMON

Warmer months.

Jassid on a leaf (J Lovatt QDAF) and in close up and jassid feeding damage

Mealybug — cotton

Phenacoccus solenopsis

DESCRIPTION

Egg: White, waxy sacks of 150–600 eggs are laid on leaves. These hatch into white to yellow mobile 'crawlers'.

Nymph: Nymphs resemble adult females.

Adult: Females are white, waxy and 3–4 mm long. Bare areas on the abdomen appear as dark bands. Adult males are grey and 1 mm long.

DAMAGE

Adult females and nymphs suck sap. Leaves become yellow, vigour is reduced and young plants may die.

MOST COMMON

Can reproduce throughout the year in warm climates, producing up to 15 generations a year. Dormant in cool conditions. Wide range of host species.

Cotton mealybug in close up, colony on a leaf, and showing damage to a young volunteer plant (J Lovatt QDAF)

Mite — bean spider

Tetranychus ludeni

DESCRIPTION

Nymph: Pale yellow to green, with later instars becoming orange. Each side of the body has a darker patch or stripe along its length.

Adult: Bright red, around 0.5 mm long, with dark red, mottled patches along either side of the body.

DAMAGE

Mites form colonies on the lower leaf surfaces, particularly along the veins. Feeding is initially visible as a speckled yellowing along the leaf veins. The undersides of leaves become covered in fine webbing.

MOST COMMON

Hot (25–30° C) dry weather.

Adult bean spider mite (Cotton CRC) and mites on the underside of a leaf (J Lovatt QDAF)

Mite — two-spotted

Tetranychus urticae

DESCRIPTION

Nymph: Translucent white, changing to bright orange in overwintering form.

Adult: Whitish to yellow green, around 0.5 mm long with a dark olive spot either side of its body. Overwintering form has a dark red body and white legs.

DAMAGE

Mites form colonies on the lower leaf surfaces, particularly along the veins. Leaves become crinkled and distorted, with yellow speckling along the veins and fine webbing underneath.

MOST COMMON

Hot (25–30° C) dry weather.

Two-spotted spider mites (F Peairs Colorado State Uni Bugwood.org) and mite damage, causing leaf distortion

Nematode — root-knot

Meloidogyne spp.

DESCRIPTION

Nematodes are microscopic, wormlike organisms <1 mm long rarely visible to the naked eye. They reproduce in the soil, where they parasitise plant roots.

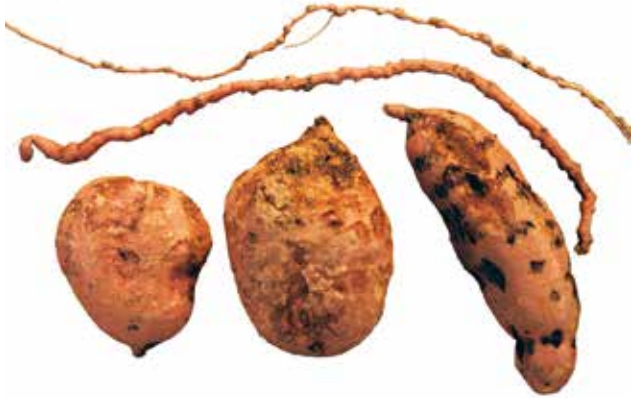
DAMAGE

Root-knot nematodes cause severe damage to many crops, but particularly affect sweetpotato during early root development. Juveniles hatch from eggs in the soil, penetrate plant roots and set up a permanent feeding site. The cells around this site swell, forming a blister. Roots may also be malformed, cracked or have a rough appearance. Upper parts of the plants become yellowed and wilt easily.

MOST COMMON

More common in sandy soils. Symptoms are increased in warm environments (over 25° C), with major egg hatching during spring. Nematodes are spread in irrigation water, on machinery and by infested plant material, making farm hygiene and crop rotation important control methods.

Blistering due to root knot nematode infestation (LSU AgCentre)



Close-up of feeding damage inside a blister (LSU AgCentre), and root knot nematode damage to feeder and storage roots showing, blistering, cracking and pitting (G Holmes CPSU Bugwood.org)

Rutherglen bug

Nysius vinitor

DESCRIPTION

Nymph: Pear-shaped, reddish brown and wingless. Nymphs mainly feed on weeds.

Adult: Slender, dark grey bugs 5 mm long with transparent wings and large black eyes.

DAMAGE

Sap sucking can cause minor damage to leaves. Not usually a major pest.

MOST COMMON

Multiplies during spring and early summer in weed species. Usually moves into sweetpotato crops when other hosts die off. Can appear in very large numbers.

Rutherglen bug

Silverleaf whitefly

Bemisia tabaci

DESCRIPTION

Nymph: First instar nymphs are flat, greenish, mobile and around 0.3 mm long. Later instar nymphs are also flat but opaque white and stationary, appearing similar to soft scale insects but with pointed tails.

Pupae: Mature nymphs turn golden, their bodies thicken and eyes turn red.

Adults: Snow white, around 1 mm long with wings held in a peak along the body.

DAMAGE

Nymphs and adults suck sap from plants, causing yellow or purplish stippling between the veins on leaves. Growth may be stunted. Whitefly can also transmit some viruses. Although sweetpotato is an important host of this species, effects on yield are usually minor.

MOST COMMON

Populations can increase rapidly if a mild winter is followed by temperatures 25–28° C. Whitefly can develop resistance to many common insecticides and may be a major issue for neighbouring crops.

Silverleaf whitefly adult (J Lovatt QDAF) and nymphs under a leaf

Spined predatory shield bug

Oechalia schellenbergii

Beneficial insect

DESCRIPTION

Nymph: Dark grey with a characteristic red to dark orange ring on their back and orange bands on their antennae.

Adult: Mottled grey and brown shield-shaped bug around 12 mm long with light triangular marking on centre of its back and obvious spines on each shoulder.

BENEFIT

Adults and older nymphs feed on insects including caterpillars and pest bugs.

MOST COMMON

Found all year with highest populations during summer.

Spined predatory shield bug young nymph, mature nymph, and adult bug attacking a caterpillar (P Chew)

Sweetpotato beetle

Colasposoma sellatum

DESCRIPTION

Larvae: White grub up to 12 mm long, rather hairy, with six small legs.

Adult: Glossy black beetle, 6–9 mm long with thickened wing covers and thorax.

DAMAGE

Larvae feed on storage roots, creating tracks on the surface of the root. Damage is similar to that caused by flea beetle larvae, but deeper. Adults chew on leaves.

MOST COMMON

All year round. Only known to occur in North Queensland.

Adult beetle (D Rentz BowerBird, J Lovatt QDAF)

Sweetpotato leafminer

Bedellia somnulentella

DESCRIPTION

Caterpillar: Slender caterpillar, initially pale green but becoming mottled brown and cream as it matures. Caterpillars often rest with their bodies held away from the leaf surface.

Adult: Slender moth up to 6 mm long with distinctive fluffy topknot, long legs and habit of resting at an angle to the leaf surface. Wings are white and heavily feathered with pale brown mottling and held close to the body at rest.

DAMAGE

Caterpillars initially form squiggly mines inside the leaves. As they grow they progress to making a series of large, brownish yellow patches on the leaves, with webbing and frass on the leaf underside. Effects on production are usually minor, although yield may be reduced.

MOST COMMON

Any time of year in warm climates.

Sweetpotato leafminer larvae partially, and fully, emerged from inside the leaf

Sweetpotato tortoise beetle

Aspidimorpha spp.

DESCRIPTION

Larvae: Light brown grub up to 10 mm long with rows of black dots and covered in black spines. Often feed in groups.

Adult: Golden, tortoise-shaped beetle 10–13 mm long. Wing covers have dark spots and markings with translucent flanged edges.

DAMAGE

Larvae and adults feed on leaves. Not usually a major problem, but heavy infestations can defoliate plants.

MOST COMMON

Any time of year.

The tortoise beetle *Aspidimorpha deusta* feeding on a leaf (MM Bos), closeup of adult beetle and damage on sweetpotato leaves (H Brown NT DPIF)

Weevil — sweetpotato

Cylas formicarius elegantulus

DESCRIPTION

Larvae: Legless white grub.

Adult: Slender weevil up to 7 mm long with long legs and ant-like appearance. Brightly coloured, with a bluish black head, snout and abdomen and orange thorax and legs.

DAMAGE

Larvae feed inside the storage roots, crown and in stems. Infested storage roots are riddled with spongy and discoloured cavities. Even a small amount of feeding induces bitter flavour and off odours. Heavy infestation can cause vines to yellow and collapse. Adults also feed on leaves and exposed parts of storage roots to the depth of their head and snout.

MOST COMMON

Any time of year. Adults are mainly nocturnal but can often be seen during daylight hours. Although poor flyers they can disperse long distances, largely on infested storage roots or planting material.

Sweetpotato weevil (opposite), external holes and internal damage with larvae inside a storage root (J Lovatt QDAF)

Weevil — West Indian

Euscepes batatae

Exotic pest

DESCRIPTION

Larvae: Legless white grub up to 10 mm long.
Adult: Stout reddish brown weevil less than 4 mm long and covered with short bristles.

Even a small amount of feeding produces bitter compounds, making the root inedible. A major pest of sweetpotato in the Caribbean, Central America and PNG.

DAMAGE

Larvae tunnel inside the storage roots and feed on the crown and stems. Adults tend to feed in groups and chew further into storage roots than sweetpotato weevils, leaving larger holes.

MOST COMMON

Not yet in Australia but common in PNG, especially during the dry season (May to October). Although adults do not fly they can disperse long distances by walking, and in infested roots and planting material.

West Indian weevil (J Cardona-Duque Uni Puerto Rico Bugwood-org) and larval tunnelling damage inside a storage root (J O'Sullivan UQ)

Weevil — whitefringed

Graphognathus leucoloma

DESCRIPTION

Larvae: Whitish, C-shaped legless grub up to 15 mm long with creamy head and brown jaws.

Adult: Grey-brown striped weevil with white band along the side and short snout. Flightless, but can walk long distances.

DAMAGE

Larvae live in the soil where they eat the storage roots, resulting in shallow, chewed holes.

MOST COMMON

Eggs are laid during summer. Most damage occurs as larvae mature during winter and spring.

Whitefringed weevil larvae (S Learmonth DAFWA) and adult (A Bradford)

Wireworm — false

Gonocephalum spp., *Pterohelaeus* spp.

DESCRIPTION

Larvae: Hard, smooth, dark cream to golden, segmented larvae up to 30 mm long. Round head and dark mouthparts. Fast moving. Usually found in the loose upper layers of soil or mulch.

Adult: Dull dark grey, brown or black oval-shaped beetle up to 9 mm long. Commonly known as a 'darkling' or 'pie dish' beetle due to the flanged edges on the thorax.

DAMAGE

Larvae tunnel into storage roots causing round, small, but deep holes (shot holes).

MOST COMMON

Larvae develop through autumn and winter, but cause most damage during late winter and spring.

False wireworm larvae emerging from a hole in a sweetpotato (D Bradbeers), adult beetle (D Hobern) and damage to storage root (E Coleman)

Wireworm — true

Family Elateridae

DESCRIPTION

Larvae: Creamy coloured with smooth, distinctly segmented, soft body. Brown head equipped with large mandibles. The reddish brown tail is forked with a serrated edge. Slower moving than the false wireworm.

Adult: Dark grey to brown, torpedo-shaped beetle up to 15 mm long with finely ridged wing covers. Commonly called a 'click' beetle due to its ability to right itself with a clicking noise if placed upside down.

DAMAGE

Larvae feed on storage roots, causing shallow holes.

MOST COMMON

Larvae are most likely to cause damage during winter.

Wireworm larvae (GRDC), adult 'click' beetle and wireworm damage to a storage root (G Holmes CPSU Bugwood.org)

Diseases

Alternaria leaf spot

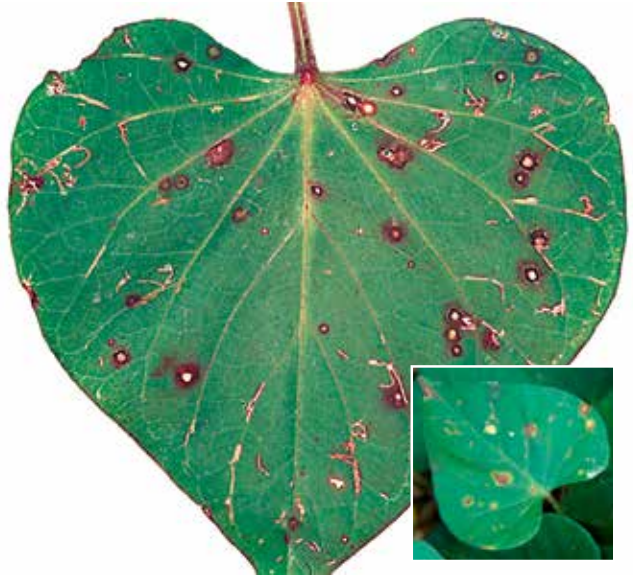
Alternaria spp.

SYMPTOMS

Small brown spots develop on the leaves, surrounded by a characteristic yellow or reddish halo. The centres of the lesions become dry and papery and may fall out. Rarely causes major production loss.

FAVOURED BY

The disease is usually most serious when dry and wet periods alternate during cropping, such as when overhead irrigation is used. Growth is fastest at around 27° C. The fungus thrives on crop debris, while spores can also spread in wind, rain and water.



Alternaria spots on leaves (J O'Sullivan UQ, QDAF)

Bacterial soft rot

Erwinia spp.

SYMPTOMS

Infected plants wilt, and eventually may completely collapse. Storage roots develop a wet, slimy rot with an unpleasant smell. This may be internal, with few symptoms visible on the skin.

FAVOURED BY

Infection occurs through injuries. These may be caused by pest damage in the field, or occur during harvest. Generally rare in the field, more common as a postharvest issue.

Bacterial soft rot (C Averre NCSU Bugwood.org)

Dry rot

Phomopsis phaseoli

SYMPTOMS

Dark, dry sunken lesions develop on storage roots. The underlying flesh also develops a dark brown rot, which expands from the skin towards the centre of the root.

FAVOURED BY

Warm, humid conditions. Infection occurs through wounds, often at one end of the root. An occasional postharvest problem associated with damage during harvest.

Dry rot of a storage root (J Lovatt QDAF)

Fusarium root rot

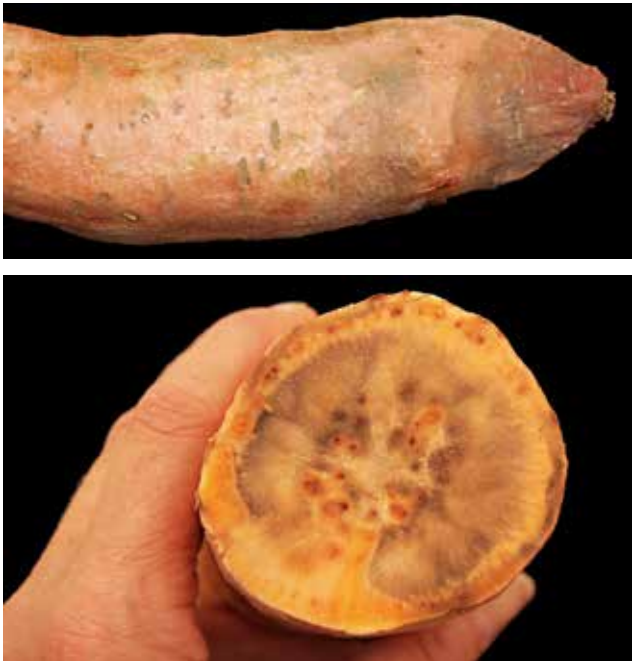
Fusarium solani

SYMPTOMS

Shrivelled, sunken areas or lesions develop on the root surface, often forming a series of irregularly shaped brown rings. The underlying tissue becomes spongy and brown, in advanced cases developing cavities covered with white fungal growth.

FAVOURED BY

Infection usually occurs through wounds, particularly during harvesting.



External and internal symptoms of fusarium root rot

Fusarium wilt

Fusarium spp.

SYMPTOMS

The earliest sign of fusarium wilt is discolouration of the vascular system. This is followed by leaf yellowing between the veins, wilting and general stunting. The lower stem can become purplish and feeder roots rot. If only part of the vascular system is infected then only one side of the plant may yellow.

FAVOURED BY

Infection is most likely at temperatures around 30°C and relatively low soil moisture (<50%). The disease spreads through infected plant materials, irrigation water and equipment. Spores remaining in the soil infect plants through wounds and natural openings.

Vascular discolouration (Clemson Uni Bugwood.org) and leaf yellowing and wilting (W Martin APS) due to fusarium wilt

Little leaf (witches broom, big bud)

Candidiatus Phytoplasma australasia

SYMPTOMS

Affected plants are stunted with a large number of small, thin shoots. Leaves are small, pale, and may have a yellow margin.

FAVOURED BY

Spread in infected plant material and by leafhoppers. While little leaf phytoplasma is widely distributed around growing regions, it is not generally a major production issue.

Symptoms of infection by the little leaf phytoplasma (J Lovatt QDAF)

Pox

Streptomyces ipomea

SYMPTOMS

Black necrotic lesions form on the feeder roots, which rot from the root tips. Sunken lesions also develop on storage roots. These become crusty and blackened, sometimes with radiating cracks. Infection that occurs during storage root expansion constricts growth at that point, deforming the root. Above ground the plant becomes stunted and yellow.

FAVOURED BY

Most development occurs in dry soils (eg sandy) with neutral or alkaline pH (pH>5.2). The disease spreads in soil and by plant materials and can persist in the soil for many years. Symptoms do not usually develop postharvest.

Pox symptoms in the field, lesions on young roots showing growth constriction, and crater shaped crusty lesions on a mature storage root (C Averre NCSU Bugwood.org)

Scab

Sphaceloma batatas

SYMPTOMS

Scabbed, brown lesions appear on stems and leaf veins. As a result, leaves become cupped and deformed. The ends of growing stems have a distinct upright habit. These are brittle and may die. Plant vigour and yield may be severely reduced if disease develops early in the growth cycle.

FAVOURED BY

Wet weather over a wide temperature range (13–26° C). Spores released from infected tissues spread in rain splash and on plant material.

Early (L) and late symptoms of scab infection on sweetpotato leaves, as well as symptoms on a stem (J O'Sullivan UQ)

Scurf

Monilochaetes infuscans

SYMPTOMS

Discoloured dark brown to black areas develop on the storage roots. These enlarge and join together, so that the entire surface of the root may be discoloured. Internal tissues are not affected.

FAVOURED BY

Alkaline to neutral soils; occurs only rarely in acidic soils. Outbreaks are more likely in wet conditions and in soils that are high in organic matter.

Scurf symptoms on the outside of storage roots (J Lovatt QDAF, OMAFRA)

Southern blight

Sclerotium rolfsii

SYMPTOMS

Depressed, water soaked lesions appear on the stems causing lower leaves to yellow and wilt. As the disease develops a white, feathery fungal growth may be seen on stems and roots, the stems may be girdled killing the plant. Brown, depressed, circular lesions occur on the storage roots. These extend only a short distance into the underlying flesh.

FAVOURED BY

Usually appears in isolated patches within the crop, particularly when the plant canopy has covered the soil surface. Most likely in moist conditions combined with high (>28° C) temperatures. The fungus can survive many years in the soil as hard, brown sclerotia (0.5–1.5 mm diameter), as well as on plant residues and alternative hosts including other vegetable crops.

White hyphae and tiny round brown sclerotes (resting form of fungus) on the surface of the stem, soil and roots

Storage rot

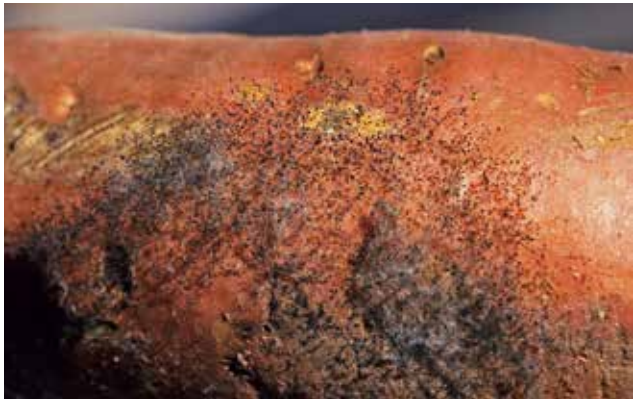
Rhizopus spp.

SYMPTOMS

Storage rots frequently start at the end of the root or a shoulder, but can spread rapidly. The infected area softens, with tufts of greyish white fungal growth emerging. As the disease progresses black spores appear, giving the appearance of grey and white whiskers.

FAVOURED BY

Infection occurs through wounds, particularly those caused at harvest. Moderate to high humidity and storage temperatures of 20° C or higher increase the probability of infection.



White mycelia and black spores of Rhizopus, cause of storage rot (G Holmes CPSU Bugwood.org)

Virus — feathery mottle (potyvirus)

SYMPTOMS

Symptoms of virus infection vary between varieties and by plant age and growing conditions. Irregular mottled spots often appear on the leaves, in some varieties surrounded by a purplish halo. Sometimes leaves develop a feathery discolouration along the veins. Vigour is reduced and storage roots tend to be thin and elongated. Severe infection can result in large numbers of small cracks over the root surface and pale flesh, particularly in orange varieties.

FAVOURED BY

A common and widespread virus which is spread through infected planting material and aphid transmission.

The varying leaf symptoms of feathery mottle virus on leaves

Symptoms of severe feathery mottle virus infection on sweetpotato storage roots (G Holmes CPSU Bugwood.org)

Disorders

Alligator skin

SYMPTOMS

Storage roots develop hard, dry patches of brown skin. These have a network of cracks, resembling a scaly skin.

CAUSED BY

While the cause of this disorder is unknown, it is associated with hot, wet conditions. Plant nutrition and pH may also have a role.

Severe alligator skin symptoms
(G Holmes CPSU Bugwood.org)

Boron deficiency

SYMPTOMS

Boron is involved in new growth, so symptoms are seen in the younger foliage and developing roots. Young leaves and shoots are thickened, distorted and brittle, breaking easily. Leaves also tend to be pale or with yellowing between the veins, with compact growth. Storage roots are thickened, blunt ended, and can develop multiple splits. If formed early during development these are often corky and overgrown. Flesh may be corky, or have internal brown spots, and lack its normal sweet flavour.

CAUSED BY

Boron deficiency is most likely in soils that are sandy or alkaline and low in organic matter, particularly following a heavy application of lime or dolomite.

Boron deficient leaves and the resulting bulbous, corky storage roots
(J O'Sullivan UQ)

Cold damage

SYMPTOMS

Cold temperatures before harvest can result in leaf purpling and slow growth. Frost will kill foliage. Low temperatures postharvest cause sunken, decayed areas in storage roots. The underlying flesh becomes pale, mottled and spongy, sometimes with internal cavities.

CAUSED BY

Air temperatures below 15°C can cause cold damage of the leaves and shoots. Symptoms appear on storage roots if they are stored below 13°C for an extended period.

Moderate cold damage causes purpling of the exposed parts of leaves whereas frost damage kills the leaves (J Lovatt QDAF)

Chilling injury on storage root (G Holmes CPSU Bugwood.org)

Copper deficiency

SYMPTOMS

Young leaves are small, yellowed and misshapen. Necrotic spots may appear, scattered over the leaf surface. Although storage roots appear normal they may have brown streaks in the flesh and break down quickly after harvest.

CAUSED BY

Often occurs in acid, sandy soils naturally low in copper. Deficiency can also occur in soils with very high pH or those with a lot of organic matter, both of which limit availability of copper to plants.

Holes in young leaves due to uneven and distorted growth (J O'Sullivan UQ)

Corky root (enlarged lenticels)

SYMPTOMS

Pores in the skin swell, resulting in small, raised corky lumps.

CAUSED BY

Occurs in excessively wet soil. Some varieties are particularly susceptible to this disorder.

Effect of corky root on a storage root (J Lovatt QDAF) and close up of enlarged lenticels

Fasciation (flat stems)

SYMPTOMS

Stems are wide, flat and strap like.

CAUSED BY

Unknown. Growth appears to be unaffected.

Fasciated stems (G Holmes CPSU Bugwood.org)

Growth cracks

SYMPTOMS

Large cracks, usually along the length of the root, which have formed during early growth and then healed. Generally the wider the cracks the smaller the storage root was when affected.

CAUSED BY

Fluctuating growth, particularly if dry periods are followed by heavy rain or irrigation. Low (non-fatal) doses of herbicide and viral infection can also cause uneven growth resulting in growth cracks.

Growth cracks caused by virus infection (G Holmes CPSU Bugwood.org) and slight herbicide damage (S Meyers MSU Extension)

Herbicide damage

SYMPTOMS

Symptoms are variable but include twisted and distorted leaves, the appearance of bleached, chlorotic or burned patches and ragged holes.

CAUSED BY

Potential causes include contamination of the spray tank due to insufficient cleaning, inappropriate herbicide selection and overspray from treatment of crop boundary areas.

Varying symptoms of moderate (S Meyers MSU Ext) and more severe herbicide damage

Iron deficiency

SYMPTOMS

Younger leaves typically develop a strongly contrasting network of dark green veins and bright yellow leaf. Varieties with reddish new growth may become pinkish. If severely affected, the growing points will die, starting from the tip and margins.

CAUSED BY

Soils with high pH, especially if they are high in phosphorus. Excessive manganese in acid soils can also result in iron deficiency.

Iron deficiency in cowpea—symptoms in sweetpotato are similar (KM Sellamuthu IPNI)

Magnesium deficiency

SYMPTOMS

Yellowing between the veins, initially of the older leaves. The veins usually retain a fairly wide green margin, giving a mottled appearance. Some older leaves may also develop purple colours as well as yellowing. Stems tend to be long, thin and twining.

CAUSED BY

Insufficient magnesium in the soil. High levels of calcium or potassium can make magnesium unavailable to the plant.

Early symptoms of magnesium deficiency on a leaf (J O'Sullivan UQ)

Nitrogen deficiency

SYMPTOMS

Older leaves become pale and eventually yellow with a light brown necrosis starting from the tips and margins. Plants are stunted and spindly and yield may be significantly reduced. Note: Excess nitrogen can result in luxuriant growth above-ground but reduced yield of storage roots.

CAUSED BY

Insufficient nitrogen available due to leaching from heavy rain and irrigation, low organic matter and insufficient fertilisation.

Yellowing of the older leaves due to nitrogen deficiency (J O'Sullivan UQ)

Phosphorus deficiency

SYMPTOMS

Plants are stunted, potentially reduced to less than half normal growth rates. Mild deficiency tends to result in dark, slightly bluish leaves. Older leaves may die prematurely, purple colours appearing before they turn yellow and die.

CAUSED BY

Phosphorus may be unavailable to plants due to adsorption onto minerals in the soil. Soil phosphorus is likely to be low in sandy soils and highly weathered tropical soils lacking organic matter.

Phosphorus deficiency (S Srinivasan IPNI)

Potassium deficiency

SYMPTOMS

Symptoms usually don't develop until 2–3 months into the cropping cycle. Older leaves yellow, particularly around the margins and interveinal areas. These eventually become brown and dry. Storage roots tend to be small and thin with paler than normal flesh.

CAUSED BY

Most common on sandy or highly weathered soils.

Early interveinal chlorosis (J O'Sullivan UQ) is followed by more extensive yellowing and the appearance of brown, dead areas on the leaves (M Hasegawa IPNI)

Salinity

SYMPTOMS

Initial symptoms are often scattered, pale patches on the older leaves. Dark lesions and dead areas appear on the older leaves, particularly around the leaf margins and at the tip. These leaves soon shrivel and fall from the plant. Yield of storage roots can be reduced before any symptoms are observed in the leaves, with roots generally being small and thin.

CAUSED BY

Concentrations of >25µM sodium chloride in the irrigation water (equiv. EC = 5.6 dS/m) are enough to severely stunt growth. Plants are killed by 200µM sodium chloride (equiv. EC = 20.4 dS/m)

Early (L) and severe symptoms of salinity damage on sweetpotato leaves (J O'Sullivan UQ)

Sunburn

SYMPTOMS

Skin develops areas that are cracked, dry and colourless. These are very prone to weevil attack.

CAUSED BY

Insufficient soil coverage. This may be because soil has been eroded or a hard underground soil pan has forced roots up as they grow. Particularly a problem in certain varieties which tend to grow close to the surface.

Sunburn effects on a storage root (J Lovatt QDAF)

Veins on roots

SYMPTOMS

Raised lumpy patterns develop on roots.

CAUSED BY

Secondary root growth under the skin. Mainly occurs in older crops of more traditional varieties.

Vein on a freshly harvested storage root

Water stress

SYMPTOMS

Plants wilt. Growth cracks occur in storage roots if plants become too dry, stopping growth and hardening the skin. If the soil is too wet the lenticels may enlarge, giving the root a rough, corky appearance (see 'Corky root').

CAUSED BY

Insufficient or excess water.

Wilting due to lack of water (J Lovatt QDAF)

Vascular browning (G Holmes CPSU Bugwood.org) **and skin damage** (C Averre NCSU Bugwood.org) **as a result of waterlogging**

Zinc deficiency

SYMPTOMS

Young leaves are small, in some cases only 10–30 mm long. New growth is often pale or has mottled yellowing, and the leaf lobes may point towards the tip more than usual. In some varieties the shoots are more strongly purple.

CAUSED BY

Acidic soils low in zinc as well as alkaline soils where zinc is unavailable. Applications of copper or phosphorus can reduce availability of zinc, as can cool weather.

Symptoms of zinc deficiency include yellow mottling of the younger leaves, development of forward pointing lobes (top) and new growth being formed of tiny leaves on a compressed stem (J O'Sullivan UQ)

Problem solver for sweetpotato pests, diseases and disorders

		Pages
Growth	Slow	16, 19, 22–23, 49
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