Pests, diseases and disorders of sweet corn

A FIELD IDENTIFICATION GUIDE

Jenny Ekman

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Abbreviations

CIMMYT	International Maize and Wheat Improvement Centre
CSU	Colorado State University
DAFWA	Department of Agriculture and Food WA
IPNI	International Plant Nutrition Institute
MAF	Ministry of Agriculture and Food
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
USDA ARS	United States Department of Agriculture,Ag. Research Service
WSU	Washington State University

Pest icons


Beneficial


Damaging


Exotic


Pre-harvest


Post-harvest

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Insects

African black beetle

Heteronychus arator

DESCRIPTION

Larva: Whitish C-shaped grub up to 30mm long with light brown head and six legs. The rear end sometimes has a grey tinge.

Adult: Shiny black, stout bodied beetle around 10 to 15mm long. Legs are adapted for digging. Strong flier. Mass dispersal flights by adults occur March–April and occasionally in spring.

DAMAGE

Larvae feed on plant roots, reducing growth and potentially killing small plants. Adults can cause major damage by chewing the bases of plants and ringbarking seedlings.

MOST COMMON

Spring and early summer, mainly in coastal areas from Victoria to South East Queensland and south-western regions of Western Australia. Favoured by winter rainfall followed by a warm, dry spring and summer.

Adult African black beetle (D Kurek) and *'curl grub' larva* (J Ekman)

Aphid — corn

Rhopalosiphum maidis

DESCRIPTION

Nymph: Similar to adult though smaller.

Adult: Light to olive green with dark purple spots at the bases of the rear cornicles (tube-like projections) and dark head.

DAMAGE

Sucks sap, reducing plant vigour. Leaves develop yellow and brownish-red streaks.

MOST COMMON

Spring to autumn, but can be found in most growing districts throughout the year.

Corn aphids in close-up, and showing feeding damage to a leaf (J Ekman)

Aphid — green peach

Myzus persicae

DESCRIPTION

Nymph: Yellowish to green.

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

DAMAGE

Causes leaf distortion through feeding and can contaminate cob.

Note that insecticide resistance is increasing among some populations.

MOST COMMON

During warmer months on a large range of host plants.

Green peach aphid mature adults and nymphs on sowthistle and mature nymph (G Smith)

Armyworm — African

Spodoptera exempta

DESCRIPTION

Egg: Large, irregularly shaped egg masses topped with cottony material, mainly laid on leaf undersides.

Caterpillar: Hairless, striped caterpillars up to 40mm long. Caterpillars are greenish when populations are low and food abundant. When large numbers are present they become dark grey to black.

Adult: Stout moth with brown speckled forewings held flat on the body, each with a distinct, dark spot near the centre. Creamy hindwings.

DAMAGE

Young larvae disperse through the crop using silk 'ballooning' threads. Feeding results in characteristic ragged chewing damage. At high population densities larvae will march en-masse to new food sites, causing severe destruction.

MOST COMMON

Mainly found in sub-tropical to tropical areas. Outbreaks often occur when a rainy period follows prolonged drought. Adult moths can migrate hundreds of kilometres.

African armyworm caterpillars at high (Leonbotha)*, and lower* (N Shepherd) *population densities, and adult moth* (inset, C Riley)

Armyworm — common and northern

Mythimna convecta, Mythimna separata

DESCRIPTION

Egg: Clumps of eggs laid in cracks or crevices, often on dry plant material.

Caterpillar: Hairless, green, brown and cream striped caterpillar up to 40mm long. Mottled brown head. Three obvious white stripes that start on the 'collar' immediately behind the head capsule.

Adult: Stout moth with light brown speckled forewings held flat, each with a small, whitish mark at the centre. Northern armyworm moth is paler than common armyworm moth. Light brown to cream hindwing. Wings held flat along body.

DAMAGE

Feeding causes ragged damage, starting along the outer edges of each leaf. Small plants may be killed, others severely damaged. Caterpillars are mainly nocturnal and tend to hide in the central leaf whorl during the day.

MOST COMMON

Larvae cause most damage through spring and early summer. In some areas three generations can occur, with moths emerging during summer and autumn.

Mature common armyworm caterpillar (J Wessels QDAF)*, and moth* (D Hobern)

Armyworm — fall

Spodoptera frugiperda

DESCRIPTION

Egg: Large, clustered egg masses usually covered with a layer of hairs, laid mostly on the undersides of leaves but also uppersides and stems.

Caterpillar: Initially light coloured with a brown head, they become darker and more strongly striped as they mature. Fall armyworms have a characteristic pale, upside down Y-shaped marking on the head and four dark spots arranged in a square on the second last body segment.

Adult: Nocturnal, speckled brown moth. Males are more strongly patterned than females, with distinct triangular white markings on their forewings. Moths are strong flyers, able to travel hundreds of kilometers.

Egg mass (QDAF)

DAMAGE

Caterpillars chew on foliage, stems and cobs, leaving ragged holes and causing extensive damage. Larvae can feed on at least 350 plant species and are resistant to many insecticides, including synthetic pyrethroids.

MOST COMMON

Spring to autumn, as prefers warm to tropical climates.

Circles indicate the four distinctive dark spots on the caterpillars' 2nd last segment and inverted 'Y' on head (FAO). *Female and male moths* (PHA)

Armyworm — southern and inland

Persectania ewingii, Persectania dyscrita

DESCRIPTION

Egg: Clumps of eggs laid in cracks or crevices, often on dry plant material.

Caterpillar: Hairless, striped brown to grey caterpillar up to 40mm long. Three obvious white stripes that start on the 'collar' immediately behind the brownish head capsule.

Adult: Grey-brown and cream patterned forewings held flat on the body, light brown hindwings. Southern armyworm moth has a pale 'dagger' on each wing, whereas the inland species has two oval marks. Furry crest behind the head.

DAMAGE

Feeding causes ragged damage, starting along the outer edges of each leaf. Small plants may be killed, others severely damaged. Caterpillars are mainly nocturnal and tend to hide in the central leaf whorl during the day.

MOST COMMON

Primarily found in south-eastern Australia, there are two generations per year, with moths emerging in both spring and autumn. Damage is most frequent during autumn and winter, also sometimes occurring in spring in cooler areas.

Southern (Left, D Hobern) *and inland* (Right, A Humpage) *armyworm moths*

Southern armyworm caterpillar (L Gregory)

Assassin bug

Family Reduviidae

DESCRIPTION

Nymph: Similar to adult but wingless.

Adult: Shield-shaped bug 10 to 30 mm long with large eyes and powerful, curved, sucking mouthpart. Colour varies from orange to red and brown, sometimes with distinct patterning. Strong front legs for grasping prey.

BENEFIT

Adults and nymphs are aggressive predators on other insects, particularly soft bodied caterpillars. A single nymph may consume 150 to 200 heliothis caterpillars in less than three months.

MOST COMMON

Any time of year.

From top: Common assassin bug nymph (Boris)*; Dicrotelus prolixus* (R Richter *and orange assassin bug* (R Greer)

Big eyed bug

Geocoris spp.

DESCRIPTION

Nymph: Patterned brown, pear-shaped with prominent eyes. Wing buds appearing in later instars.

Adult: Black bug around 5mm long with prominent dark eyes. Fast moving, with clear wings folded flat over its back.

BENEFIT

Adults and nymphs prey on aphids, mites, heliothis eggs and small caterpillars.

MOST COMMON

Any time of year.

Adult big-eyed bug (Alain C Flickr)

Black headed mirid

Tytthus spp.

DESCRIPTION

Nymph: Pale green, pear-shaped bug with dark reddish eyes and banded antennae.

Adult: Slender black bug, around 3mm in length with long antennae. Fast moving, with semitransparent wings held flat along its back.

BENEFIT

Adults and nymphs eat heliothis and leafhopper eggs.

MOST COMMON

Any time of year.

Adult mirid (WG Kim)

Brown marmorated stink bug

Halyomorpha halys

DESCRIPTION

Eggs: Barrel shaped, light green eggs found on leaf undersides.

Nymph: Initially black and orange, progressing to patterned brown with rust-red markings.

Adult: Mottled brown shield shaped bug up to 17mm long and 10mm wide. Distinctive alternating light coloured bands on antennae, legs and side margins of the abdomen.

DAMAGE

Sap sucking by all life stages causes severe damage. Although BMSB have a large host range, sweet corn is a favoured food source, with sap sucking on kernels causing severe damage.

MOST COMMON

Not yet in Australia, but has been detected relatively frequently inside shipping containers. This is because adults seek shelter when overwintering, emerging from hibernation in spring.

Native to eastern Asia, BMSB have spread through Europe and to the USA, where they are a major horticultural pest.

Brown marmorated stink bug on corn (B Little Uni Georgia)*, an adult, and feeding damage to kernels* (TP Kuhar Virginia Tech)

Cluster caterpillar

Spodoptera litura

DESCRIPTION

Egg: Laid in a large mass, usually covered with fluffy light brown material.

Caterpillar: Initially grey-green and feeds in a group, but separate as they grow. Smooth bodied caterpillars are distinctively patterned with thin yellow stripes and conspicuous dark spots and triangles, reaching up to 50mm long when mature. Tends to curl into a ball if disturbed.

Adult: Moth with brown, cream and grey patterned forewings held in a tent over the body. Cream hind wings.

DAMAGE

Caterpillars skeletonise leaves.

MOST COMMON

Spring to autumn in Queensland.

Cluster caterpillar (J Ekman) *and adult moth* (L Craggs)

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 problem, but can cause damage by chewing on plant roots. May also damage irrigation by chewing on drip tape.

MOST COMMON

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

Black field cricket (J Ekman)

Cricket — mole

Family Gryllotalpidae

DESCRIPTION

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

Adult: Brown, roughly cylindrical cricket 3 to 4cm 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

Nymphs and adults eat plant roots, both above and below ground. These may be accessed using a network of burrows.

MOST COMMON

Moist, grassy areas. Most active during warmer months.

Mole cricket (C Trainor) *with inset showing burrowing behaviour*

Cutworm

Agrotis spp.

DESCRIPTION

Egg: Ribbed creamy domes laid in a compact cluster.

Caterpillar: Grey-green initially, darkening as they age. Mature larvae are hairless, up to 40mm long and dark grey to black with inconspicuous red, yellow and cream markings.

Adult: Patterned brown, cream and grey moth with wings held flat over its back.

DAMAGE

Caterpillars cut off seedlings at soil level, usually during the night. Plants may be dragged underground to feed on during the day. Caterpillars also burrow into the stems of larger plants and feed on leaves.

MOST COMMON

Damage is most likely during spring, especially in damp areas newly converted to cropping.

*Active cutworm; cutworm damage to corn (*B. Potter, Uni Minnesota) *and an adult Agrotis spp. moth* (D Townsend)

Damsel bug

Nabisi spp.

DESCRIPTION

Nymph: Similar to adults except smaller and wingless.

Adult: Slender, light tan bug 8 to12mm long with long, prominent sucking mouthpart. Long legs, with front two stronger for grasping prey.

BENEFIT

Nymphs and adults are aggressive predators on many other insects including aphids, leafhoppers, moth eggs and small caterpillars.

MOST COMMON

Any time of year.

Damsel bug (J Ekman)

Dried fruit beetle

Carpophilus **spp.**

DESCRIPTION

Larva: Tiny, cream-coloured grub.

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

DAMAGE

Beetles get inside corn husks which have been loosened due to damage by other insects (e.g. heliothis) or disease. They chew on the kernels and are a contamination issue.

MOST COMMON

During summer, especially if heliothis is not adequately controlled.

Beetles in corn showing feeding damage (J Ekman) *and beetle in closeup* (L Leclerc)

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 15mm 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 germinating seeds and young plants and upper parts of corn roots.

MOST COMMON

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

Adult male black field earwig (D Hobern)

Earwig — brown

Labidura truncata

DESCRIPTION

Nymph: Similar to adult but smaller and lighter coloured.

Adult: Light brown, flattened and segmented body up to 35mm 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.

Brown earwig attacking a pupa (J Wessels QDAF) *and a male earwig* (A Henderson Minibeast Wildlife)

Glossy shield bug

Cermatulus nasalis

DESCRIPTION

Egg: Cylindrical, black eggs with short white spines laid in a neat raft of up to 50 on a leaf or stem.

Nymph: Early instars have bright red bodies with black head and legs. Later instars develop bright red, orange and black markings.

Adult: Shield-shaped bug up to 12mm long with brown to black patterning and small light yellow markings. Obvious piercing and sucking mouthpart.

BENEFIT

Nymphs and adults attack soft bodied insects such as heliothis caterpillars.

MOST COMMON

Spring to summer.

Glossy shield bug nymph (P Chew) *and adult bug feeding on a young caterpillar* (S Brown)

Green vegetable bug

Nezara viridula

DESCRIPTION

Egg: Neat rafts of barrel-shaped, creamy eggs laid on leaf undersides, which turn golden as they mature.

Nymph: Initially orange-red, then darkening with bright red, green and white patterning. Tend to stay in groups.

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

DAMAGE

Sucks sap from young shoots and directly from developing kernels. Feeding sites can become diseased.

MOST COMMON

An occasional pest, most common during spring and summer.

Green vegetable bug eggs, nymph (A Ryland) *and adult* (J Ekman)

Heliothis

Helicoverpa armigera

DESCRIPTION

Egg: Ribbed white domes 1 mm diameter laid singly or in small groups. Darken to brown before hatching.

Caterpillar: Initially 1.5mm long, light brown with dark heads. When they reach around 15mm long they darken and develop distinctive stripes. Colour ranges from brown to greenish or reddish. Up to 30 to 40mm long.

Pupa: Golden brown and usually found just under the soil surface. Rain stimulates emergence.

Adult: Stout moth with lightly patterned brown wings held flat across the body. Hind wings are pale with a dark section towards the margin. Large, olive green eyes.

Caterpillars attacking the tassels and cob (A Ryland)

DAMAGE

Larval feeding results in damage to silks, large ragged holes in leaves, holes in husks and destruction of the cobs. Frass can be a contamination issue, even if caterpillars are removed.

MOST COMMON

Warm weather, such as from late spring to autumn in Queensland and summer in more southern states. Populations usually peak during late summer. Heliothis is resistant to many insecticides. Nuclear polyhedrosis viruses (marketed as ViVUS) can assist control.

Typical feeding damage and frass in the leaf whorl (A Ryland) *and a heliothis egg laid singly on a corn silk* (QDAF)

Heliothis caterpillar killed by the biopesticide ViVus (a virus); moths often hide in the leaf whorl during the day (J Ekman)

Hoverfly

Syrphidae spp.

DESCRIPTION

Larva: Cream to brownish maggot with stripe on upper surface and dark mouth hooks, up to 10mm long.

Adult: Resembles a bee or wasp with black and yellow bands across its rather flattened abdomen, but actually harmless. Often hovers near flowers, feeding on nectar and pollen.

BENEFIT

Larvae eat large numbers of aphids.

MOST COMMON

Warm weather, especially summer.

Hoverfly larva attacking aphids (P Scanlon DAFWA) *and adult* (J Ekman)

Lacewing — brown and green

Micromus tasmaniae and Mallada signatus

DESCRIPTION

Larva: Brown lacewing larvae are slender and up to 10mm long with a smallish head, large jaws and a long tail. Green lacewing nymphs are thicker bodied and often camouflage themselves with the remains of their prey.

Adult: Brown lacewings are up to 8mm long with large green eyes. Green lacewings are up to 15mm long with red eyes. Both have large, delicately-veined wings held upright along the body.

BENEFIT

Adults and larvae are voracious predators of aphids, small caterpillars, thrips and mites.

MOST COMMON

Year round.

Brown lacewing adult (J Ekman) *and larva attacking an aphid* (Splish)

Green lacewing adult and larva (J Ekman)

Ladybirds

Various species

DESCRIPTION

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

Adult: Most are brightly coloured, dome-shaped beetles 3 to 5mm long with distinctive spots and stripes on their outer wing covers. One exception is the mite eating ladybird (Stethorus), which is black, hairy and 1 to 2mm long.

BENEFIT

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

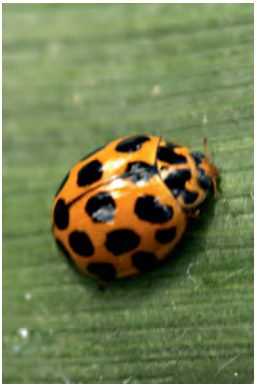
MOST COMMON

Late spring to autumn.

White collared ladybird (Hippodamia variegata) larva

Transverse ladybird (Coccinella transversalis) adult (J Ekman)

White collared ladybird (Hippodamia variegata) adult (J Ekman)



Common spotted ladybird (Harmonia conformis) (J Ekman)

Mite eating ladybird (Stethorus) with two-spotted mites (QDAF)

Maize leafhopper (Wallaby ear)

Cicadulina bimaculata

DESCRIPTION

Nymph: Similar to adult but smaller, paler and wingless.

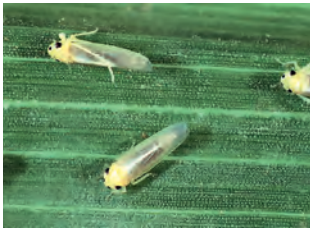
Adult: Wedge-shaped golden yellow insect with clear wings, dark eyes and black spots either side of the 'nose'. Looks like a tiny (3mm long) cicada. They quickly jump away in any direction if disturbed.

DAMAGE

Maize leafhoppers inject a toxin into the leaf during feeding. This toxin causes a syndrome known as 'wallaby ear'. Symptoms include severely stunted growth and swelling of the leaf veins. Leaves tend to crinkle and in-roll, developing a shortened, upright habit.

MOST COMMON

Late summer, particularly in coastal areas. Some varieties are more susceptible to damage than others. Plants can recover from wallaby ear symptoms if leafhoppers are controlled.



Maize leafhoppers on a leaf (QDAF) *and in close-up* (D Clarke)

Symptoms of 'wallaby ear' due to leafhopper damage (J Ekman)

Maize thrips

Frankliniella williamsi

DESCRIPTION

Nymph: Cream to yellowish, wingless, generally less than 1mm long.

Adult: Light to dark brown, torpedo-shaped and 1 to 2mm long. Narrow transparent wings fringed with long hairs are held along their backs.

DAMAGE

Feeding in the leaf whorl can cause the leaves to become distorted and cupped, with yellow streaks developing. While this does not appear to significantly affect plant growth, feeding on the cob creates an entry point for diseases such as Fusarium.

MOST COMMON

Warm to hot, dry weather.

Maize thrips with eggs (UC Statewide IPM project)

Feeding damage on sweet corn leaves. A single thrip is just visible in the inset close-up (J Duff QDAF)

Mite — predatory

Phytoseiulus persimilis, Transeius montdorensis and others

DESCRIPTION

While several predatory mite species can be purchased commercially, others occur naturally in unsprayed crops.

Egg: Eggs are usually laid singly on leaf undersides and other protected areas. Compared to pest mite eggs they tend to be oval rather than round.

Nymph: Similar to adults, but more translucent.

Adult: *P. persimilis* are orange to reddish and pear shaped. Other species are cream to pale pink. Most predatory mites are 1mm long or less, but faster moving and larger than pest mites.

BENEFIT

Predatory on pest mites including two-spotted mite, spider mites and broad mites, as well as thrips and whitefly depending on species.

MOST COMMON

Generally prefer sheltered, conditions, with temperatures between 20 to 30°C.

Predatory mite Phytoseiulis persimilis attacking a two spotted mite (QDAF)

Predatory mite Transeius montdorensis (Biobest)

Mite — two-spotted

Tetranychus urticae

DESCRIPTION

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

Adult: Whitish to yellow green, around 0.5mm long with a dark olive spot either side of its body.

The overwintering form has a dark red body and white legs. These are often called red spider mites.

DAMAGE

Feeding damages leaves, which initially develop light yellow stippled areas. As populations increase the yellowed area spreads and may turn reddish. Leaf undersides become covered in fine webbing.

MOST COMMON

Hot (25 to 30°C) dry weather.

Two-spotted spider mites, showing egg, adults and nymph (M Bowie) *and leaf damage* (J Ekman) *with close-up inset* (Purdue University Extension)

Parasitoid wasps

Trichogramma spp. *Telenomus* spp. *Microplitis* spp. *Cotesia* spp.

DESCRIPTION

There are many different types of parasitoid wasp, of which a number are sold commercially for control of caterpillars and aphids.

Adult: Most egg parasitoids are tiny black or brown wasps less than 0.5mm long. Larval parasitoids are usually larger, 3 to 20mm long, and may .

BENEFIT

Trichogramma spp. and *Telenomus* spp. parasitise heliothis eggs while *Trissolcus basalis* attacks green vegetable bug eggs. *Microplitis* lays a single egg into heliothis and armyworm caterpillars. Braconid wasps such as *Cotesia* spp. parasitise heliothis, armyworm and sorghum head caterpillars, with up to 30 mature larvae forming fluffy white pupae on the outside of the dead host.

MOST COMMON

Any time of year.

Trichogramma spp. with heliothis eggs (P Sinkyrik)

Adult Microplitis spp. (JK Lindsey) *and a Microplitis egg laid into a young heliothis caterpillar* (B Harris)

The green vegetable bug egg parasitoid Trissulcus basalis (Black Robin)

Parasitoid wasp newly emerged from its mummified aphid host (J Duff QDAF)

Pirate bug

Orius spp.

DESCRIPTION

Nymph: Bright orange-red, wingless nymph with dark red eyes and plump appearance.

Adult: Oval bug 2 to 3mm long with clear wings folded flat across its back. Prominent piercing and sucking mouthpart.

BENEFIT

Feeds on thrips, mites and a variety of moth eggs including heliothis.

MOST COMMON

In summer.

Pirate bug nymph (A Sisson Iowa State Uni Bugwood.org), *adult* (P Scanlon DAFWA) *and pirate bug hunting on corn silks, showing its small size*

Plague soldier beetle

Chauliognathus lugubris

DESCRIPTION

Larva: Soil dwelling grub.

Adult: Slender beetle with bright orange abdomen and metallic green wings. Up to 15mm long.

BENEFIT / DAMAGE

Larvae are carnivores, attacking insect pupae, eggs and young caterpillars in soil and leaf litter. Adults mainly feed on nectar and pollen, but may also attack soft-bodied insects.

Plague soldier beetle (J Ekman) *and swarming on corn tassels* (A Ryland)

Planthopper

Family Delphacidae

DESCRIPTION

Nymph: Creamy coloured, oval nymph with short wing stubs.

Adult: Mottled brown with lighter patch on the top of the head. Resemble tiny cicadas. Adults may be short- or long-winged, with the latter being around 4 mm long.

DAMAGE

Adults and nymphs can gather in large numbers inside the leaf whorl, where they suck plant sap and excrete honeydew. This reduces plant vigour, resulting in leaf yellowing, wilting and withering. Young seedlings may be killed. Growth of sooty mould on honeydew reduces photosynthesis. Planthoppers can transmit viruses, particularly maize stripe virus.

MOST COMMON

Warm, humid weather.

Maize planthopper (Peregrinus maidis) (USDA ARS)*; Planthopper adult, species undetermined* (J Ekman)

Red and blue beetle

Dicranolaius bellulus

DESCRIPTION

Larva: Creamy, soil-dwelling grub.

Adult: Glossy beetle around 5mm long with blue head and orange thorax. The metallic blue wing covers have a distinctive broad orange band across the centre and an orange tip at the end.

BENEFIT

An omnivore, the adult beetle feeds on heliothis eggs, small caterpillars and other small insects as well as pollen.

MOST COMMON

Most active in the early morning and at sunset during warmer months.

Female red and blue beetle hunting aphids on a corn tassel (J Ekman) *and male beetle showing distinctive antennae 'clubs'* (S Kerr)

Red-shouldered leaf beetle

Monolepta australis

DESCRIPTION

Larva: White grub with brown plates at the head and tail, up to 10mm long.

Adult: Golden yellow beetle around 6mm long with dark red band across the shoulders and a dark red spot on each wing cover.

DAMAGE

Adults eat leaves and silks. Larvae feed on plant roots but are not generally a problem in corn. Only occasionally a pest but can cause severe damage if present in large numbers.

MOST COMMON

Swarms appear from spring to autumn, particularly in coastal areas of northern New South Wales and Queensland.

Adult beetle feeding on a corn leaf (QDAF) *and beetle in closeup* (Dan B)

Rutherglen bug

Nysius vinitor

DESCRIPTION

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

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

DAMAGE

Sap sucking can dry out tassels and silks and damage leaves and husks. Can also contaminate packed cobs.

MOST COMMON

Multiplies during spring and early summer in weed species. Usually moves into corn when other hosts are unavailable.

Rutherglen bug adult on a cob (J Ekman), *in large numbers sucking sap from the tassel, and the resulting dried out tassels* (A Ryland)

Sorghum head caterpillar

Cryptoblabes adoceta

DESCRIPTION

Caterpillar: Young larvae are beige but darken with age to brown or grey with darker stripes. Resemble armyworm but are smaller (up to 13mm long) and lack the distinguishing three white stripes behind the head.

Adult: Slender mottled grey and reddish-brown moth up to 8mm long. Wings are folded along the body.

DAMAGE

Caterpillars feed on silks and wrapper leaves of cobs. Both larvae and their frass can be a contamination issue.

MOST COMMON

An occasional pest in NSW, Queensland and the NT. Mainly attacks sorghum.

Young sorghum head caterpillar with damage, and the caterpillar (QDAF) *and moth* (R Stroud) *close up*

Symphyla

Scutigerella spp.

DESCRIPTION

Juveniles and adults look like tiny (3 to 7mm long), white, soft-bodied centipedes. The number of pairs of legs increases each time the animal moults, reaching a maximum of twelve pairs. If disturbed, symphilids move rapidly through pores and gaps in the soil to escape the light.

DAMAGE

While symphyla normally eat decaying vegetation, they will also attack germinating seeds, roots and root hairs. Heavy infestations can cause major losses of germinating seeds and seedlings.

MOST COMMON

Well structured, moist soils, particularly if temperatures are mild. Symphyla move up or down the soil profile in response to moisture levels, so are less likely to attack seeds in dry conditions.

Symphyla in close up (S Martinez) *and with a damaged seed showing size* (M Hinderager)

Tachinid flies

Family Tachinidae

DESCRIPTION

Egg: Creamy oval egg, usually stuck directly onto the skin of a host caterpillar. Laid singly or in a small group.

Larva: White, carrot-shaped maggot that lives inside the host.

Adult: Tachinid flies have a very large size range. Also known as bristle flies, most are grey or brown, similar to a housefly, but strongly bristled and often with a stout appearance.

BENEFIT

Larvae feed inside *Helicoverpa* caterpillars, killing their host once it starts to pupate.

MOST COMMON

Any time of year.

Tachinid attacking a heliothis (QDAF), *egg laid onto a caterpillar* (RT Villaneuva) *and adult fly* (P Chew)

Whitefringed weevil

Naupactus leucoloma

DESCRIPTION

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

Adult: Pale grey-brown striped weevil with white side band and short broad snout. Up to 12mm long. Adults cannot fly but can walk long distances.

DAMAGE

Larvae live in the soil where they eat plant roots. They can kill young seedlings by chewing through the stem below the soil surface. Adults rarely cause major damage.

MOST COMMON

Mainly a pest of legumes such as peas and lucerne, but will occasionally attack corn especially if it is grown after a more susceptible crop. Larvae are active from autumn to spring, adults emerge during summer.

Weevil larvae (S Andreoli BGA AgriServices) *and adult* (J Ekman)

Wireworm — false

Gonocephalum **spp.**

DESCRIPTION

Larva: False wireworm larvae are smooth, golden to brown and up to 30mm long with a round head and dark mouthparts.

Adult: Known as 'darkling' beetles, these dark, oval-shaped beetles have a thorax with flanged edges and ridged wing covers.

DAMAGE

Soil dwelling larvae are attracted to germinating seeds. They chew through the seed coat and feed on the kernel and cotyledons, as well as developing roots and shoots. Adult darkling beetles are active on the soil surface and feed on young shoots, but are not normally a major pest.

MOST COMMON

Most likely to be a problem when corn is planted in a field previously used for grain crops or pasture.

Darkling beetle (P Chew) *and false wireworm larva* (Virgina Tech Extension)

Wireworm — true

Family Elateridae

DESCRIPTION

Larva: True wireworm larvae are creamy to light brown with a darker, reddish head and tail. They are softer bodied than false wireworms and normally have a slightly forked tail with serrated edge.

Adult: Mature into 'click' beetles, so called because they can right themselves with a click if placed upside-down. Generally dark brown or black, nocturnal and less than 20mm long.

DAMAGE

Larvae spend three to four years in the soil, resist insecticides and can travel significant distances through the soil in search of food. They feed on germinating seeds, young plant roots and stem bases. Adults feed on rotting vegetation and are not generally considered agricultural pests.

MOST COMMON.

Most likely to be a problem when corn is planted in a field previously used for grain crops or pasture.

Click beetle (J Ekman) *and true wireworm larva* (TurfFinder.com)

Yellow peach moth

Conogethes punctiferalis

DESCRIPTION

Caterpillar: Up to 20mm long with a dark head. Creamy yellow to pink body with dark spots at maturity.

Adult: Bright orange yellow moth with spotted black markings. Wings held out from body.

DAMAGE

Caterpillars feed on developing cobs.

MOST COMMON

December to May.

Caterpillars feeding on corn (Q Game) *and adult moth* (J Tann)

Diseases

Aspergillus ear rot

Aspergillus flavus, Aspergillus spp.

SYMPTOMS

Grey-green to brown powdery mould growth on and between kernels. Infection often starts near the tip but can develop anywhere. The powdery fungal spores become airborne when the husk is pulled back. Mould produces aflatoxins in the infected cob.

FAVOURED BY

Although Aspergillus is primarily a disease of maize, it can occasionally affect sweetcorn crops. Aspergillus infection most frequently occurs under hot, dry conditions. Infection can also be associated with insect or weather damage. Latent infections can develop postharvest.

Aspergillus in the field (G Munkvold, Bugwood.org) *and after harvest* (S Murray Texas A&M). *Note that images are maize, not sweetcorn.*

Boil smut

Ustilago maydis

SYMPTOMS

The fungus infects any rapidly growing part of the plant, commonly the cobs, but also stems, tassels and leaves. Pale green to grey galls form and enlarge, reaching up to 150mm diameter on the cobs. These eventually burst, releasing masses of dark spores.

FAVOURED BY

Infection is increased by high soil nitrogen and physical damage. Spores are carried on the wind and in irrigation water.

Resting spores on crop residues can potentially survive for more than 15 years in the soil.

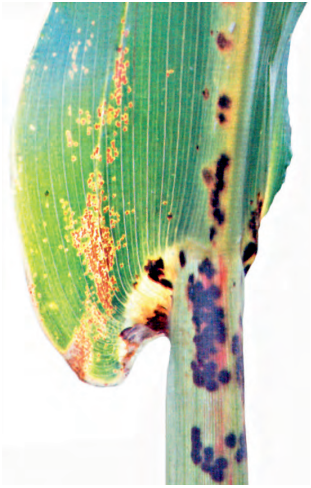
Boil smut on a tassel (B Watt Uni Maine Bugwood.org), *cob* (CIMMYT) *and leaf* (Z Bliska)

Brown spot

Physoderma maydis

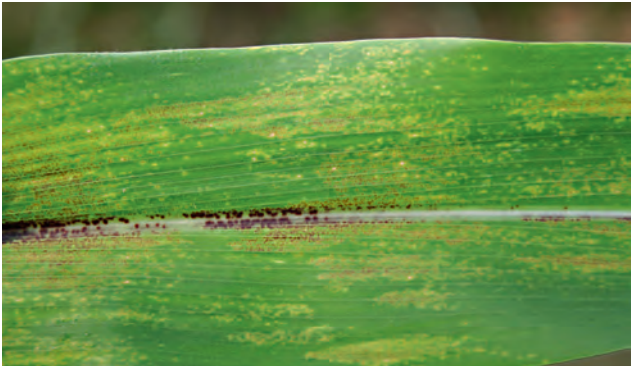
SYMPTOMS

Small, oval chocolate brown lesions develop, usually initially in the leaf axils and whorls. Dark spots appear along the mid ribs with lighter, rust-like spotting on the leaf blade. Severe infection can result in plants collapsing.



FAVOURED BY

Warm (23 to 30°C), humid weather. Infection requires free water, so is more likely after heavy rain. Most common on the Atherton Tablelands.



Brown spot lesions on petiole (QDAF) *and leaf* (D Mueller Iowa State Uni Bugwood.org)

Damping off

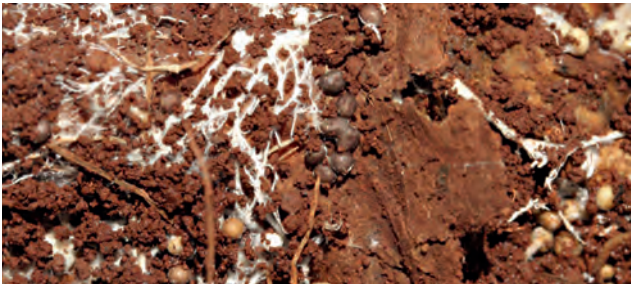
Pythium spp., *Fusarium* spp., *Sclerotium rolfsii, Rhizoctonia solani*

SYMPTOMS

Crop emergence is poor. Seedlings that do emerge wilt, lose colour and have stunted growth. Water-soaked, brown lesions appear on the emerging stem near the soil junction and plants may collapse.

FAVOURED BY

Wet soil conditions. The different fungi responsible for damping off can survive in the soil for extended periods, either as resting spores or in crop residues.



Damping off of corn seedling, showing brown lesion near the soil junction (WM Brown Bugwood.org)*; Sclerotinia rolfsii fungus on soil, showing white mycelium and round, brownish sclerotes (resting structures)*

Fusarium cob rot

Fusarium vertilliodes, F. spp.

SYMPTOMS

White to pale pink fungal growth which can spread over the whole cob. White streaks radiating from the tips of individual kernels ('starburst') are characteristic of the disease. The mould produces mycotoxins in the infected cob, even before symptoms appear.

FAVOURED BY

Insect damage to cobs, high temperatures during growth or moisture stress due to excess or inadequate irrigation.

Although infection usually occurs in the field, symptoms may not appear until after harvest. Mould commonly develops on the cut surfaces of trimmed cobs, especially if the cold chain is not well managed.

Left and top right: Pre-harvest (T Kristensen) *and postharvest* (J Ekman) *infection of sweetcorn by Fusarium spp,; Bottom right: Close-up showing 'starburst' pattern of fungal threads* (OMAFRA)

Head smut

Sphacelotheca reiliana

SYMPTOMS

Unlike boil smut, head smut only affects the cob and silk. Tassels become distorted and develop masses of black spores. Husks of infected cobs are stunted and develop a teardrop shape. Inside, large smut galls usually replace the entire cob. This 'cob' lacks silks, instead developing leaf like protrusions. The plant's vascular system remains relatively intact inside the spore mass, giving it a spongy appearance.

FAVOURED BY

Infection usually occurs when plants are seedlings, although symptoms are not expressed until flowering and cob formation. Spores can survive at least 5 to 7 years in cool, dry soils with infection most likely if weather is warm (20 to 30°C) and dry and soil is deficient in nitrogen. Resistant varieties are available.

Head smut on tassels (RL Croissant Bugwood.org) *and replacement of the normal cob by a mass of spores and leaf-like growths (whole and cut in half)* (A Sisson)

Java downy mildew

Peronosclerospora maydis

SYMPTOMS

Pale green to yellowish striping develops along the leaf veins. These have clear borders, with the affected area increasing as the plant grows. Downy growth may appear on either side of the leaf. Mature plants are stunted and distorted, forming multiple or deformed cobs.

FAVOURED BY

Infection most commonly occurs in seedlings, with plants becoming more resistant with age. Sorghum is also a host, which is why the disease is mainly found in drier areas of north Queensland.

Leaf striping due to downy mildew (B Kemerait Uni Georgia Bugwood.org)

Northern / Turcicum leaf blight

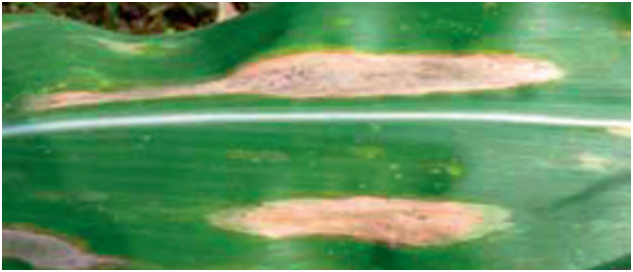
Exserohilum turcicum

SYMPTOMS

Elongated grey-brown lesions develop, often with a yellow halo. These expand, and greyish streaks eventually cover much of the leaf surface. Initial infection is often in the lower leaves. In moist weather masses of dark spores are produced inside the lesions.

FAVOURED BY

Warm, wet conditions, as can occur with heavy dew or overhead irrigation. Spores survive in crop residues and are spread by wind and irrigation water.



Initial (W Khampanich) *and more advanced* (OMAFRA) *symptoms of northern leaf blight*

Rust — common

Puccinia sorghi

SYMPTOMS

Elongated, reddish-brown pustules appear scattered over both the upper and lower leaf surfaces. As these mature they turn brownish black. Leaves yellow and can become fragile.

FAVOURED BY

Warm (16 to 24°C) weather combined with high humidity or heavy dews. Spores are easily spread by wind and can disperse long distances. Some sweet corn varieties are resistant to common rust.

Common rust symptoms and close-up of pustules (J Ekman)

Rust — tropical/Polysora

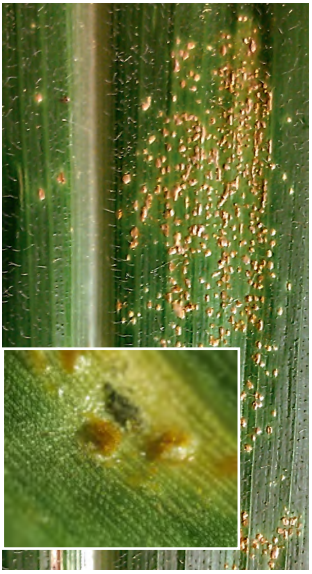
Puccinia polysora

SYMPTOMS

Oval, orange-brown pustules up to 2mm long appear scattered over the upper leaf surfaces. Spots can also develop on the stems and husks. As these mature they turn brownish black. Leaves yellow and can become fragile.

FAVOURED BY

Warm to hot conditions combined with high humidity, as occurs in northern Queensland. Polysora can be distinguished from common rust by its lighter colour, absence from lower leaf surfaces and presence on stems.



Symptoms of tropical rust on the corn plant upper leaf surface and stem (Uni Nebraska) *and closeup of pustules* (W Chen)

Virus — Johnsongrass mosaic virus (JGMV)

SYMPTOMS

Plants are stunted, and leaves yellow, developing stippled patches of light and dark green. These appear as broken lines running parallel with the veins, giving leaves a marbled appearance. Yield may be reduced by up to 90%.

FAVOURED BY

Transmission is primarily by aphids. Johnson grass and wild sorghum act as reservoirs for the virus, which is widespread in wetter subtropical and tropical areas of NSW, Queensland, Northern Territory and Western Australia. Sweetcorn varieties resistant to maize dwarf mosaic virus are also resistant to Johnsongrass mosaic virus.

Virus symptoms on the plant and close-up of leaf (QDAF)

Virus — maize stripe virus (MSV)

SYMPTOMS

Initially appears as small yellow flecks in the young leaves. These broaden and expand with plant growth, forming wide, pale yellow stripes parallel with the veins. Affected plants are stunted and deformed.

FAVOURED BY

Although commonly found in coastal areas, it is usually a minor issue. The virus is transmitted by the maize planthopper.

Maize stripe disease (CIMMYT)

Disorders

Blanking

SYMPTOMS

Blank areas or unevenly sized kernels occur on the cob. This can be a particular problem on the tip of the cob, which fails to develop kernels.

CAUSED BY

Heat stress (over 35°C during the day or over 22°C at night), too much or too little water and nutrient deficiencies can all result in failure of pollination and therefore blanking. Some varieties are susceptible to tip blanking, caused by pollination failure in the late emerging silks, but this may not be a problem if corn is processed.

Partial blanking (J Ekman) *and tip blanking* (E Larson)

Boron deficiency

SYMPTOMS

Plants develop smaller tassels than normal and glumes may fail to open. Younger leaves are inrolled, erect and brittle, developing pale yellow streaks and mottled appearance. Plants are shortened with oval stems. As boron affects silk development and pollination, cobs are often curved, small and/or have blank areas.

CAUSED BY

Alkaline or strongly acid soils, particularly under dry conditions or in cold weather. Boron deficiency is more likely in soils with low organic matter.

Boron deficiency symptoms in leaves (JE Espinosa IPNI) *and cobs* (QDAF)

Calcium deficiency

SYMPTOMS

New leaves develop pale, whitish lesions that tear easily. In severe cases the youngest leaves tend to inroll with leaf tips remaining joined to together, causing a ladder-like appearance.

CAUSED BY

Most likely in acid (pH<5.0), sandy soils or soils high in sodium, magnesium or potassium.

Calcium deficiency symptoms (MK Sharma & P Kumar IPNI)

Copper deficiency

SYMPTOMS

Deficiency appears first on new leaves, which can appear twisted and have a bluish-green tint. Older leaves are distorted and may brown and crack on the tips and along the edges. Yellowing between the veins gives leaves a striped appearance.

CAUSED BY

Most likely on alkaline (pH>7.5) soils with very high (peaty) or low (sandy) organic matter.

Distorted leaves due to copper deficiency (T Yamada IPNI)

Iron deficiency

SYMPTOMS

Iron is immobile in the plant but is needed for chlorophyll formation. Distinct and severe yellowing between the veins therefore develops in the youngest leaves. Plants develop a striped appearance. Symptoms are similar to manganese deficiency, but chlorotic areas have a more distinct boundary, with veins remaining green.

CAUSED BY

Insufficient iron available to the plant. Worst in sandy soils with low organic matter, or those with a high pH (>7). Iron deficiencies are more likely in cool, damp weather.

Initial yellowing between the veins due to iron deficiency gives a striped appearance to the younger leaves (MK Sharma and P Kumar IPNI)

Magnesium deficiency

SYMPTOMS

Magnesium is essential for formation of chlorophyll but, unlike iron, is mobile in the plant, so symptoms appear first on older leaves. Yellowing and dead tissue initially occur between the veins at the leaf margins. In severe cases this spreads inwards, developing into a characteristic reddening or browning of the lower leaves. Only the central rib area may remain green, the leaf edges becoming dry and papery.

CAUSED BY

Deficiency is most likely in sandy soils, especially if pH is less than five. Wet conditions and low soil temperatures increase the likelihood of deficiency. High levels of calcium and potassium in the soil can reduce magnesium availability to the plant.

Early symptoms of magnesium deficiency (D Whalen)

Magnesium-deficient plant (MK Sharma and P Kumar IPNI)

Manganese deficiency

SYMPTOMS

Manganese is immobile in the plant but is needed for chlorophyll formation.

Symptoms therefore occur first in the youngest leaves. Yellowing between the veins means plants develop a striped appearance. Pale, streaky lesions may occur in severe cases. Plants are stunted and cobs are malformed, with poor or uneven kernel development.

CAUSED BY

Deficiency is associated with pH higher than eight. High levels of calcium and potassium in the soil can reduce availability of manganese to the plant.

Interveinal yellowing on young leaves due to manganese deficiency
(MK Sharma & P Kumar IPNI)

Nitrogen deficiency

SYMPTOMS

As nitrogen is mobile in the plant, yellowing is initially observed in the older leaves. Symptoms can then spread to the whole plant, which becomes pale and spindly. Older leaves may die prematurely. Yellowing tends to appear in a V-shape, starting at the leaf tip and progressing down the midrib to the leaf base.

CAUSED BY

Insufficient nitrogen is most likely in cold, waterlogged soils lacking organic matter. Heavy rain and high carbon crop residues can remove nitrogen from soils, especially from light, sandy soils.

Nitrogen deficient leaves compared to healthy leaf at right

Symptoms of nitrogen deficiency on a leaf (GR Pugliese IPNI) *and whole plants* (MK Sharma & P Kumar IPNI)

Overmaturity

SYMPTOMS

Kernels develop dimples and/or individual kernels brown and soften, developing a fermented flavour. Cobs lack sweetness.

CAUSED BY

Incorrect assessment of maturity, resulting in late harvest. Fermentation can occur in supersweet varieties, especially under warm, humid conditions. Harvest should occur at the milk stage (squeezed kernels release milky liquid), before cobs start to dry, and convert sugars to starch.

Dimpled kernels due to overmaturity (QDAF)

Phosphorus deficiency

SYMPTOMS

Phosphorus is mobile in the plant, so new shoots appear unaffected. Older leaves are dark green, but with reddish purple leaf tips and margins. Seedlings are frequently affected, resulting in purpling and stunting. While older plants appear to recover, they have a shallow root system, silk emergence is delayed, and cob size is reduced.

CAUSED BY

Soils low in organic matter or high in iron, which ties up phosphorus in a less available form. Symptoms are most likely in cold soils that are excessively wet or dry. Phosphorus is most readily available within the pH range 6.0 to 7.5.

Phosphorus deficient seedlings (MK Sharma & P Kumar IPNI) *and symptoms on a mature leaf* (J Ekman)

Potassium deficiency

SYMPTOMS

Yellowing and then browning of the older leaves starting at the leaf tip and outer margin. Symptoms usually don't appear until at least a month after planting. As the plant grows the lower leaves yellow and die back from the tip.

CAUSED BY

Heavy rain leaching potassium from the soil, especially if early root growth has been limited by dry or compacted soil. Excess calcium and magnesium reduce potassium availability.

Potassium deficient leaf and resulting death of the older leaves in a crop (MK Sharma & P Kumar IPNI)

Salinity

SYMPTOMS

Seed germination may be slow and patchy. The tips and margins of the older leaves become yellowed and necrotic. Leaves are short, erect and may tend to inroll along the margins. Severe salinity can kill plants.

CAUSED BY

High levels of salts, especially sodium chloride, in the soil and/or irrigation water. While salt tolerance differs widely between varieties, water with an EC reading >1.5dS/m may affect growth.

Effect of high levels of dissolved salts on plant leaves (J Ekman)

Senescence

SYMPTOMS

As the husk dries it changes from pale green to papery and browning. Symptoms initially develop as patches but spread across the whole husk.

Internally, kernels dehydrate and develop dimples. Depending on moisture levels, kernels may become dry and fibrous or brown and soften. Cobs lack sweetness and may even develop a fermented flavour.

CAUSED BY

Sweetcorn has an extremely high respiration rate and produces significant amounts of ethylene. If it is not cooled rapidly after harvest, storage life will be short and quality reduced. Extended storage at higher than optimal temperatures (>5°C) and/or storage under low relative humidity will increase kernel dimpling due to ageing and moisture loss.

Husk drying and kernel dimpling are symptoms of moisture loss and senescence (T Kristensen)

Sulphur deficiency

SYMPTOMS

Younger leaves are pale to yellowed. Yellowing may be interveinal, or quite diffuse across the leaf. Plants are stunted with delayed maturity.

CAUSED BY

Most likely in sandy, acid soils with low organic matter, especially if conditions are cold and dry after planting.

Yellowing of the younger leaves may be interveinal (R Taylor Uni Delaware) *or diffuse* (MK Sharma & P Kumar IPNI)

Uneven germination or growth

SYMPTOMS

Crop fails to grow uniformly.

CAUSED BY

Possible causes include changes in soil type, uneven planting depth, poor seed quality or old seed, planting too deep early in the season (increasing seed rots), planting while soil temperatures are still below 13° C and uneven watering resulting in dry or waterlogged areas. Soil borne fungi and nematodes can also cause this effect.

Uneven crop of sweet corn (J Ekman)

Zinc deficiency

SYMPTOMS

A broad creamy white to translucent band appears either side of the midrib, starting at the bases of younger leaves. Bleaching does not normally extend as far as the leaf tip; the leaf margins and midrib usually remain green. Plants are stunted due to shortened lengths between the leaf nodes.

CAUSED BY

Usually occurs in soils with pH higher than seven, especially where soil is sandy or low in organic matter due to removal of the topsoil. Cold, wet conditions or high levels of soil phosphorus reduce uptake of zinc.

Zinc deficient plants and leaf showing white band either side of the midrib (MK Sharma & P Kumar IPNI)

Nutrient deficiency symptoms

The following is a diagrammatic representation only.
Note that symptoms can vary significantly between cultivars, environments and soil types.

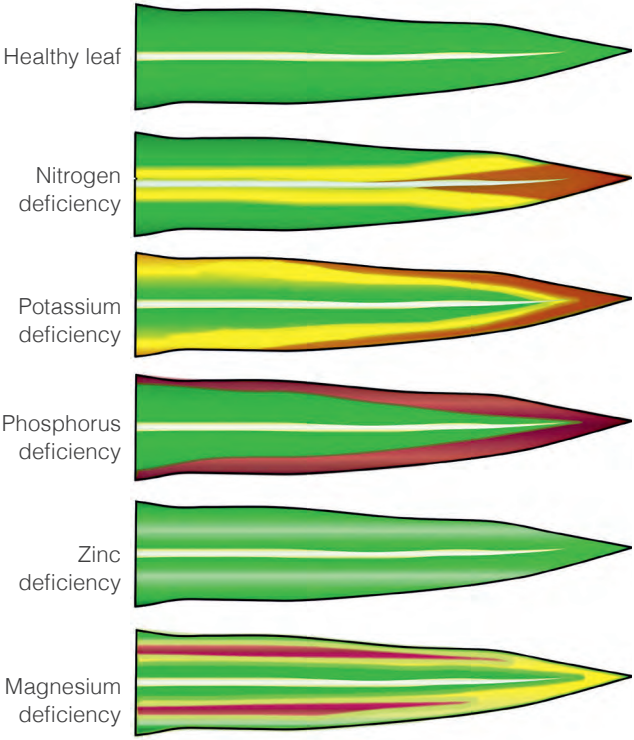


Photo by Andre Ouellet on Unsplash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