Introduction

This photo booklet has been produced by the CABI-led **Plantwise** programme (www.plantwise.org) to aid extension officers and other plant health advisors in diagnosing the most common pests, diseases and abiotic problems of coffee around the world. The symptoms presented on a real plant sample can be compared with the photos in this guide to identify possible causes.

The booklet is organized into two broad sections, one showing the common insect pests that attack the crop and the other showing the various symptoms of poor health. In the symptoms section, the images are arranged by plant part, with similar-looking symptoms displayed together. Some biotic and abiotic factors cause more than one type of symptom, so there may be multiple images in different parts of the photo booklet for a specific problem. The photos for a particular problem are cross-referenced to make it easy to find all the relevant photos.
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Beet armyworm
*Spodoptera exigua*

Worldwide except S America

- The larvae are pale green or yellow when small but gain pale stripes later.
- The body is practically without hairs or spines.
- Older larvae are generally darker but variable in colour, pink or yellow on the underside.
- The adults are moderately sized mottled grey brown moths, the wing span of 25-30 mm.

Photos: M. Young, Rural Agricultural Development Authority, Jamaica; P. Harris, Bugwood.org
American cotton bollworm/Corn earworm
*Helicoverpa zea*
Americas and China

- Usually with orange heads and a black region just behind head.
- Bodies usually blackish but can be brown green/yellow covered with many thorny micro spines.
- Young larvae feed together but older ones eat each other; larger larvae are not so common.
- Adults variable colour (yellowish brown) 32–45 mm wingspan.

Photos: Clemson University – USDA Cooperative Extension Slide Series, Bugwood.org; Seabrooke Leckie, Flickr
Oriental armyworm
*Mythimna separate*

Asia and SE Asia

- Young larvae are white, they turn green when older, head orange or brown.
- Mature larvae are variable but are greenish to light brown marble orange brown with narrow white line along the back.
- Mature larvae bite off the grain stalks and let them fall.
- Adults about 20 mm long wingspan 40 mm forewings have two pale round spots.

*Photos: Takahashi, Wikimedia commons; Shipher Wu, Flickr*
Sorghum webworm
Nola sorghiella
N America only

- External feeders of floral parts not leaves.
- Greenish/yellowish with 4 red/brown lines on back (max 13 mm) covered in spines they eat round holes in grains.
- When monitoring, shake heads of grain over white paper as larvae can be well hidden and not immediately obvious.
- Larvae spin cocoons.

Photos: Alton N. Sparks, Jr., University of Georgia, Bugwood.org; Andy Reago and Chrissy McClaren, Flickr
Cotton bollworm
*Helicoverpa armigera*

Worldwide except N America

- Up to 40mm long the head is yellow with several spots. Three dark stripes extend along the back and a yellow one along the side.
- Underside is pale.
- Larvae often eat each other; the older larvae are less common.
- When disturbed they drop from the plant and curl up.

*Photos: Paolo Mazzei, Bugwood.org; W. Billen, Pflanzenbeschaustelle, Weil am Rhein, Bugwood.org*
African armyworm
*Spodoptera exempta*

Worldwide except S America

- Two types of larvae: those which like to live together and those which live alone.
- Grouped larvae have a velvety-black upper surface with pale lines on their sides, a green or yellow under surface, and no hairs on the body.
- There are three parallel lines on the back of the first body segment. The head is always shiny-black.
- Larvae living alone are fat and extremely sluggish and variable in colour.

Photos: M Powell, ARC-PPRI; P. Taylor, CABI
Fall armyworm
*Spodoptera frugiperda*

America and Africa

- Young larvae are greenish with a black head. Later the body becomes brownish, white lines develop down the sides.
- Raised spots are on the back; they are usually dark, and bear spines.
- The face of the mature larva is marked with a white upsidedown “Y”.
- Adult moth: Triangular white spots at the tip and centre of the wings, rear wing is shiny silver-white with a narrow dark border round the edge.

Photos: Frank Peairs, Colorado State University, Bugwood.org; M. Cock, CABI
Cutworm, Turnip moth larvae
*Agrotis* sp.

Worldwide

- The larvae are generally grey, sometimes tinged with purple.
- Live in the soil rarely climb plants.
- On each segment, 2 small black spots at the front and two at the back, each bearing a small bristle.
- Generally active at night will curl up if discovered during the day.

Photos: Frank Peairs, Colorado State University, Bugwood.org; Donald Hobern, Flickr
Sorghum chafer and other Chafer grubs

*Pachnoda interrupta*

**Worldwide**

- Large fleshy body with brown head.
- Grubs always live underground and are characteristically C-shaped when disturbed.
- Three pairs of well-developed legs.
- Adults are typical beetle shaped, usually brown but may be patterned.

Wireworms, and false wireworm
*Agriotes* spp. *Gonocephalum* spp. and many others

**Worldwide**

- Larvae are long and thin, small yellow brown, shiny hard-bodied and live in the soil.
- Can be move quickly with three pairs of well-developed legs near the head.
- Cannot curl into a tight C-shape as cutworms and chafer grubs do.

Photo: Kansas State University
African sugarcane borer
*Edlana saccharina*

- Oval yellow eggs. Larvae light-brown to dark-grey with small dark spots. Head reddish to dark brown.
- Often a great deal of frass hanging from exit holes.
- Moths vary considerably but have long forewings with two distinct dark spots at the top. When settled the sides of the wings are parallel to each other, 35 mm wingspan.

Photos: David Agassiz (top); ICIPE (lower)
Sugarcane stalk borer
*Diatraea saccharalis*

- Egg mass 25-50, whitish-yellow.
- Larvae 25 mm, red-brown head, yellowish-white body, brown spots.
- At low temp lacks spots and becomes yellower.
- Adults, straw-colour, V-shape black dots on forewing, 25 mm wingspan.

Photos: Aldo Norberto Bonaveri; William White, Bugwood.org
African maize stalk borer
Busseola fusca

- Eggs (white but turn darker with age) laid under leaf in a long column stretching up the stem.
- Young larvae are deep purple or black.
- Larvae featureless, up to 40 mm. The body is creamy-white with grey or pink hint, head dark brown.
- Adult wing-span 25-35 mm. The colour is variable depending on place and time of year.

Photos: D. Cugala ICIPE
Spotted Stalk borer

*Chilo partellus*

E Africa and S Asia

- Eggs 1.5 mm whitish and laid overlapping.
- Larvae up to 25 mm, reddish head, white-yellowish body, four dark stripes and spotted.
- Hooks on the prolegs (the four pairs of short stubby ones) are arranged in a circle (hand lens needed).
- The hooks of similar borers are arranged in a crescent or rows.

Photos: Rob Reeder, CABI; Georg Goergen/IITA Insect Museum, Cotonou, Benin
European corn borer

*Ostrinia nubilalis*

Worldwide except S America

- Eggs are nearly flat and 1 mm in diameter laid in a mass and overlap like tiles on a roof.
- The head is black in young larvae but in older ones they are dark brown.
- 4 large spots at the front of each segment and 2 smaller ones behind, small hairs grow from each spot.
- Underside is cream coloured and unmarked.

Photos: Frank Peairs, Colorado State University, Bugwood.org; Tony Morris, Flikr
African pink stem borer
*Sesamia calamistis*

- Eggs creamy white but darken with age, 1 mm wide.
- Larvae lack hairs and look creamy-white smooth and shiny. Often a distinctive pink colour under the skin.
- Hooks on the ends of short stubby legs are arranged in rows (hand lens needed).
- Unlikely to cause holing as it doesn’t feed on the top leaves.

Photos: IRD Lab Evolution, Génomes et Spéciation; CIMMYT
Purple stem borer
*Sesamia inferens*

S Asia and SE Asia

- Eats a wide range of crops, prefers rice not generally a major pest of Sorghum.
- The larva is without stripes but is obviously segmented.
- The legs are black and the last two segments have many black hairs.
- Larval stage appears very similar to *Sesamia calamistis*.
- The adult moths have a thick brown hair tuft in the head and neck region.
- The wingspan up to 35 mm The forewings are light brown with some scattered dark brown spots throughout.

Photos: Agnes Adique Talavera courtesy Project Noah; IRRI
Earhead bug
*Calocoris angustatus* and other

India and Africa

- Eggs (blue) cigar shaped 1.5 mm laid under the scales covering the grain.
- Nymphs and adults attack developing grain (adults 5 mm long yellowish green).
- Nymphs and adults suck juice from grains when they are at the milky ripe stage.
- Grains fail to fill and heads become chaffy.

Photo: Entomart, commons.wikipedia.org
Southern green stink bug

*Nezara viridula*

Worldwide

- Large and green (sometimes brown) 15 x 8 mm.
- Mostly a pest of legumes but can attack sorghum.
- Eggs are in groups of about 60. They are cream to yellow but become orange before hatching they are and tightly glued to each other.
- Young nymphs are black, older ones green. Nymphs and adults feed by sucking sap from developing grains.

Photo: R Ottens, University of Georgia, Bugwood.org
• Eggs are yellow but turn red found at the base of plants behind lower leaf sheaths and on soil.
• Nymphs, dark red and have a white band across their bodies. Adults 5 x 1.5 mm They are mostly black with reddish legs and milky white wings.
• Adults produce a familiar foul odour when crushed.
Corn planthopper

*Peregrinus maidis*

Worldwide

- The nymphs have no wings and are green to light brown about 3 mm long.
- They run rapidly when disturbed. Both adults and nymphs like to feed inside the funnel of the plant, particularly in young plants. As the plants grow, they move out onto the underside of the leaves.
Stalk eyed fly
*Diasemopsis* spp.

- The maggots feed inside the stems or tillers of seedlings results in “dead hearts”.
- Adults small, 6 mm and come out in the evenings.
- Several different types all with eyes on stalks.
- Damage can be mistaken for the Sorghum shoot fly.

Photo: Ton Rulkens Flickr
Sorghum midge  
*Stenodiplosis sorghicola*

- Eggs are 0.4 mm long, tube shaped, transparent and with a light-red tinge in the middle one egg per spikelet at flowering.
- Older maggots become red and 2 mm. Red juice will flow from infested seeds when squeezed.
- Adults are, deep-red, 3 mm long, with see through wings. They emerge in the early mornings and can be seen hovering around developing grain heads.
Sorghum stem fly
*Atherigona soccata*

Africa, Asia, SE Asia

- White eggs are long and thin, 0.8 x 0.2 mm 1-3 eggs laid per leaf.
- Larvae (maggots) crawl down into funnel and eat the youngest leaves of seedlings: Deadheart develops maggot up to 10 mm.
- Leaf easily removed and gives off bad smell.
- Fly (4 mm) looks like a small house fly.
- Older plants are more resistant.

Photo: G. Goergen, Ecoport.org
Desert locust
*Scistocerca gregaria*

Africa and Asia

Solitary desert locusts colour is greyish or brownish, but males may become yellow when they mature. Males are 40-50 mm, females are 50-60 mm long.

When they cluster together they turn black and develop orange spots.

Photo: H Hubert, Flickr
Migratory locust
Locusta migratoria

Africa, Asia, SE Asia

- Body length varying from 35 to 50 mm for males and from 45-55 mm for females.
- Mandibles (mouth parts) are blue. Wing cases are shining and long: 45-55 mm (males), 50-60 mm (females).
- Wings are colourless, except smoky tint and black veins.

Photo: P Rowley, Flickr
Lesser grain weevil
*Sitophilus oryzae*

- 2 mm long with long snout, brown/black with four orange spots on wing cases.
- Usually a pest of stored products but can attack plants in the field.
- Female chews hole in stored grain and lays an egg the larvae develop inside the stored seed.

Photo: Udo Schmidt, Flickr
Greater grain weevil
*Sitophilus zeamais*

- 3 mm long but very similar to the lesser grain weevil.
- Four orange spots on wing cases but not as clear as in the lesser grain weevil.
- Pest of stored grain, larvae are found inside the stored seeds.

Photo: Gary Alpert, Harvard University, Bugwood.org
Grain moth  
*Sitotroga cerealella* (shown on Maize)

- A major pest of stored grain. Larvae not often seen as they develop within a grain.
- Eggs laid in cracks on grain in field but moths do survive in stores too.
- Larvae bore chamber into grain forming exit hole (above) for emerging adult.
- Adult small white moth wingspan 13–20 mm.
Mites
*Tetranychus urticae* (and others)

Worldwide

- Mites are extremely small and difficult to see (0.3 mm x 0.4 mm).
- There are many types but all create similar damage and characteristic webbing.
- Do not look for mites without a hand lens and do not look for mites on the dead areas of the plant.

Photo: F.C. Schweissing, Bugwood.org
Grey sugarcane mealy bug
Saccharicoccus sacchari

- Pink, of typical mealybug appearance, often covered with white wax up to 7 mm long.
- Egg shaped, fleshy and with a slightly segmented body, no obvious head or bottom end.
- For most of their life cycle they live in the highly protected environment behind the leaf sheath.
- May attack underground as well above ground.

Photo: CABI
Spring green aphid
*Schizaphis graminum*

- Feed on underside of leaf. Female 1.5-2.0 mm and typically pale green often with a stipe down the back.
- Fully grown they have the classic pear shaped body of aphids but young ones are smaller and with parallel sides.
- Winged forms develop when population are high or nearing the end of the season.

Photo: Frank Peairs, Colorado State University, Bugwood.org
Sugarcane aphid
*Melanaphis* spp.

- Live on the lower surface of leaves.
- 1.8 mm long pale yellow or orange with black tail pipes and black feet.
- Later in the season the aphids will leave the leaves and move up onto the filling grain.
- Winged forms develop when population high.
- Sooty mould is extremely common with this pest.

Photo: D Sekula Flickr
Green Corn Aphid
*Rhopalosiphum maidis*

- Typical aphid shape (2 mm) with black legs and black head and black bottom pale green grey body.
- Often in groups in the curl of the leaves and upper part of the stalk and may completely cover a large area. They may be found in large numbers down in the funnel of the plant.
Zonate leaf spot
Gloeocercospora sorghi

• Red spots on lower leaves are the first symptoms.
• These spots develop into circles (mid leaf) or semi-circular if on the edge of leaves but they then elongate and join together.
• It can become severe in times of high temperature and humidity.

Photo: L Claflin, Kansas State University
Anthracnose foliar blight
*Colletotrichum sublineolum*

**Worldwide**

- Circular dark spots with red edges and a lighter middle.
- Older spots get a brown centre, (2–20 mm).
- Black fruiting bodies within the spots are an important thing to look out for.
- Whole leaves can be killed and plant may die before harvest.

Photo: Clemson University – USDA Cooperative Extension Slide Series, Bugwood.org
Sooty stripe (NOT Sooty mould)

*Ramulispora sorghi*

Worldwide

- Small yellow spots are the first symptom.
- These become oval and develop a brown centre with a wide yellow edge.
- Spots can get really large and join up.
- Older spots have a lot of black spores appear as a “soot” covering the surface of the brown area.

Photo: David Nowell, Ecoport.org
Northern leaf blight
*Setosphaeria turcica*

On seedlings, small red spots join, leaf wilts, and plants die.

Starts on lower leaves or (less so) on stems, long, oval brown spots, matures to yellow-brown with purple borders; can be as wide as leaf.

Will kill whole plant if conditions allow.

Photo: David Nowell, Ecoport.org
Rust
*Puccinia purpurea*

- Purple-red spots on both leaf surfaces, parallel to veins, they mature to ‘bumps’, which break into reddish powdery masses (pustules).
- On the head stalk long brownish streaks develop.
- Later in the season black spots develop on leaves; this is the same problem but in a different phase.

Photo: S Nelson, Flickr
Southern leaf spot
*Cochilobolus heterostrophus*

Worldwide

- Tan spots 2–6 mm wide and 3–22 mm long.
- Spots have yellow green or chlorotic border.
- When the seed head emerges a black felty mould may cover the affected seeds and ear rot may occur.
Grey leaf spot
*Cercospora sorghi*

- Rectangular narrow tan/brown spots appear on mature leaves (12-50 mm) x (3-6 mm) turn grey with time.
- Individual lesions may coalesce, and under severe disease conditions, blight entire leaves.

Photo: P. Taylor, CABI
Rough leaf spot
*Ascochyta sorghi*

Asia, Africa, N America

- Spots first appear 2-3 mm x 2 mm as reddish areas.
- Fruiting bodies are usually produced rapidly sometimes before the discolouration (on both sides of the leaf).
- Spots enlarge until they become 8-14 x 4-8 mm. Usually the centres become tan with a purple or red border but this depends on the variety.
Spring green aphid
_Schizaphis graminum_

Worldwide

- Extensive red brown spotting of leaves develops and remains even once the aphids have been controlled.
- Whole plants at seedling stage can be destroyed and feeding on older plants causes lodging.

Photo: Alton N. Sparks, Jr., University of Georgia, Bugwood.org
Downy mildew
Peronosclerospora spp. (on Maize)
Worldwide

- Leaves have yellow to white stripes from the base.
- Leaves are often narrower than usual, erect, and shredded. A white, downy growth may develop on both surfaces of leaves.
- Plants may be stunted, and have an irregular seed set.

Photo: Thomas Isakeit, Texas A&M University
Mite damage
Mite damage (on maize) Worldwide

- Silvering of the leaf associated with webbing.
- Death of the leaf soon follows but mites are not be seen on the dead leaves.
- Mites are commonly found on the back of the leaf near the midrib and near the leaf sheath.

Photo: S. Zukoff, Kansas State University, Department of Entomology
Downy mildew
Peronosclerospora sorghi
Worldwide

- White downy growth on underside of leaves. Later, narrow yellow striping which turn brown.
- White areas dry, brown, die appear shredded.
- Plants become stunted, fail to produce grain.
Discolouration of the leaves is extremely common.
Leaf spots develop spots usually on underside of leaf.
Whole leaf drying can occur in severe situations.
Corn planthopper
*Peregrinus maidis*

- Small (5 mm) and look little bit like aphids.
- Waxy nymphs and adults often seen in plant funnel, on leaf sheaths and underneath leaves.
- Large numbers (looking like aphid colonies) will stunt the plant, leaves become twisted, brown and the ear will fail to emerge.
- Transmits Maize mosaic virus.

Photo: ARS Corn And Soybean Research Unit
Shortage of Phosphate
Phosphate deficiency

- Severe stunting of the plant associated with dark green colour and purpling of the lower leaves.
- Other stress factors can produce similar symptoms but this is very characteristic of phosphate (P) shortage.

Photo: Dr Prakash Kumar
Shortage of Nitrogen
Nitrogen deficiency

Worldwide

- General yellowing of the plant usually associated with stunting.
- Symptoms first seen in the lower leaves, tip of the plant remains green.
- Yellow V-shape spreads down the centre of the leaf from the tip of the leaf to the stem.

Photo: Dr Prakash Kumar
Shortage of Potassium

Potassium deficiency

• The edges of the lower leaves are the first to show symptoms.
• Symptoms first seen in the lower leaves, tip of the plant remains green.
• Unlike nitrogen (N) shortage where the area closest to the centre of the leaf turns yellow in the case of potassium (K) shortage the edges of the leaf turn yellow and then brown.
Shortage of Calcium
Calcium deficiency

- The plants are stunted and the leaves fail to expand properly and they are often partially trapped by the lower leaf.
- The plant may develop a ladder like appearance with each leaf holding the one above it.
- In this photo ignore the leaf borer damage and slight necrosis.

Photo: Dr Prakash Kumar
Shortage of Sulphur
Sulphur deficiency

• General yellowing of the plant similar to nitrogen shortage but in the case of sulphur shortage the tip of the plant also turns pale yellow whereas when nitrogen (N) is short it will remain green.

Photo: Dr Prakash Kumar and Dr Manoj Kumar
Maize streak virus
MSV Symptoms shown on Maize

- Long stripes on the leaves usually seen in the younger leaves first.
- Appears similar to other causes but the stripes caused by downy mildew are much wider and those due to iron deficiency are continuous and longer.

Photo: P. Taylor, CABi
Maize dwarf mosaic virus

Mosaic may develop on young leaves, chlorotic dots enlarge to form stripes.

In cool climates, red streaks turn brown.

Stunting is a common symptom.
Downy mildew
*Peronosclerospora sorghi*

- Early symptoms, pale leaves, white downy growth on underside.
- On older leaves, wide yellow or white striping, and often develop brown spots.
- White areas dry, brown, die and appear shredded.
- Plants are stunted and fail to produce grain.

Photo: International Maize and Wheat Improvement Center
Shortage of Iron

Iron deficiency Worldwide

- Long and continuous stripes on the leaves.
- Usually seen in the younger leaves first.
- Leaves can become almost totally yellow in extreme cases.
- Stripes caused by viruses are usually not continuous and downy mildew stripes are much wider.

Photo: Dr Prakash Kumar and Dr Manoj Kumar
Ergot, sugary disease
*Claviceps africana*

- At harvest time the fungus will no longer be active.
- Once the sugary honey dew stops the heads appear black and contain no or few seeds.

Photo: G Odvody, Texas A&M University
Ergot, sugary disease

*Claviceps Africana*

Africa and S America

- The sugary honey dew that oozes from the developing ears may develop a whitish bloom as shown above.
- This is the characteristic of this disease.
Crazy top
*Sclerophthora macrospora*

Worldwide

- Characteristic ‘crazy top’.
- Early infection: leaf mosaic Severe: lower leaves, strap-like, leathery, roughened underside, with translucent chlorotic streaks and twisted.
- Stunted roots, plant pulls up easily.
- Related to Downy mildew.

Photo: Paul Bachi, University of Kentucky Research and Education Center, Bugwood.org
Grain mould
Various fungi

• Variable symptoms due to the nature of the problem.
• Severe infection results in grains with pink, white, or black fungal mycelium and sporulating structures.
• May lead to toxin production making the sorghum dangerous to eat and storage problems.
• Compact ear heads are highly susceptible in wet weather.

Photo: Tom Allen, Mississippi State University Extension
Sorghum midge
*Stenodiplosis sorghicola*
(worldwide)

- Grains fail to develop resulting in black shrivelled heads.
- The maggots and the adult midge will not be present at this stage as they only attack the developing grain and not the mature seeds.
- Empty pupae cases may be visible on top of spikelets and adults may be seen.

Photo: E Boa, CABI
Once the plant begins to produce seed the aphids may move up onto the developing stalks of the grain.

Seed head becomes splayed.

Feeding on the developing grains prevents them from filling and they will die.

Many aphids can produce similar symptoms and the individuals need to be examined.
Covered kernel smut
*Sporisorium sorghi*

- Plants are infected at the seedling stage but show no symptoms until near maturity.
- Dark brown powdery masses are covered by a tough greyish white or brown membrane, this usually breaks at harvest time.
- Usually all the seeds in the head are affected.
Head smut
*Sphacelotheca reiliana*

- No symptoms except stunting initially; smut replaces seed before emergence from the leaves.
- Developing head is enclosed in a thick whitish membrane but this ruptures before emergence.
- Dark brownish dusty masses from tangled parts of plant strands will blow around.
- Small leaves may develop within the smutted head.

Photo: R Shivas, PaDIL.gov.au
Covered kernal smut
*Sporisorium sorghi*

- Infected grains turn white, uninfected ones remain brown.
- In this case seed head is only partially infected but usually all the seeds in the head are affected.

Photo: University of Georgia Plant Pathology, University of Georgia, Bugwood.org
Loose kernel smut
*Sphacelotheca cruenta*

Worldwide

- Plants become infected as seedlings, plants are often stunted.
- Infected heads emerge before uninfected ones.
- Individual seeds are replaced by pointed galls (25 mm or longer), with a thin grey membrane.
- This membrane soon breaks after ear emergence and black dusty material is released and will blow away, long black pointed structures remain.

Photo: P Sajjabbi, www.runetwork.org
Ergot, sugary disease

*Claviceps africana*

Worldwide

- Clear sticky honeydew, oozes from grain and drips on leaves grain heads often compacted.
- May become blackened with sooty mould or may develop a whitish bloom on the honey dew surface.
- Black fungal survival structures produced later in place of the seed.

Photo: G Odvody, Texas A&M University
Maggots feeding on milky stage grains will make empty chaffy spikelets as shrivelled grains fail to develop.

Empty pupae cases (ringed) remain at top of spikelet once the damage has been done and the adult has flown.
Bollworms
*Helicoverpa* spp.

- In addition to the damage to leaves the caterpillars attack the developing grains.
- Often a lot of frass is seen.
- These large caterpillars are never hidden within the stems or seeds.

Photo: K O Bell, Texas A & M University
Stemborer damage
Many species

- Exit holes in the stem often surrounded by frass.
- Almost always associated with holes in leaves.
- Cut open the stem to find the eaten cavity inside, and there may be other larvae within.
- It is necessary to see the larvae to identify the pest.
- Stems may break due to weakness caused by boreholes.

Photo: A Nallusamy and C Karthikeyan, Tamil Nadu Ag University
Armyworms
*Spodoptera* spp. and others

Worldwide

- Leaves only feeders they never bore into stems.
- Larvae feed on leaf funnels, and emerging leaves will have extensive areas of damage.
- Some species feed on leaves leaving mid-rib.
- It is necessary to see the larvae to identify the pest.

Photo: J. Mulema, CABI
Stemborer damage
Many species Worldwide

- Damage to the unfolded leaves result in lines of holes in the leaves once they unfold.
- Dead heart may be seen in young plants if the growing tip is eaten.

Photo: Joseph Mulema, CABI
Cutworm, Turnip moth larvae
*Agrotis segetum*

- Severe damage can be done to seedlings.
- Larvae chew stems at or just above the soil line and plant the falls over.
- It looks as though the plant has been cut off.
- Larvae hide in soil during the day.

Photo: W.M. Hantsbarger, Bugwood.org
Anthracnose head rot and stalk red rot
*Colletotrichum sublineolum*

- Stems dark brown/black regions shiny or blotchy.
- Inside the stem is black and rotted.

Photo: Department of Plant Pathology, North Carolina State, Bugwood.org
Fusarium root and stalk rot

*Fusarium* spp. Worldwide

- The lower area of the stem will appear shredded and characteristically pink or red in colour.
- Small sterile grain head is produced if anything at all.
- Isolated plants will die within the crop looking like they are suffering from drought.

Photo: L Clarfin, Kansas State University
Stemborer damage
Many species

- Plants likely to fall over due to weakness in the stem.
- Plants likely to be suffering from drought stress and will mature early if they mature at all.
- Stem borer larvae are easily found once the stem is split open.

Photo: P. Kelly, CABI
Bacterial black stalk (on maize)

Dickeya zeae

Worldwide

- Lower regions of stem turn brown and become water soaked soft and slimy.
- There may be a foul smell and plants frequently fall over.
- Upper leaves wilt and soft rot may occur at the base of the funnel and this may spread down rapidly. Outer leaves generally unaffected.
- Often seen in poorly drained soils.

Photo: Howard F. Schwartz, Colorado State University, Bugwood.org
Charcoal root and stalk rot
*Macrophomina phaseolina*

- Stalks are soft, the plant material inside the stem is missing, only the fibers remain, small dots of fungi giving a charred “burnt” appearance.
- Plants are likely to fall over.

Photo: University of Nebraska, Lincoln Extension
**Pythium seedling and root rot**  
*Pythium* spp.  

- Common under prolonged waterlogged conditions.
- Seeds fail to emerge.
- Discoloured leaves develop.
- Roots rot and develop dark reddish spots, other diseases will often take over once the plant is affected.
Bacterial top and stalk rot

*Dickeya zeae*

- The growing point of the plant disintegrates.
- Leaves are easily pulled out of the whorl and the lower end has a bad smell.
- Often basal rots accompany this symptom and the plant is likely to fall over.

Photo: University of Nebraska, Lincoln Extension
Sorghum stem fly
*Atherigona soccata*

Africa, Asia, SE Asia

- Maggot eats out the centre of the plant giving dead heart, older leaves are unaffected.
- Youngest leaf is easily removed and gives off bad smell.
- Plants may recover and send out side shoots these also may be attacked but are more able to stand the attack, papery leaves are produce in this case.
Chinch bug
*Bliissus leucopterus*

N and S America

- Mostly attacks behind leaf sheaths but occasionally from roots and leaves.
- Severely damaged plants may die or be badly stunted (failure of leaf sheaths and stems to properly extend).
- Reddish feeding marks behind leaf sheaths and a reddish or yellowish streaking on the leaves.

Photo: Gerald Wilde, CABI CPC
Maize stripe virus
MSpV symptoms shown on Maize Worldwide

- Chlorotic bands in leaves little or no panicle emerges and stunting is common.
- Chlorosis can become severe and the plant appears extremely pale.
Maize mosaic virus
MMV symptoms shown on Maize

- Transmitted by hopper Peregrinus maidis.
- Discontinuous chlorotic streaks between fine veins stunting and yield loss.
- Severe if infection of young seedlings, takes place grain set reduces.
Locust and grasshopper

Worldwide

- Feeding damage. Nymphs and adults feed on leaf edges, flowers and developing seed heads.
- The eaten areas are generally continuous rather and lines of holes.

Photo: D Mock, Texas A&M University
Spring green aphid
Schizaphis graminum

Worldwide

- Reddish yellow spots develop 2-4 days after feeding.
- These spots join together and can discolour the whole leaf which will die if feeding was severe.
- Seedlings may be killed and older plants may fall over in severe cases.

Photo: P Sloderbeck and L Brooks, Texas A&M University
Extensive mite damage leads to wholesale death of leaves which gain a scorched appearance.

Mites cannot be found on the dead leaves they are present hidden on the young leaves.

Detailed examination of the youngest leaves is required.
Spring green aphid  
*Schizaphis graminum*  

- This aphid causes much greater damage than many other kinds of aphid due to the reddening leaf spots that develop where feeding takes place.
- These areas can become so extensive that whole plants can die.
- Close inspection of the plants are required.

*Photo: B Massey, Texas A&M University*
Anthracnose
Colletotrichum sublineolum

Worldwide

- Spots on the stem are circular with a red to black border and grey centre. They penetrate into the stem and red marbling can be seen inside the stem.
- Fruiting bodies often seen within the spots on the stems.
- The disease can kill crops that have poor resistance.

Photo: Uni Georgia Dept Agricultural and Environmental sciences
The leaves bearing the reddish powdery pustules will dry up. Plants will show poor head development and this will lead to shrivelled grain. Under ideal conditions the whole plant will be affected.
Seedlings especially affected.

Very reduced root system with short stubby roots with black areas on them especially at the tips.

As roots are eaten new ones develop creating a highly branched root system.

Plants may grow away from damage with time.
Stubby root nematode
Paratrichodorus minor

• Seedlings especially affected.
• Very reduced root system with short stubby roots with black areas on them especially at the tips.
• As roots are eaten new ones develop creating a highly branched root system.
• Plants may grow away from damage with time.
Lesion nematode

*Pratylenchus* spp. (on banana)

**Worldwide**

- Causes black dead areas on root surface and holes inside roots.
- Above ground only general symptoms develop, reduced growth, with stunting.

Photo: University of Nebraska
Root knot nematode
Meloidogyne spp.

- Plants, small, yellow less vigorous. Looks like drought and nutrient deficiencies.
- Symptoms are particularly severe when plants are infected soon after planting.
- Below ground galls ranging in size from 1-10 mm. In severe infestations, heavily galled roots may rot away, leaving a poor root system with a few large galls.
Stunt nematode
Tylenchorhynchus spp.

• Root feeder. Few stubby roots, swollen brown tips.
• Plants, small, yellow, less vigorous.
• Looks like drought and nutrient deficiencies.
• Makes other root diseases such as charcoal rot more likely to occur.

Photo: Dept of Plant Path, NCSU, Bugwood.org
Witchweed
*Striga asiatica*

Africa and Asia

- Parasite or hemi-parasitic reddish flowered plant causes scorching early drying and often the plant will fall.
- Plants will show poor vigour and fail to yield.

Photo: P. Taylor, CABI
Witchweed
*Striga hermonithica*

- Parasite or hemi-parasitic purple flowered plant causes scorching early drying and often the plant will fall.
- Plants will show poor vigour and fail to yield.

Photo: IITA image library
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