

A close-up photograph of a cluster of bright red, ripe tomatoes with green stems and leaves.

CABI PEST AND DISEASE PHOTOGUIDE TO

Tomato disorders

KNOWLEDGE FOR LIFE

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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American cotton bollworm

Helicoverpa zea

Caribbean Central
and South America



Photo: Clemson University – USDA Cooperative Extension Slide Series, Bugwood.org

- Larvae various colours, about 40 mm long when mature, often hidden inside fruit.
- Lines of white, cream or yellow on the body and as they get larger the pattern becomes more clear.
- Larvae have 5 pairs of stubby little legs (prolegs).

Tomato leafminer

Tuta absoluta

S America, Central America,
Africa, Asia



Photo: Marja van der Straten, NVWA Plant Protection Service, Bugwood.org

- Larvae small, whitish turning to green/light pink.
- It prefers the tip of the plant, flowers or new fruits.

Cotton bollworm

Helicoverpa armigera

Africa, Oceania, Asia



Photo: Central Science Laboratory, Harpenden, British Crown, Bugwood.org

- Larvae greenish-grey to orange-brown (colour is extremely variable) larvae often hidden in fruit, 30-40 mm long when fully grown.
- The final body segment is longer than the other segments.

Beet Army worm

Spodoptera exigua

Africa, Asia, Oceania,
Central America, Caribbean



Photo: Alton N. Sparks, Jr., University of Georgia, Bugwood.org

- Larvae 25-30 mm long; underside green with thin brown lines, on sides there are light green lines with a wide dark brown strip above.
- If crowded on the plant they turn almost black.

American cotton bollworm

Helicoverpa zea

Caribbean, Central
and S America



Photo: Seabrooke Leckie, Flickr

- Adult 20-25 mm long and brown.
- Rear wings pale with a broad dark edge; wing-span 38-43 mm.

Tomato leafminer

Tuta absoluta

S America, Central America,
Africa, Asia



Photo: Marja van der Straten, NVWA Plant Protection Service, Bugwood.org

- Adults small and slim, 10 mm long, with silvery grey scales.
- Body is only just wider at the rear than at the head end.
- Feelers (antennae) are stripey.

Cotton bollworm

Helicoverpa armigera

Africa, Oceania, Asia



Photo: T. Morris, Flickr

- Adult wing-span 35-40 mm; body broad across the thorax and then tapering (14-18 mm long).
- Forewings have a line of 7 or 8 blackish spots on the edge and a broad irregular brown band. Rear wings are pale with a dark, shape in the middle.

Beet Army worm

Spodoptera exigua

Africa, Asia, Oceania,
Central America, Caribbean



Photo: Paul Harris, Bugwood.org

- Adult wing-span 25-30 mm; forewings are mottled grey and brown with an irregular banding pattern and light coloured bean shaped spot.
- Rear wings are uniform grey or white with a dark line at the edges.

Potato aphid

Macrosiphum euphorbiae

Worldwide



Photo: Joseph Berger, Bugwood.org

- Pear shaped insect, green or pink with red eyes; about 4 mm long; unusually long legs.
- Feelers (antennae) usually darker at the tip.
- Tail pipes same colour as body but may have black tips.
- Secretes honeydew.

Tobacco whitefly

Bemisia tabaci

Worldwide



Photo: Central Science Laboratory, UK Bugwood.org

- Adults tiny and yellow with white wings.
- Larvae yellow-white scales, 0.3-0.6 mm long.
- Cause mottling, yellowing and curling of leaves.
- Usually found on the underside of leaves.
- Secrete honeydew.

Thrips

Thrips tabaci, *Frankliniella occidentalis* & others

Worldwide



Photo: Whitney Cranshaw, Colorado State University, Bugwood.org

- Very small, slim insects with feathery wings; adults black young (nymphs) yellow.
- Silvering of leaf surface and distortion is common.

Striped mealybug

Ferrisia virgata

Worldwide



Photo: Georg Goergen/IITA Insect Museum, Cotonou, Benin

- Small, segmented, slow moving dusty white insects seen on leaves, young shoots and berries. Live in colonies usually on young tissue.
- Two dark stripes on its back, long glassy wax threads, an obvious tail and produces a waxy powder.
- Slimmer body shape than other similar mealybugs.
- Often associated with sooty mould.

Citrus mealybug

Planococcus citri

Worldwide



Photo: Charles Olsen, USDA APHIS PPQ, Bugwood.org

- Adults covered in a white wax with an obviously segmented body.
- Young (nymphs) are small, flat and yellow.
- Often live in clusters in sheltered areas.
- Often associated with sooty mould.

Green stink bug

Nezara viridula

Worldwide



Photos: Wikimedia.org

- Shield-shaped insect 15x8 mm, can vary in colour from black to green as they develop.
- Lays cream to yellow (tightly glued together) eggs on the underside of leaves.

Flea beetle

Epitrix spp.

Caribbean,
Central and S America



Photo: Mark Marathon, Wikicommons

- Small (1.5-3 mm long) black beetles; when disturbed will readily jump away like fleas.

Tomato Yellow Leaf Curl Virus

TYLCV

Worldwide



Photo: Don Ferrin, Louisiana State University Agricultural Center, Bugwood.org

- Leaves tend to be clustered and curled upwards.
- Internodes are shortened and the plant may take on a bushy appearance; often referred to as broccoli-like.
- Flowers fall off and small fruits develop.
- Severe stunting if plants are infected early.
- Whitefly transmitted.

Tobacco Leaf Curl Virus

TLCV

Worldwide



Photo: Howard F. Schwartz, Colorado State University, Bugwood.org

- Leaves curled, yellow, puckered may have dark green thickened areas along the veins.
- Shoots twisted, yellow, stunted.
- Whitefly transmitted.

Tomato Mosaic Virus

ToMV

Worldwide



Photo: Gerald Holmes, California Polytechnic State University at San Luis Obispo, Bugwood.org

- Typically yellow blotches on leaves often looking more like a mottle than a mosaic.
- Seed-borne and mechanically transmitted.

Tomato Mosaic Virus

ToMV

Worldwide



Photo: Gerald Holmes, California Polytechnic State University at San Luis Obispo, Bugwood.org

- Typically yellow blotches on leaves often looking more like a mottle than a mosaic.
- Seed-borne and mechanically transmitted.

Tomato spotted wilt virus

TSWV

Worldwide



Photo: Scot Nelson, Flickr

- Necrotic patches on leaves which may develop ringspots.
- Stronger diagnostic symptoms on the fruits.
- Transmitted by thrips.

Iron deficiency

Iron deficiency

Worldwide



Photo: Gerald Holmes, California Polytechnic State University at San Luis Obispo, Bugwood.org

- New growth is affected first, the young leaves are yellow with green veins.
- Unless the condition is corrected the yellowing will spread down the plant and the leaf veins will begin to lose their colour too.

Magnesium deficiency

Magnesium deficiency

Worldwide



Photo: Scot Nelson, Flickr

- Older leaves are affected first, yellow blotchy pattern on the lower leaves between the leaf veins which can turn brown if severe.
- Blossom end rot can be caused by a severe lack of Magnesium but much more usually caused by a shortage of Calcium.

Spider mite damage

Tetranychus spp.

Worldwide



Photo: Scot Nelson, Flickr

- Light stippling of the leaves (initial symptom).
- Mites may be found (handlens required) on the underside of the leaves, often near the midrib.
- Cast-off skins of the mites can also often be seen.

Powdery mildew

Leveillula taurica and others

Worldwide



Photo: Scot Nelson, Flickr

- White powder coating on the upper leaf surface.
- Yellow patches and browning, especially on the lower leaves; early leaf fall can also occur.
- Has a characteristic “mushroom” smell if severe.

Herbicide damage (Glyphosate)

Worldwide



Photo: P. Taylor, CABI

- Extremely low levels of glyphosate will produce white/yellow discolouration at base of youngest leaves; leaves may also be small and curled.
- Higher doses will lead to plant death.
- Fruit often smaller than normal and irregularly shaped.

Iron deficiency

Iron deficiency

Worldwide



Photo: Gerald Holmes, California Polytechnic State University at San Luis Obispo, Bugwood.org

- Starts as interveinal yellowing, becomes overall yellowing; possible brown spots in bleached areas.
- Often the base of the leaves show the most severe symptoms.

Tomato leafminer damage

Tuta absoluta

S America, Central
America, Africa, Asia



Photo: vt_oia, Flickr

- Slender, white, winding trails which may become white blotches with heavy infestations.
- Leaves may fall early.
- Larvae and frass (excrement) often seen inside mines.

Verticillium wilt

Verticillium spp.

Worldwide



Photo: Gerald Holmes, California Polytechnic State University at San Luis Obispo, Bugwood.org

- Yellow blotches on the lower leaves often the first symptom (wilt may only develop in latter stages).
- Typical V-shaped lesions at the leaf tips often develop (these lesions could be confused with *Alternaria* although do not have the target appearance which is a common feature of *Alternaria* infection).

Fusarium wilt

Fusarium spp.

Worldwide



Photo: Gerald Holmes, California Polytechnic State University at San Luis Obispo, Bugwood.org

- Leaf symptoms generally extend from the tip of the leaf.
- Very similar symptoms to Verticillium wilt, however is more likely to kill the plant; is also more likely to cause a wilt than Verticillium.

Flea beetle damage

Epitrix spp.

Caribbean,
Central and S America



Photos: Whitney Cranshaw, Colorado State University, Bugwood.org

- Many chewed holes on leaves, often giving a shot-hole appearance.
- Only really a problem on seedlings, which can be killed in a severe attack.

Leaf mould

Passalora fulva

Worldwide



Photo: P. Taylor, CABI

- Lower leaves attacked first; yellow blotches/spots on upper leaf surface.
- Tan/greyish growth on underside of leaves; later turn brown and shrivel.
- Plants lack vigour; yields poor.

Tomato Spotted Wilt Virus

TSWV

Worldwide



Photo: Paul Bachi, University of Kentucky Research and Education Center, Bugwood.org

- Bronzing of leaves.
- Stronger diagnostic symptoms on the fruits.
- Transmitted by thrips.

Bacterial canker

Clavibacter michiganensis subsp. *michiganensis*

Worldwide



Photo: Mary Ann Hansen, Virginia Polytechnic Institute and State University, Bugwood.org

- Distinctive black leaf edge spots.
- No spots occur in the middle of the leaf.
- Pronounced yellow halo is often present.
- General stunting of the plant.

Early blight

Alternaria solani

Worldwide



Photo: P. Taylor CABI

- Target appearance seen in the leaf spots.
- Considerable yellowing on the older leaves associated with the leaf spots.

Early blight

Alternaria solani

Worldwide



Photo: Clemson University, Bugwood.org

- Small black spots which grow.
- Spots do not grow across the whole leaf but are limited in size.
- Target appearance (rings) will develop in the older spots.

Septoria leaf spot

Septoria lycopersici

Worldwide



Photos: Margaret McGrath, Cornell University, Bugwood.org

- Brown, round/oval lesions which may join up and become large brown areas; leaves snap easily and are deformed.
- With hand lens black dots (pycnidia) seen in some of the spots (insert).

Grey leaf spot

Stemphylium spp.

Worldwide



Photo: Clemson University – USDA Cooperative Extension Slide Series, Bugwood.org

- Small specks initially, enlarging to circular, dark grey lesions with yellow borders; leaves may fall early.
- No fruiting bodies are seen in spots unlike *Septoria*.
- No symptoms seen on fruit.

Bacterial pustule (or Bacterial spot)

Xanthomonas campestris pv *vesicatoria*

Worldwide



Photo: Clemson University – USDA Cooperative Extension Slide Series, Bugwood.org

- Small, dark lesions on leaves, sometimes with yellow border; leaf yellowing, browning, early drop.
- Almost the same as bacterial speck on the leaves but is different fruits.

Potato aphid damage

Macrosiphum euphorbiae

Worldwide



Photo: Scot Nelson, Flickr

- Brown spots on leaves.
- Leaves may often curl down and, together with stems, may distort.
- Fruit distortion may occur.

Bacterial speck

Pseudomonas syringae pv *tomato*

Worldwide



Photo: Edward Sikora, Auburn University, Bugwood.org

- Small, brown, dry spots; very similar to Bacterial spot but more likely to deform leaves.
- Distinguish between Bacterial speck and Bacterial spot by the fruit symptoms.

Grey leaf spot

Stemphylium spp.

Worldwide



Photo: Bruce Watt, University of Maine, Bugwood.org

- Spots seen on both surfaces of the leaf; rarely joining together.
- Leaf spots can cause a shot-hole effect.

Late Blight

Phytophthora infestans

Worldwide



Photo: P. Taylor, CABI

- Stems become blackened.
- Even after a lot of damage to the stem which involves the stem collapsing and shrinking the plant does not wilt.
- Extensive foliar browning, especially on the lower leaves.

Spider mite damage

Tetranychus spp.

Worldwide



Photo: MK Campbell, Flickr

- Chlorosis of the leaves and defoliation.
- Plants may have a yellowish/brown (bronzed) appearance.

Bacterial pustule or spot

Xanthomonas campestris pv *vesicatoria*

Worldwide



Photo: Howard F. Schwartz, Colorado State University, Bugwood.org

- Leaves can become scorched, yellowed and brown.
- Leaves may fall early.

Grey leaf spot

Stemphylium spp.

Worldwide



Photo: Clemson University – USDA Cooperative Extension Slide Series, Bugwood.org

- Leaves snap easily and turn brown.
- Leaves will often fall early.

Late blight

Phytophthora infestans

Worldwide



Photo: P. Taylor, CABI

- White zone of sporulation on the underside of the leaf.
- The rapidly spreading centre will become dark and die, the outer regions develop a pale colour before dying.
- Extremely aggressive pathogen that will spread quickly.

Grey mould

Botrytis cinerea

Worldwide



Photo: Scot Nelson, Flickr

- Rapid browning of the leaves often if the plants are weakened or in times of high humidity.
- Grey fluffy fungal growth may develop on the leaf surface.
- Unlike the late blight there is no white border around the leaf spot.

Fluffy white wax from mealybugs

Phytophthora infestans

Worldwide



Photo: Jeffrey W. Lotz, Florida Department of Agriculture and Consumer Services, Bugwood.org

- Infestations usually accompanied by white fluffy wax in the sheltered places on the plant.
- Can be confused with fungal material on the leaf surface.

Powdery mildew

Leveillula taurica and others

Worldwide



Photo: Scot Nelson, Flickr

- Yellow patches and browning, especially on the lower leaves; early leaf fall can also occur.
- Characteristic white powdery growth on upper leaf surfaces.
- Has a characteristic “mushroom” smell if severe, gently rub the leaves then smell your fingers.

Sooty mould

Various fungi

Worldwide



Photo: Dr. Wayne Nishijima, University of Hawaii at Mānoa

- Black/brown velvety coating on leaves; grows on honeydew produced by any one of many sap sucking insects.
- The sooty mould can be easily removed with a wet finger revealing a healthy leaf beneath.
- In dry conditions it may peel away from the leaf and crack off.

Spider mites

Tetranychus spp.

Worldwide



Photos: Alton N. Sparks, Jr., University of Georgia, Bugwood.org

- Fine silk webbing seen covering leaves, shoots and fruits.
- Leaves develop a speckled yellow aspect on the upper side.
- When severe leaves will fall early.

Tomato Mosaic Virus

ToMV

Worldwide



Photo: Mary Ann Hansen, Virginia Polytechnic Institute and State University, Bugwood.org

- Reduction in the leaf lamina can be severe leading to a symptom which look as though the leaf has been eaten.
- This symptom is not usual but will only occur in some varieties, usually at low temperature (below 20 °C) and low light conditions.

Herbicide damage

“hormonal type herbicides”

MCPA MCPB 2,4,D Mecoprop

Worldwide



Photo: Rebekah D. Wallace, University of Georgia, Bugwood.org

- Mecoprop, MCPA, MCPB and 2,4D are all examples of these herbicides.
- Twisted and curled leaves and stems.
- Leaves thickened and curled, may also be discoloured/mottled.
- Lower stems may develop small, light coloured bumps.

Tomato leafminer damage

Tuta absoluta

S America, Central
America, Africa, Asia



Photo: E Çota, Agricultural University of Tirana

- Entry holes on the fruit, with cavities made inside.
- Leaves will often fall early.

Cotton bollworm damage

Helicoverpa armigera

Africa,
Oceania, Asia



Photo: www.export.biocontrol.ch

- Larvae make round holes on fruits; frass (excrement) often visible.
- Young fruits are invaded and fall; larger larvae may bore into older fruits.
- Secondary infections by other organisms lead to rotting.
- Larvae will also attack the foliage, creating chewed areas.

American cotton bollworm damage

Helicoverpa zea

Caribbean, Central and S America



Photo: T Kuhar, Virginia Polytechnic Institute and State University

- Older larvae make deep watery cavities in fruit, where they are often found, along with frass.
- Young larvae chew tiny holes in the blossom end of fruits, they may also attack leaves and flowers.

Green stink bug damage

Chinavia hilaris

Worldwide



Photo: Wikimedia.org

- Feeding damage. Dark spots on fruit, surrounded by light ring; fruit turns yellow; can also introduce pathogens that rot fruit.

Green stink bug damage

Chinavia hilaris

Worldwide



Photo: Wikimedia.org

- Cracks below the feeding damage turn corky and the surface of the fruit can become brown and rough.
- Pathogens introduced by the damage may add to the symptoms.

Bacterial canker

Clavibacter michiganensis subsp *michiganensis* Worldwide



Photo: Scot Nelson, Flickr

- Small spots with light brown centres generally with a greasy white border 3-6 mm diameter.
- The rings will reduce as the fruit ripens (in other bacterial diseases they often remain).

Bacterial speck

Pseudomonas syringae pv *tomato*

S America, Asia,
Africa, Oceania

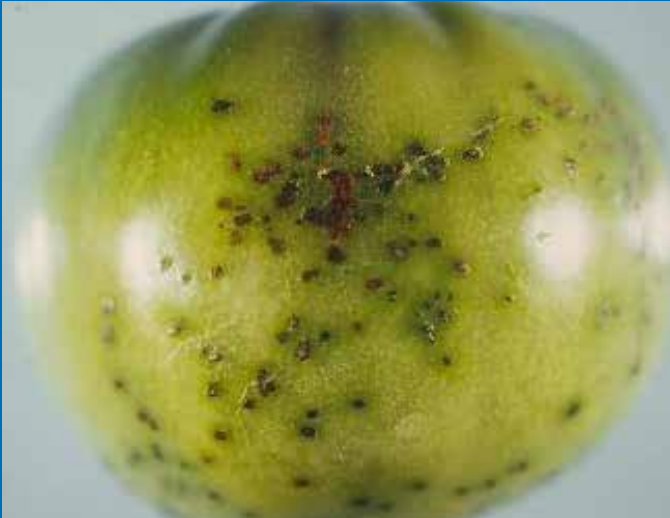


Photo: Scot Nelson, Flickr

- Small scabs on the surface of the fruit.
- Unlike the small spoil marks (blemishes) caused by Bacterial spot these scabs can be easily removed with a finger nail and flicked off.
- Ripe fruit are not susceptible but the earlier scabs remain.

Bacterial pustule or spot

Xanthomonas campestris pv *vesicatoria*

Worldwide



Photo: Clemson University – USDA Cooperative Extension Slide Series, Bugwood.org

- Small water soaked spots develop, becoming slightly raised, 3-6 mm in diameter, centre is brown with a slightly sunken rough scabby surface.
- Ripe fruit are not susceptible but the earlier scabs remain.
- Early blossom drop is common.

Blossom-end rot

Nutrient disorder

Worldwide



Photo: M.E. Bartolo, Bugwood.org

- Brown to black circular necrotic patches form at the base of developing fruit, over time they become sunken.
- Caused by a calcium deficiency and irregular watering.
- Never appears elsewhere on the plant.

Sunscald

Physiological disorder

Worldwide



Photo: Howard F. Schwartz, Colorado State University, Bugwood.org

- Scorched area on the ripe fruit; the skin appears papery.
- Very clear line between scorched and healthy tissue.
- Does not spread and occurs suddenly.
- Loss of leaves due to pathogens or pests can lead to sunscald as the shading effects of the leaves is lost.

Rhizopus

Rhizopus stolonifer

Asia, Africa,
S America, Oceania



Photo: P. Taylor, CABI

- Grey growth often seen on the outside of the fruit.
- Often a post-harvest problem on stored fruit.
- Fruit will soften and rot.

Grey mould

Botrytis cinerea

Worldwide



Photo: P. Taylor, CABI

- Soft sunken areas develop which then produce grey fluffy growth especially in time of high humidity.
- Storage disease often on over-ripe fruit.

Early blight

Alternaria solani

Worldwide



Photo: P. Taylor, CABI

- Sunken black regions on the fruit most often seen in storage.
- Small amounts of white fluffy growth may appear on the surface.

Late Blight

Phytophthora infestans

Worldwide



Photo: P. Taylor, CABI

- Hard rot on the fruits; they do not shrink or soften.
- There may also be target type rings on the fruit.
- White fluffy material sometimes seen on the surface of the fruit, especially in storage or in wet weather.

Cat face

Physiological disorder

Worldwide



Photo: Gerald Holmes, California Polytechnic State University at San Luis Obispo, Bugwood.org

- Swollen areas of the fruits with streaks and bands of scaly tissue, dark greenish to tan coloured, between swellings.
- Often found on the first fruit produced.
- More common on the larger varieties of tomato.

Tomato Mosaic Virus

ToMV

Worldwide



Photo: www.disnil.huntinorganics.com

- Fruit are often symptomless but may be reduced in size and number.
- “Brown wall” may develop in some varieties often on the first truss of fruit before they are ripe.
- Seed-borne and mechanically transmitted.

Tomato Spotted Wilt Virus

TSWV

Worldwide



Photo: David Riley, University of Georgia, Bugwood.org

- Discoloured fruits with irregular yellow blotches or rings.
- Transmitted by thrips.

Late Blight

Phytophthora infestans

Worldwide



Photo: P. Taylor, CABI

- Extensive browning on stems, leaves and fruit; the border between healthy and diseased tissue is distinct.
- Stem necrosis spreads rapidly.

Late Blight

Phytophthora infestans

Worldwide



Photo: P. Taylor, CABI

- Stems become blackened.
- Even after extensive damage to the stem which involves the stem collapsing and shrinking the plant does not wilt.
- Extensive necrosis especially on the lower leaves.

Tomato Spotted Wilt Virus

TSWV

Worldwide



Photo: Gerald Holmes, California Polytechnic State University at San Luis Obispo, Bugwood.org

- Dark brown streaks appear on stem and leaf stalks.
- Growing tips become bronze with many dark spots; systemic browning and severely stunted growth.
- Wilt of the tip of the plant may occur and the plant may exhibit one sided growth.
- The symptoms are much more diagnostic on fruit.

Bacterial wilt

Ralstonia solanacearum

Worldwide



Photo: Jackie Mullen, Auburn University, Bugwood.org

- Discolouration of the internal regions of the stem. However this does not develop until well after wilting.
- It is often the pith and the cortex (the middle bit) that turns brown, rather than the vascular strands (in contrast to fungal wilt pathogens).

Bacterial wilt

Ralstonia solanacearum

Worldwide



Photo: Jason Brock, University of Georgia, Bugwood.org

- Cut the stem with a sharp knife and hang the cut end in a container of still water. Place a black background behind it and after a few minutes look carefully for wisps of white ooze draining from the cut end of the stem.

Early blight

Alternaria solani

Worldwide



Photo: Clemson University – USDA Cooperative Extension Slide Series, Bugwood.org

- Black or brown stem lesions, initially 1-2 mm long, sometimes with a yellow edge.
- Stem lesions are often sunken and lens shaped with a light centre and will develop the typical concentric rings.
- With time they may completely girdle the stem.

Early blight

Alternaria solani

Worldwide



Photo: Paul Bachi, University of Kentucky Research and Education Center, Bugwood.org

- Black or brown stem lesions, initially 1-2mm long, sometimes with a yellow halo.
- Stem lesions are often sunken and lens shaped with a light centre and will develop the typical concentric rings.
- With time they may completely grow round the stem.

Verticillium wilt

Verticillium spp.

Worldwide



Photo: www.missouribotanicalgarden.org

- Cut stems show a light brown colour near (up to 30-35 cm) ground level.
- The streaking of Verticillium has a lighter colour and does not extend as far up the stem as Fusarium.
- Internal tissue does not break down.

Fusarium wilt

Fusarium spp.

Worldwide



Photo: Nelson, Flickr

- Wilted plants have dark brown streaks running through the stem, when split.
- Discolouration may be seen relatively high up the stem and is especially obvious where the leaves join the stem.
- Internal stem material does not break down.

Bacterial canker

Clavibacter michiganensis subsp. *michiganensis*

Worldwide



Photo: Gerald Holmes, California Polytechnic State University at San Luis Obispo, Bugwood.org

- Main stem is dark and water-soaked inside.
- Possible stem collapse.
- General stunting of plants.

Tomato Spotted Wilt Virus

TSWV

Worldwide



Photo: Gerald Holmes, California Polytechnic State University at San Luis Obispo, Bugwood.org

- Tip die-back.
- General stunting of plants.
- The symptoms are much more obvious on the fruit.
- Transmitted by thrips.

Verticillium wilt

Verticillium spp.

Worldwide



- Lower leaves become pale; their tips and edges die and the leaves may then drop off.
- Very similar leaf symptoms to Fusarium wilt.
- Plants may survive but will not produce many fruits.

Bacterial wilt

Ralstonia solanacearum

Worldwide



Photo: P. Taylor, CABI

- Sudden and rapid wilting of leaves, although to begin with the leaves will often remain green.
- Plant death is rapid.

Root knot nematode

Meloidogyne spp.

Worldwide



Photo: R Gardner, North Carolina State University

- General stunting, yellowing and wilting of plants.
- Damage often in a patchy field distribution.

Tomato Mosaic Virus

ToMV

Worldwide



Photo: George Kelley, University of Kentucky, Bugwood.org

- General stunting of the plant can occur, although it will not usually kill the plant.
- Seed-borne and mechanically transmitted.

Tomato Spotted Wilt Virus

TSWV

Worldwide



Photo: Don Ferrin, Louisiana State University Agricultural Center, Bugwood.org

- General stunting of the plant.
- Despite the name wilting is not an especially common symptom of TSWV.
- Symptoms on fruits much more obvious.

Root knot nematode

Meloidogyne spp.

Worldwide



Photo: Gerald Holmes, California Polytechnic State University at San Luis Obispo, Bugwood.org

- Galls on roots, often appear as small balls.
- Damage often in a patchy field distribution.

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