

MAJOR INSECT PESTS AND DISEASES OF TOMATO IN EAST AFRICA AND THEIR MANAGEMENT

INSECT AND MITE PESTS

Leafminers



Leafmining flies on leaflets, note feeding and egg-laying punctures (1), mining caused by feeding maggots (1 and 2) and maggot ready to pupate (yellow) and pupa (brown) (2)

Whiteflies



Whiteflies on leaflet (1). Close-up of whitefly immature stages (2) and an adult (3). Whiteflies cause damage by sucking plant sap and by transmitting virus diseases such as the Tomato Yellow Leaf Curl Virus.

Tomato Bugs



Immature stages of the tomato bug (1). Close-up of an adult bug (2). They cause damage by sucking plant sap. Feeding causes brownish rings on stems, petioles, growing points and leaves. Attacked leaves become brittle and crinkled.

Thrips



Severe damage by thrips on a leaflet (1). Close-up of an adult (2). Damage to flowers (3). Thrips (4) and thrips damage on a fruit (5). Some thrips are vectors of virus diseases such as the Tomato Spotted Wilt Virus.

Fruitworms



Caterpillar of the African bollworm feeding on a fruit (1). Moth of the African bollworm (2). Green fruit damaged by fruitworms (3). Caterpillar of the cotton leafworm feeding on a fruit (4). Cotton leafworm moth (5). Ripe fruit damaged by fruitworms (6).

Spider Mites



A colony of red spider mites on a leaflet (1). Close-up of spider mites (2). Plant severely infested by tobacco spider mites (3); note extensive webbing produced by mites. Severely damaged plants (4). Damaged fruits (5).

Pest and Disease Management

Nursery stage

- Select nursery site far away from tomato fields to avoid spread of pests and diseases into the nursery.
- Prepare the seedbed properly. Use forest topsoil and/or compost. Burn plant trash on the surface of seedbed for at least one hour and after cooling, mix soil with compost or livestock manure at a rate of 20 litre-container per square metre. In semi-arid areas, solarise seedbeds.
- Use certified disease-free seed of suitable varieties. Use varieties tolerant or resistant to pests and diseases. For example: Fortune Maker (resistant to fusarium and bacterial wilt); Rio Grande (resistant to early and late blight, and fusarium wilt); Kentom (resistant to bacterial wilt, root-knot nematodes and Tomato Mosaic Virus); Tengeru 97 (resistant to late blight, fusarium wilt, Tomato Mosaic Virus, Tomato Yellow Leaf Curl Virus and root-knot nematodes); Meru (resistant to late blight, Tomato Mosaic Virus and root-knot nematodes); Shengena (resistant to late blight and Tomato Mosaic Virus); Taiwan F1 (resistant to bacterial wilt); Roma VFN (resistant to fusarium and verticillium wilt, root-knot nematodes and red spider mites); and Roma VF (resistant to fusarium and verticillium wilt).
- Treat own seed with an appropriate fungicide and insecticide to protect it against pests and diseases.
- Avoid sowing seeds densely; space at 5 x 5 cm; if necessary thin seedlings at first true-leaf stage and transplant in another bed.
- Keep the seedbed free of weeds.
- Irrigate the seedbed regularly but avoid over watering as it can induce damping-off diseases. Do not water late in the afternoon because extended wetness of leaf surfaces promotes foliar diseases. Reduce watering from third week to harden seedlings.
- Cover seedlings with insect-proof netting in areas where virus diseases are endemic. This will restrict infestation by insect vectors of viral diseases. Alternatively, spray or drench with appropriate insecticides.
- Inspect the nursery regularly for pests, diseases, weeds, nutritional disorders, soil moisture and general plant health. Remove weak and unhealthy looking seedlings.

Transplanting stage

- Avoid transplanting seedlings near an old tomato crop. Ensure that a new field is sited uphill, particularly where surface irrigation is used to avoid spread of soil-borne diseases.
- Use proper plant spacing as prescribed by seed companies.
- Plant border rows of coriander, fenugreek, maize, marigold, millet, pigeon pea or sorghum. They act as windbreaks; fenugreek and coriander are repellent to whiteflies, and provide refuge for natural enemies.
- Apply organic manure, mixing it well with the soil before transplanting.
- Transplant seedlings late in the afternoon. This is important in dry areas to avoid transplanting stress.

Field stage

- Keep tomato field weed-free. Weeds may be alternative hosts of diseases and pests.
- Ensure proper fertilisation.
- Choose proper irrigation. Furrow and drip minimise foliar diseases (e.g. early and late blight); over-head irrigation reduces mites, thrips, aphids and powdery mildew. Avoid furrow irrigation where soil-borne diseases (e.g. bacterial wilt; fusarium wilt; root-knot nematodes) are a problem. If using furrow irrigation ensure that water flows from new to old fields to minimise spread of soil-borne diseases.
- Stake and prune indeterminate varieties, mulch determinate varieties to reduce early and late blight and bacterial diseases. In areas prone to bacterial diseases disinfect pruning knives with a commercial detergent (e.g. Tepool) before working on a new plant.
- Do not work in tomato fields when plants are wet to avoid spread of diseases.
- Inspect fields regularly for pests, diseases, weeds, nutritional disorders, soil moisture and general plant health. Remove unhealthy looking plants from the fields.
- Ensure correct identification of problems.
- Use pesticides on need basis only. Avoid use of broad-spectrum pesticides as they would kill natural enemies. Do not use highly toxic pesticides (WHO Class 1 and 2).

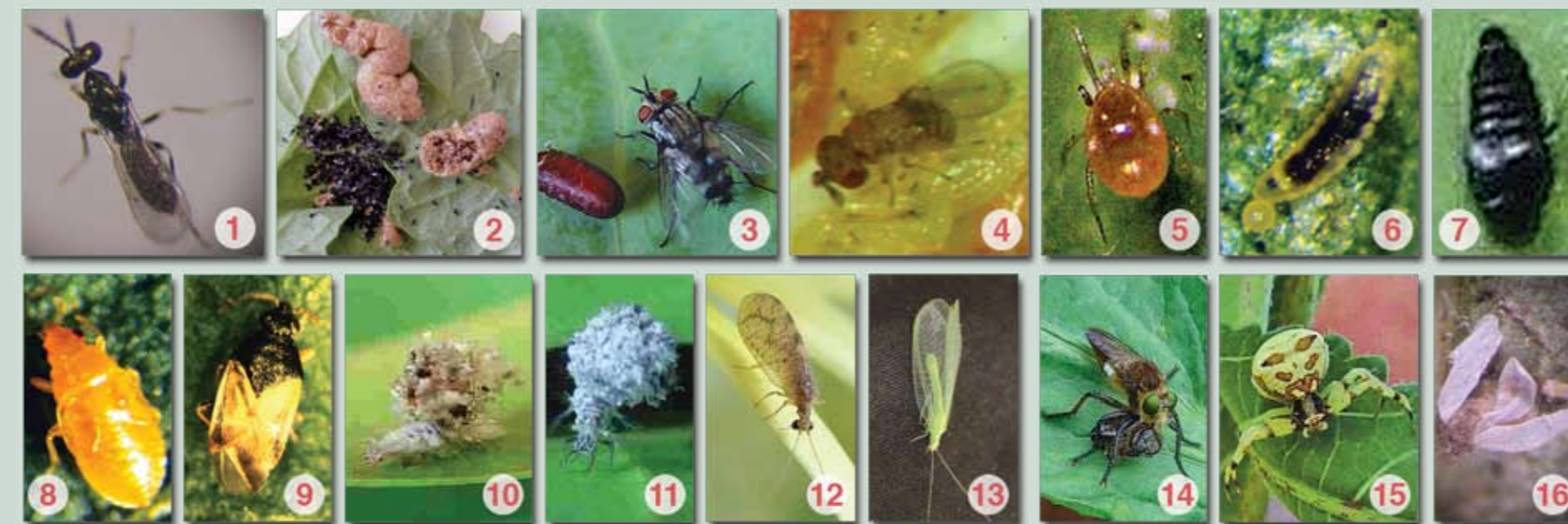
Fruiting period, harvest and after harvest

- Strictly follow pre-harvest intervals when applying pesticides after fruit set.
- Avoid damaging fruit when harvesting to minimise post-harvest diseases and to cater for market demand of blemish-free produce.
- Place harvested crop in a cool shaded area to minimise dehydration of the produce.
- Remove crop debris from fields after harvest to minimise carry-over of pests and diseases.
- Avoid overlapping of crops to minimise spread of pests and diseases from old to new crop.
- Practice crop rotation with crops unrelated to tomato to minimise soil-borne problems and also maintain soil fertility (e.g. brassicas, cereals, legumes, onions and fodder grasses).

When necessary, use only pesticides locally registered for tomatoes or vegetables. Strictly follow label instructions, particularly pre-harvest intervals and safety requirements.

For detailed information on pests and diseases refer to "A Guide to IPM in Tomato Production in Eastern and Southern Africa", ISBN: 92 9064 149 5, available at icipe.

Natural enemies



Parasitic wasp *Diglyphus isaea*, a natural enemy of leafminers (1). Many parasitic wasps emerged from a caterpillar (2). Tachinid fly, a parasitoid of caterpillars (3). *Trichogramma* wasp, a parasitoid of moth eggs (4). *Phytoseiulus longipes*, a mite predator of tobacco spider mites (5). Immature stage (6) and adult (7) of rove beetles, predators of red spider mites. Immature stage (8) and adult (9) of minute pirate bugs, predators of mites and thrips. Larvae of lacewings (10-11), adults of brown lacewing (12) and green lacewing (13); lacewings feed on aphids, moth eggs, small caterpillars and mites. A robber fly (14) and a spider (15), general predators of many types of insects. Whitefly killed by a fungal disease (16).

Conserve natural enemies

- **Avoid or reduce use of pesticides**, in particular broad-spectrum pesticides that kill a wide range of pests and also natural enemies. When pesticide use is necessary, choose selective pesticides (e.g. Bt products) or pesticides which are not harmful to natural enemies (e.g. neem-based products).
- **Keep flowering plants** for nectar and pollen, as sources of food for adults of some natural enemies.
- **Maintain a mixed cropping system.** A diversity of crops provides refuge and food for a wide range of natural enemies.
- **Mulch**, it provides an attractive environment for ground living natural enemies.

DISEASES

Bacterial Canker, Speck and Spot



Bacterial canker (1); note "birds-eye" symptoms on fruit. Bacterial speck (2); the specks are superficial, small, black and raised. Bacterial spots (3); older spots are larger than canker and specks; they are blackish and slightly raised later become scabby.

Bacterial Wilt



Plant wilting without necrosis of the foliage (1). Water test for detection of bacterial wilt (2); note bacterial strands oozing from infected tissue.

Fusarium Wilt



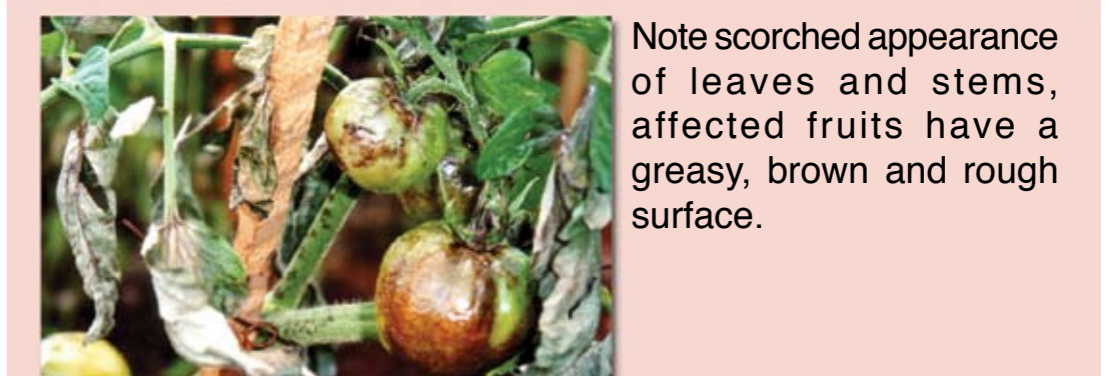
One-sided wilting of tomato plant caused by infection with Fusarium (1). Browning of water conducting tissues (2 and 3).

Early Blight



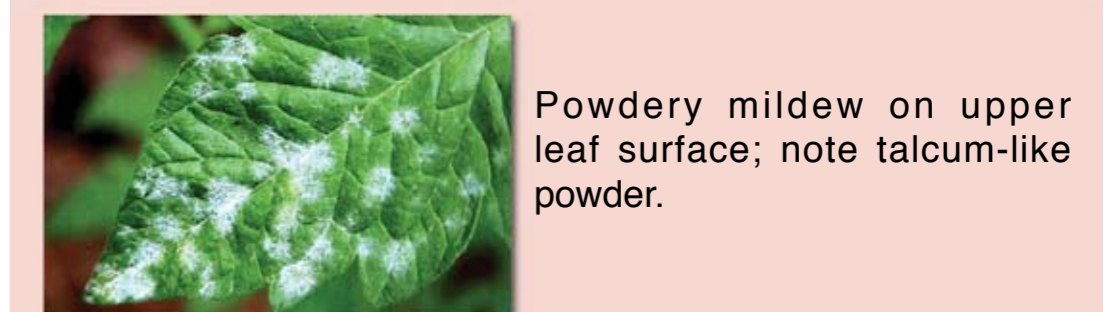
Early blight on a tomato leaflet (1) and on a fruit (2); note concentric rings in the spots

Late Blight



Note scorched appearance of leaves and stems, affected fruits have a greasy, brown and rough surface.

Powdery Mildew



Powdery mildew on upper leaf surface; note talcum-like powder.

Root-knot Nematodes



Affected plants become stunted and yellow and have a tendency to wilt in hot weather. The roots are severely distorted, swollen and bear knots or galls.

Viral Diseases



Tomato Yellow Leaf Curl Virus (1); note thickening of the shoots and reduced size of leaflets. Tomato Spotted Wilt Virus (2); note round spots on fruit. Tomato Mosaic Virus (3); note internal browning of the fruit. Cucumber Mosaic Virus (4); note shoe-string symptoms on the leaves.

Blossom-end Rot



Blossom-end rot is caused by calcium deficiency. It starts as a water-soaked spot (1) which enlarges becoming brown (2); the surface of the spot becomes dark, sunken, leathery and dry (3), when wet secondary infection may occur (4).