

PREFACE: Tomato is the most important vegetable, however; its production is under the constant threat of certain diseases. About 200 diseases and disorders are known to infect tomato worldwide inflicting heavy yield losses. To avoid these losses proper disease management is necessary which is only possible with the proper identification of causes involved. This brochure is designed as a quick guide to provide a brief symptomatology, cause and control measures together with photographic illustrations of important diseases and disorders of tomatoes in Pakistan. This knowledge is important for students, scientist, farmers, extension agents etc.

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FUNGAL DISEASES

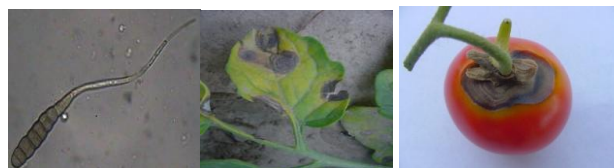
EARLY BLIGHT (EB)

CAUSE: *Alternaria solani*

SYMPTOMS: In nursery EB can cause pre and post-emergence damping off. After transplanting it can cause foot and collar rot on young plants. Collar rot is characterized by dark brown, slightly sunken & irregular lesions at the base of stem. Affected seedlings may be stunted, wilt and die, or become unproductive when set in field. The most characteristic symptoms on leaves are expressed as brown circular to angular spots with concentric rings or ridges. Affected leaves develop yellow areas around the lesions, soon turn yellow, wither and drop off. Severely affected plant can be completely defoliated late in season. On stems and branches dark sunken spots with grayish white centers may also develop. On fruit around the stem end and shoulder, it can produce dark brown to black, leathery, depressed lesion with concentric rings. This situation is called as stem end rot (SER).

A. Solani survives on infected debris in soil and on seed. Frequent showers, heavy dews, 20-29°C temperature and over crowding of plants favor disease.

CONTROL: Use resistant varieties. Seed dressing with proper fungicides. Use of preventive and protective sprays with proper fungicides during favorable conditions.



A. solani EB on leaves EB on fruit

LATE BLIGHT OF TOMATO (LB)

CAUSE: *Phytophthora infestans*

SYMPTOMS: On leaves LB symptoms may start as water soaked & pale green irregular lesions, which enlarge, turn brown, shrivel and dry out. On petioles and stems lesions appear at any point as oily, brown areas later turning into black and the whole plant may die. On fruits the disease appears as dark green to brown, greasy, irregular blotches, and fruits become shriveled at later stages.

P. infestans can survive on infected debris in soil and on seed. LB may be initiated in nursery and adult plants by air-borne sporangia or by oospores harboring the soil and seed. Rainy weather, high relative humidity and heavy dew formation favor the infection.

CONTROL: Same as in case of early blight.



P. infestans LB on leaves LB on fruit

ALTERNARIA LEAF BLIGHT

CAUSE: *Alternaria alternata*

SYMPTOMS: Chlorosis and necrosis of the lower leaves which progress upwards under high humidity conditions. Symptoms often start from the leaf tips and along the margins of the leaf petiole. Under severe infection, lesions coalesced, causing blighting of the leaves. Infection under favorable conditions is found to cause severe defoliation, with considerable yield losses when the disease occurs prior to flowering.

CONTROL: Same as in case of Early blight.

ANTHRACNOSE ON TOMATO FRUIT

CAUSE: *Colletotrichum* spp.

SYMPTOMS: Symptoms start as slightly depressed circular lesions on fruit. These lesions then enlarge & become more sunken with concentric rings.

CONTROL: Same as in case of Early blight.



A. alternata leaf blight Anthracnose on fruits

VIRAL DISEASES

TOMATO SHOESTRING DISEASE

CAUSE: *Cucumber mosaic virus (CMV)*

INSECT VECTOR: Aphid (*Myzus persicae*)

SYMPTOMS: CMV infected plants can show severe mosaic or mottling & leaf deformity, shoe-stringing and stunting. Infected plants produce no or few malformed flowers. CMV infected plants can show no or few unmarketable fruit setting.

Disease mostly appears during March-April (25-30°C) with the onset of aphids.

CONTROL: Use resistant variety. Control of insect vectors with proper insecticides. Eradication of weeds.



CMV infected plant and fruits *M. persicae*

TOMATO LEAF CURL DISEASE (TLCD)

CAUSE: *Tomato leaf curl new-Delhi begomovirus*

INSECT VECTOR: Whitefly (*Bemisia tabaci*)

SYMPTOMS: Plants can be affected at any stage. Early infected plants grow very slowly, become bushy and dwarfed. The leaf margin becomes yellowish and rolls either inward or upward. Leaves become thicker than normal, with leathery texture. The flowers appear normal but dropping of flowers is common. Fruits do not show any symptom from the viral infection.

Disease may be initiated at any time during cropping season with the onset of vector whitefly.

CONTROL: Same as in case of shoe-string disease.

NEMATODE DISEASES

ROOT KNOT NEMATODE

CAUSE: *Meloidogyne incognita*

SYMPTOMS: Above ground symptoms include chlorosis, nutrient deficiencies, stunting, slow growth, dieback, wilting, reduced yield, lack of response to other treatments. Infected roots may show root tip stunting, galls at root tip or along roots.

CONTROL: Use resistant/ tolerant varieties.



ToLCD on leaves *M. incognita* infected roots

PHYSIOLOGICAL DISORDERS

CATFACE

CAUSE: Abnormal development of the pistil of the flower, cold temperature (below 58°F) during flower development and/ or exposure to hormone-type, phenoxy herbicides such as 2,4-D.

SYMPTOMS: Misshapen fruit with scars on the blossom end. Affected fruits are often kidney shaped but can also be distorted into other shapes. Fruit ripens unevenly and market quality is reduced.

CONTROL: Avoid planting large-fruited varieties.



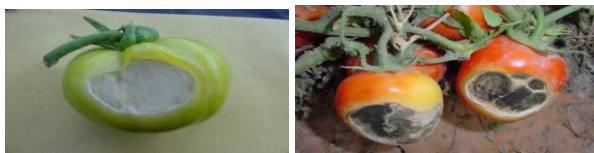
Catfaced tomatoes

SUNSCALD

CAUSE: Fruits mostly subjected to sunscald are those that have been exposed suddenly to the sun because of pruning, natural spreading of the plant caused by a heavy fruit load, or loss of foliage from diseases. The extent of the injury is more serious during periods of abnormally high temperature.

SYMPTOMS: It occurs on green tomato fruit exposed to the sun. Initial symptom is a whitish, shiny area that appears blistered. Infected tissues gradually collapse, forming a slightly sunken, pale yellowish and wrinkled area as the fruit ripens. The killed tissue is quickly invaded by secondary organisms and the fruit decays.

CONTROL: Control foliar diseases and avoid heavy pruning or shoot removal.



Sunscald tomatoes

BLOSSOM END ROT (BER)

CAUSE: BER is a complex disorder. It is thought to be caused by a localized calcium deficiency in the blossom end of the fruit. Excessive growth due to too much nitrogen fertility can also promote BER.

SYMPTOMS: Fruits are most commonly affected when they are about half grown. Symptoms begin as small, tan, water soaked area near the blossom end of the fruit. The spot enlarges, darkens, and becomes sunken and leathery.

Affected fruit often ripens prematurely and is prone to invasion from secondary, fruit-rotting pathogens.

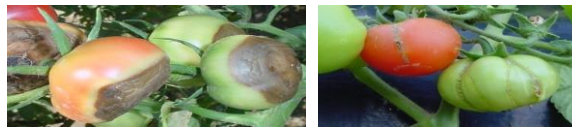
CONTROL: Use of nitrate forms of nitrogen fertilizer, rather than ammonium forms which can interfere with calcium uptake, may reduce BER.

ZIPPERING

CAUSE: Usually an anther that is attached to the newly forming fruit causes the zipper scar.

SYMPTOMS: Zippering is described as a fruit having thin scars that extend partially or fully from the stem scar area to the blossom end.

CONTROL: Use resistant/ tolerant varieties.



Blossom end rot Zippering

PHYSIOLOGICAL LEAF ROLLING (PLR)

CAUSE: Irregular supply of water or severe pruning can cause physiological leaf rolling.

Symptoms: It is a temporary disorder in which the edges of the leaves roll upward or inward, even overlapping when conditions is severe.

CONTROL: Use resistant/ tolerant varieties.

FROST INJURY (FI)

SYMPTOMS: Foliage is the most affected part. Injured plants look blighted. Less or partially infected plants recover soon after rise in temperature. Severely infected plants die.

CONTROL: Use resistant/ tolerant varieties.

CHEMICAL INJURY (CI)

CAUSE: Phytotoxicity from pesticides, fungicides, herbicides can cause injury when applied off of the label or applied in sloppy manner, by using expired chemicals and by using contaminated sprayers.

SYMPTOMS: Chlorosis of leaves, severe distortion, puckering, strapping of veins & leaves.

CONTROL: Follow the proper instructions before use. Don't use expired chemicals. Wash sprayer thoroughly after use.

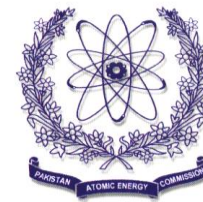


PLR FI Chlorosis and deformation due to CI

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IMPORTANT TOMATO DISEASES AND DISORDERS IN PAKISTAN



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