SECTION A  GENERAL
CHAPTER I

REVIEW OF LITERATURE

The enormous losses of fruit and vegetable crops caused by various microorganisms have attracted the attention of numerous workers all over the world and the flood of activity during the last 50 years has resulted into a voluminous literature in this field. Some of the more important works and reports are being summarized below.

As early as 1916, Dastur reported that microorganisms are involved in causing decay of plantains. Green (1932) studied the storage infection of oranges caused by *Panicillium* sp. Ghatak (1938) also worked on oranges. Woglum and Lewis (1941) reported grape fruit damage from *Septoria* sp. Saha (1945) and Sinha (1946) worked on the storage rots of several fruits. Tyner (1945) worked on several diseases of cucurbits, caused by *Fusarium sambucinum*. Wormald (1945) reported black apple rot caused by *Monilia cinerea*. Diplodia rot of onion was studied by Ramsey et al. (1945). Das Gupta and Bhatt (1946) reported that *Aspergillus nidulans* causes infection in mango in early stages. Sinha (1948) reported a list of microorganisms which attack the mango.
in storage. Agrawal (1949) reported that the storage degradation of potato was due to *Fusarium oxysporum*. Verma (1950) reported that *Pythium aphanidermatum* caused the soft rot of radish. Chaudhary (1950) described a fruit rot of papaya caused by *Ascochyta cericas*. Mango rot caused by *Aspergillus niger* was recorded by Verma and Kamal (1951). Venkatrayan and Dalvi (1951) reported back onion rot caused by *Aspergillus niger*. Ellis (1951, 1953) observed *Rhizoctonia solani* causing a water soaked rot of cucurbits. He also studied the anthracnose in fruits caused by *Colletotrichum lagenarium*. Walker (1952) reviewed extensively the diseases of fruit crops. Bhargava and Gupta (1957 a) while studying the market diseases of fruits and vegetables, reported cottonytaek disease of stored beans. They described a causal organism *Pythium debaryanum*, which was wound pathogen. Rangaswami and Sarojini (1957) studied the action of mycostatin on fungi, pathogenic to banana. *Rhizopus* rot of *Curcuma maxima* was described by Dalala(1957). Bharagava and Gupta (1957 b) reported Rhizopus diseases of plums from Kumaon market. Mathur and Mathur (1958) worked on *Fusarium oxysporum* causing fruit rot of *Citrullus vulgaris*. Turner (1959) described control measures for fruit diseases in storage caused by fungal organisms. De Wolfe et. al. (1959) investigated the decay of lemons
caused by *Alternaria citri*. Malik and Hassan (1959) studied the control of anthracnose disease of mangoes in Bihar. Nema and Agrawal (1960) described the *Cladosporium papaya* as a causal organism on papaya. Friedman (1960) and Fisher and Freeman (1960, 1961) extensively worked on citrus and potato spoilage in transport and in storage. *Macrophoma mangifera* causing blight disease of mango, was reported by Hingorani *et al.* (1960).

Tondon (1961) described control measures for the storage decay of oranges caused by *Panicillium digitatum* and *P. italicum*. Tondon (1962) reported *Botryodiplodia ananas* causing rot of pineapples in storage. *Botryodiplodia* fruit rot of papaya was reported by Sirdhana and Jain (1962). Tondon and Ghosh (1962) made some pathological studies on *Alternaria tenuis* causing rot of pear. Sreeramulu (1962) worked on the *Deightoniella* fruit and leaf spot disease of banana. Mishra and Singh (1962) studied the effect of temperature and humidity on banana anthracnose. *Collatotrichum cocccodes* causing storage rot of tomato, was reported by Lockhart and Harrison (1962). Lopez and Christiansen (1962) studied the storage rot of bean seeds caused by *Aspergillus* sp. *Fusarium sambucinum*, *F. coeruleum* causing storage rots of potatoes were reported by Ayers (1962). Loest and Roth (1963) reported that oranges in storage were
mostly infected with *Panicillium digitatum*. Apple and pear rots were described by Mehrotra (1963). Mehrotra (1964) reported fruit rot of pear caused by *Gibberella persicaria*. Chandra and Tondon (1964, 1965) reported for the first time from India *Sclerotium rolfsii* causing soft rot of onion, and *Mycophoma phaseoli* attacking garlic bulbs in storage. Shrivastava *et al.* (1964) reported that the rot pathogens of mature fruits in the market were often associated with orchard infections. They found that *Diplodia natalensis*, *Phoma psidii* and *Gloeosporium psidii* were the chief pathogens of guava which also caused leaf spots and were often associated with the flowers. They also recorded that leaf pathogens which were associated with storage rots included *Gloeosporium musarum*, *Fusarium oxysporum*, *Botryodiplodia theobromae* and *Deightoniella torulosa*. Rao (1966) has also done some work on fruit storage rot in Bombay. Tondon (1967) emphasized the need to devote much attention in this field. Chand *et al.* (1968) studied the epidemiology and control of bitter rot of apples caused by *Gloeosporium fructigenum*. Agrawal and Sharma (1968) worked on storage disease of apples with special reference to its control. Chenulu and Thakur (1968) gave a list of organisms which cause the disease of fruits and vegetables in Delhi. They also
studied the control of soft rot caused by *Rhizopus* sp. Shrivastava and Tondon (1969) gave an account of the *Botryodiplodia* rot of guava. Tondon and Singh (1969) carried out some work on guava rot. Tondon (1967, 1970); Tondon and Mishra (1969); Tondon and Singh (1969) and Ghosh et al. (1969) studied some post harvest diseases of fruits with special reference to the post infection changes in amino acids, sugars, organic acids and vitamins. Thakur and Chenulu (1970) gave a list of micro-organism which were responsible for decay of apples, banana, mango, tomato and potatoes.
CHAPTER II

THE HOST

*Lycopersicon esculentum*, Mill the common tomato plant belongs to the family Solanaceae of Dicotangiosperm with 75 genera and more than 2000 species (Bailey, 1949). A great family abounding in the tropics but well represented in the temperate regions. The tomato plant can grow from plains to 6000 ft. It is a tall pubescent herb reaching to a height of 3 to 6 ft., bearing pinnate leaves. It is a native of South America. In India tomato is grown in almost all parts of the country.

The tomato fruits are eaten raw or cooked and are also used for preservative. Only the pulp, which retains its characteristic flavours is used. The waste materials consisting of skins, cores, seeds and unripe parts, were formerly discarded but they are now utilized and a fixed oil is expressed, which can be used for food, soap or as drying oil. The oil cake is of great value as a stock feed. Tomato is not only used as
a fresh vegetable, but is also canned alone or combined with other foods. Ripe tomatoes are also used for chilli sauce, ketchup, tomato juice and tomato pastes, while green tomatoes are used for pickles and preserves. Tomato fruit is an excellent source of vitamin C and can also furnish other vitamins.

The chemical composition of tomato varies with variety and stage of maturity. The pulp constitutes 85.4% (av) of the whole fruit and contains 6-7%, total solid. Analysis of the edible portions of green and ripe fruits gave the following values.

**Green fruit**: Moisture, 92.8%; protein 1.9%; fat 0.1; carbohydrates 4.5; and mineral matter 0.7%; calcium 20 mg; phosphorus 40 mg; iron 2.4; carotene (as vitamin A) 320 i.u.; thiamine 69 µg; nicotinic acid, 0.4, mg; riboflavin 60 µg; and ascorbic acid 31 mg./100 g.

**Ripe fruit**: Moisture, 94.5; protein 1.0; fat 0.1; carbohydrates 3.9; and mineral matter, 05%; calcium, 10mg; phosphorus, 20 mg; iron, 0.1 mg; carotene (as vitamin A) 320 i.u.; thiamine, 120 µg; nicotinic acid, 0.4 mg; riboflavin, 60 µg; and ascorbic acid 32 mg, /100 gm.

Tomato contains folic acid, pantothenic acid, biotene, vitamin K, and inhibitols which are related
to vitamin E.

The ascorbic acid content of tomato is only slightly, if not at all, affected by the degree of ripeness after the fruit is mature green. Unripe fruits contain ascorbic acid in a combined form; dehydro ascorbic acid is also present. Fruit exposed to direct sunlight contain a higher concentration of ascorbic acid than those ripening in shade.

Analysis of a number of cultivated and wild types of Indian tomatoes, however, showed the presence of only lycopene, neolycopene, B-carotene, neo B-carotene and Xanthophylls. The chlorophyll content of fresh green tomato is 3 mg/100 g.

The mineral constituents present in fresh ripe tomatoes are sodium, 2.8; potassium 288; calcium, 13.5; magnesium, 11.0; iron 0.43; copper, 0.10; phosphorus, 21.3; sulphur, 10.7; and chlorine, 51.0 mg./100 g.; aluminium, manganese, cobalt, zinc, boron, arsenic and iodine are reported to be present in trace. Fresh Indian tomatoes contain sodium (35 mg./100 g.), potassium 216 mg./100 gm.; copper (0.3 ug./g.) and iodine (6 ug./kg.). (Wealth of India, raw material, vol. VI, 1962).
CHAPTER III

PATHOGENS

*Alternaria solani* (Ellis & Mart.) Jones and Grout

Aerial mycelium dense cottony; conidiophore unbranched, 24 to 96 μ in length and 2 to 6 μ in width. Conidia single, smooth and tapering to long beak. Spore length ranging from 24 to 104 μ and width 10 to 16 μ with 3 -12 transverse septa and 0-9 longitudinal septa. Beak hyaline. Total length of spore varying from 110 to 270 μ. The pathogen has earlier been reported from this place (Sauagar) by Siddiqui (1960) on brinjal, tomato and potato plants.

*Alternaria tenuis* Auct

The general colony character are similar to those of *A. solani*; spores clavate to obelavate, muriform, slightly constricted at the septa, buffy brown to olive brown with 1 to 5 longitudinal and 2 to 6 transverse septa and a short beak. They measure 19.5 to 76.5 μ x 11.0 to 24 μ.
This fungus has also been reported earlier by Siddiqui (1960) from several host plants including *Allium cepa*, *Amaranthus* sp., *Cardamum tinctorium*, *Carum copticum*, *Citrus* sp., *Cosmos bipinnatus*, *Daucus carota*, *Helianthus* sp., *Linum usitatissimum*, and *Ricinus communis*, *Solanum tuberosum*, *Triticum vulgare*.
CHAPTER IV

Tomato fruit rot caused by *Alternaria* sp

The local vegetable fields and market shops were frequently visited for the diseased fruits during the period 1970-72.

Tomato fruit rot caused by *Alternaria solani*

Symptoms:

Lesions produced by *A. solani* which are regular in shape appear as dark necrotic center ¼ to ½ inches in diameter having concentric rings which is a typical symptom. Firstly the spots show a depression as they increase in size. Later on the surface of the spot is usually covered with a mass of black spores. The disease becomes quite severe in the month of December and January. Injured fruits which are fallen down show greater severeness than the uninjured fruits which are still on the plant.
Tomato fruit rot caused by A. tenuis

Symptoms

The rot is characterized by the brown coloured spots, which are usually sunken and irregular in outline. Occasionally these spots are surrounded by a yellow halo. Subsequently they get covered by dense, velvety olive green or black conidial masses of the causal organism. The lesions are firm and the rot extends into the pulp of the fruit. After injuries, such as sunscald and blossoms and rot, it develops rapidly inside the dead tissue producing scanty fungal growth. The fungus is a weak pathogen and only causes infection after some injury to the fruit.