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COMMON PHYSIOLOGICAL DISORDER OF TOMATO (*SOLANUM LYCOPERSICUM*): A REVIEW

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Abstract: Tomato is the one of the important crop and which are grown through out the year and in India climate condition is change which is affect the plant growth and development. Physiological disorders are abnormalities in fruit color, shape, texture or appearance which are abiotic and biotic in origin which are not caused by infectious diseases or insects. Sometime after abnormalities in plant permit to enter of microorganism. Physiological disorders are distinguished from deficiencies of a nutrient, and physical, chemical or herbicide injury. Causes of physiological disorders include genetic factor, environmental factors, watering practices, nutrition, soil factors and cultural practices such as pruning and training. For most physiological disorders, involved many factors, and there is almost always a genetic component. Major physiological disorders of tomato include blossom end rot (BER), catface, cracking, irregular ripening, puffiness, sun scald, gold fleck, unfruitfulness.

Keyward: Tomato crops, Physiological disorder, Adverse climate, Genetic factor

INTRODUCTION

Tomato is a one of the important vegetable of worldwide, which is grown though out the year and year around great demand in global market. It is highest producing vegetable after potato. China is the highest tomato producing country in the world. Tomato (*Solanum lycopersicum* L.) is belong to Solanaceace family it is a native of Maxico or Peru. Plant is herbaceous annual plant which produce red to orange color (red color due to lycopene), round, spherical shape fruits, fruit is commercially used for cooking, salad making, preparation of puree, ketchup, *chatni* and no any dish making without tomato. In India tomato share 11.2% production of total vegetable production (Annon. 2013) and total cultivated area is 8.8 million ha and production is 182.2 million tones per year (Annon. 2013). Consumer demand quality produces in market and quality fruit of tomato in term of color, shape, texture etc. required for processing. India is the various agro climatic condition and vary the soil type, which cause several disorder for growing of plant and fruit and affect the quality which type of affected fruit less demand in market.

Major physiological disorder of tomato

Blossom end rot (BER)

Blossom end rot is common disorder of tomato. Blossom end rot is first appear in a white and brown color. BER incidence started after two week of fruit set (Adam and El-GiZawy, 1998). Internally BER appear first fruit placenta than appear in external tissue (Adam And Ho, 1992). The externally symptoms is brown water soaked discoloration appear at the distal end of fruits, when fruit are still green. Internally BER parenchyma tissue and seeds are black color (Adams and Ho, 1993) are seen.

The sport is starting from small area than it is enlarged sunken black color (Vanderlinden, 2009). Sometime blossom end rot cover the half portion of fruit and fungus are attack the fruit from infected part.

BER is caused by Ca deficiency (Ho and White, 2005), which incidence due to daily changed the air temperature, nutrient status in soil, soil moisture and growth rate of fruit. Ho *et al*,(1993) significance reported that positive relationship between BER and temperature or solar radiation during fruit growth. He was separated high light and high temperature of each plant in a green house, added the heat and rises the temperature 2^0C than compare to shaded reduced light plant, they found high incidence in high temperature because high temperature increase the cell expansion than extra light. High rate of cell elongation in a fruit required high concentration of Ca which is not full-fill caused BER (Ho, *et al* 1993). Some flower are tinned out from the each cluster found that increase the fruit size but more incidence of BER (Dorais and Papadopolos, 2001)

Salinity is also increase the BER incidence, in saline soil Na inhibit the uptake of Ca by root (Adam and Ho, 1992) also soil moisture deficit (Sergio, 2013) and excess water condition both are increase the insidance of BER because both condition root are unavailable to uptake Ca from soil (Vanderlinden, 2009; McLaurin, 1998). Excess water, high ammonia, K, Mg ion inhibit the uptake of Ca.

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Fruit cracking

Fruit craching is one of the major physiological disorder of tomato, which is more economical loss the fruit. Fruit cracking is occur during all stage of fruit growth but more prone during the maturity especially during the color development. Tomato fruit cracking are two type: circular cracking and concentric cracking (Peet, 1992; Olsen, 2004; Kenelly, 2009). In circular cracking mostly occur during the mature green stage of fruit, concentrically around the shoulder of fruit and in radical cracking surface of fruits cracks rapidly from the stem end of the fruit. Crack of the fruit permit the entry of the most of the pathogen.

Various factor involving the fruit cracking such as irrigation after long dry spell, expose of the fruits direct to the sun light, Boron deficiency and genetic factor.

Fruit cracking are generally caused during rapid growth of fruits in abundant water and high temperature condition after water deficit. Water and sugar are generally more movement in fruit during the fruit ripening which changed the cuticle elasticity caused fruit cracking (Dorias *et al.* 2001), fluctuation of water contain in a fruit favor fruit cracking (Dorias, 2001). During the summer month fruit are direct expose to the sun light caused fruit cracking. Sudden water available enhances rapid fruit expansion resulting in subsequent fruit cracking (Masarirambi, 2009). Genetically fruit cracking are control by two recessive genes (Young, 1959).

Catface

It is a very serious disorder of tomato fruit which directly reduce the market demand of fruit, it is characterized by malformation of tomato fruit at the basal end. This disorder is more seen during first harvest (Masarirambi, *et al.* 2009).

Low temperature is the important factor for enhance the catface in tomato fruit during flower development (Basten, *et al.* 1992) and flower is not normally developed. Cool and cold temperature enhance catface (Gruda, 2005), about three week before bloom increase the percentage of catface (Olsen ,2004)

Indeterminate verity of tomato is more susceptible for catface than determinate verities due to removing of auxin from the plant tip, 2,4-D and undesiable chemical drift also enhance catfacing (olsen, 2004)

Low temperature treating at provided at the time very sensitive is 18-19 days before anthesis, increase the number of locus in a fruit (Wein and Turner, 1994) GA_3 foliar application also increase the locus number (Wein and Zhang, 1991).

Sunscald

Expose portion of green or nearly ripe fruit get blisterness and water soaked due to extreme heat of scorching sunshine fast dessication in water soaked portion and turn sunken area white or gray color in green fruit and yellow in pink or red fruits. This disorder cause prevents the fruit softening, formation of hard tissue and differentiation of fruit ripening.

This disorder occur due to high sunshine and also pruning, training operation enhance sunscald because fruit facing direct sunlight. If mean temperature goes to above 40^0C more occur (Olsen, 2004) upper part of the fruit are more suffered by this disorder due to small and low number of foliage (Olsen, 2004). This disorder more occur in summer month , high light first damage the pigment but high light intensity cellular death and turning the skin papery thin (Prohens *et al.* 2004; Kay, 1999).

Puffiness

Also known as holloness and boxness, puffiness defined as existence of open cavity between outer wall and the locular contains in one or more locus (Grierson and Kaden, 1986). Affected fruit are low specific gravity and not preferred by consumer in market. This disorder characterization by lack of seed gel in a one or more locus of fruit. Cross section of affected fruit shows emptiness.

This disorder is caused by type of genotype and environment hot condition that prevent the pollination (Greison and Kedar, 1986). Improper pollination is due to inadequate pollination, fertilization and seed development (Olsen, 2004). Poor pollination due to high night temperature and fluctuation of day and night temperature caused abortion of embryo after fertilization. Low K and high nitrogen or rainy weather enhance the puffiness (Imas, 1999; Peet, 2009)

Gold fleck

Fruit surface around the calyx and fruit shoulder, thin yellow sport appear, generally in summer. In green fruits speaks are white and less abundance, these are gold in color during ripening. This are decrease the attractiveness of fruit or less demand in market and also decrease the self life (Janse, 1988).

This disorder is appear due to the excess calcium accumulate in the fruit and high temperature also increase the gold fleck. Kreij *et al.* (1992) reported under the high humidity high Ca/K ratio are more transport the Ca in a fruit which increase the incidence of gold fleck. Applying high P fertilizer increases the uptake of Ca by root and increase the speaking. High temperature also increases the gold fleck.

Unfruitfulness

Summer tomato crops is generally suffer for fruit sets, in summer if day temperature is goes to above 40^0C and night temperature goes to above 20^0C not congenial for fruit setting, this temperature drying the pollen and flower are not fertilized by pollen, resulting lack of fruit setting.

Low temperature also affect fruit setting of tomato fruit are normally fail to set temperature goes to

below 13^0C. Both high and low temperature affect the fruit setting both temperature inhibit the pollen germination on stigma of flowers. High temperature affect the fruit set during summer in east India and low temperature during winter in north India.

Chilling injury of tomato

Tomato is a tropical plant which is sensitive to low temperature. If the fruit of tomato goes to below 10^0C sugar are accumulate in fruit and softening, water soaked and dull color appear in a fruit and plant appear dark color. Low temperature affect the fruit in field during the winter season and after harvested in cold storage, if the fruits are stored in 2.5^0C to near freezing point (Luengwilai, *et al.* 2012).

Uneven fruit ripening

This disorder is characterized by fail of equal color development in fruit. Same time hard and yellow area is seen around the fruit shoulder (green back), yellow, green and waxy area scattered on a fruit (blotchy ripening) and sometime bronze color (bronzed ripening). Uneven fruit are not preferred in market; this disorder is most problems of tomato grower for processing purpose.

This disorder is much prevalence in cool, wet after cloudy condition; high soil nitrogen and low potash increase the incidence (Morgan, 2006). Incidence of silver white fly nymph also increase the uneven ripening (Elinek, 2010) and Blotchy ripening affected by low light incidence.

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