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## The effect of tomato mosaic virus on root meristem of *Lycopersicon esculentum* Mill.

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### Abstract

In our country, tomato (*Lycopersicon esculentum* Mill.) is cultivated throughout the year because of the favourable agroclimatic conditions in our part or another. They also prefer warm growing season. High humidity and high temperature makes the tomato plants susceptible towards foliage disease. Root elongation and root initiation were reduced due to the infection of virus. At the time of germination there was not so much difference between the root initiation of healthy and infected tomato plant, but as the intensity of disease was increased the root initiation was decreased and thus inhibiting the emergence of new root initials.

**Keywords:** Tomato mosaic virus, root meristem

### Introduction

Tomato (*Lycopersicon esculentum* Mill) is an important annual or short lived perennial fruit vegetable. It belongs to family solanaceae. It is indigenous to the western region of tropical South America. Tomatoes are cultivated throughout the world for its edible fruits. Tomatoes are a good source of vitamins in addition to their endless flavouring characters for other foods. In India, according to FAO estimates the average per hectare yield of tomatoes in India about 9316 kgs against that the world and developing countries which is about 19915 kg and 14483 kg respectively.

Symptoms can be found during any growth stage and all plant parts are affected. Generally, infected plant have a light or dark green mottling or mosaic with distortion of younger leaves, and stunting to varying degrees. Severely affected leaves may have a "Fernlike" appearance and may show raised dark green areas. Fruit set may be severely reduced in affected plants. They may be internal browning of the fruit wall, yellow blotches and necrotic spots may occur on green or ripe fruit. Some strains can cause yellow mottling of leaves, others cause dark necrotic streaks in stems, petioles, leaves or fruit, or other symptoms to occur. Symptoms are influenced by environmental conditions such as day length, temperature and light intensity as well as by variety, plant age at infection, and virulence of tomato mosaic virus (ToMV) strain. On susceptible cultivars, symptoms may range from severe to none.

The virus is seed borne. Infected tomato seeds can be the source of infection and the means by which the virus can be disseminated over large distances. Only a few seedlings need to be infected for the virus spread rapidly. The virus can be spread by horticultural workers on contaminated hands, clothing, and tools during routine horticultural operations such as transplanting, tying, pruning, grafting, pollinating, cultivating, spraying, watering and picking. The presence of virus in the guttation fluid of tomato plants facilitates spread by workers during horticultural operations. ToMV can also enter a tomato field through infected weed, pepper or potato plants. Also, ToMV is spread to a lesser extent by feeding grasshoppers, small mammals and birds. ToMV is a closely related strain of tobacco mosaic virus (TMV). The virus is quite stable under adverse environmental conditions and can persist in plant debris in dry soil for 2 years or in moist soil for 1 month or in root debris in fallow soil for 22 months. It can also persist in greenhouse structures for long periods of time. Healthy seedlings planted into contaminated soil can be infected through minor wounds caused by damage to roots. The virus may also be present in water used for irrigation. Dissemination of tiny particles of contaminated soil by wind is also possible.

Effect on root meristem studies play a significant role in the characterization of plant viruses. Viruses affected growth of plants, therefore growth of root of infected plants are also influenced by viruses. For the study of effect on root meristem, root initiation and root elongation are studied investigation the effect of disease on the infected plants.

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### Methods and Materials

Growth of the root of tomato were also influenced by virus infection, so far the study of effect of virus infection on root meristem studies were conducted on root initiation and root elongation. For this study the growth of root of tomato plants were recorded after one month intervals in the tomato field as well as in the pots kept in the insect proof chamber at 30 °C. Length of root and their branches were measured by scale and time of inhibition of the root and root branches were also noted.

### Observations

Tomato mosaic virus (ToMV) affects growth of the root and reduced the total number of branches. For the study of effect of virus infection on root meristem, ToMV plants were observed from the date of sowing till to the maturity of crop. The observations were taken every 30 days intervals in the tomato field at Agra.

The virus under study has induced some important anatomical changes in roots of *Lycopersicon esculentum* Mill. Plants These anatomical changes were observed in vascular region. The epidermal cells of the roots possessed lignified walls on its inner surface which increased the thickness of epidermal cells. The cortical region of the infected roots was thin as compared to healthy roots of tomato.

At the time of germination there was not so much difference between the root initiation of healthy and diseased tomato plants but as the intensity of diseased was increased the root initiation was decreased and inhibited the emergence of new root initials. The root elongation is healthy tomato the plants was very well established and the root having long branches

and number of branches was more, but reduction is root length and root elongation is healthy tomato plants was very well established and the root having long branches and no. of branches was more, but reduction is root length and root elongation was observed in the diseased plants of tomato. No. of branches were decreased in diseased plants of tomato and they were very thin and short in length.

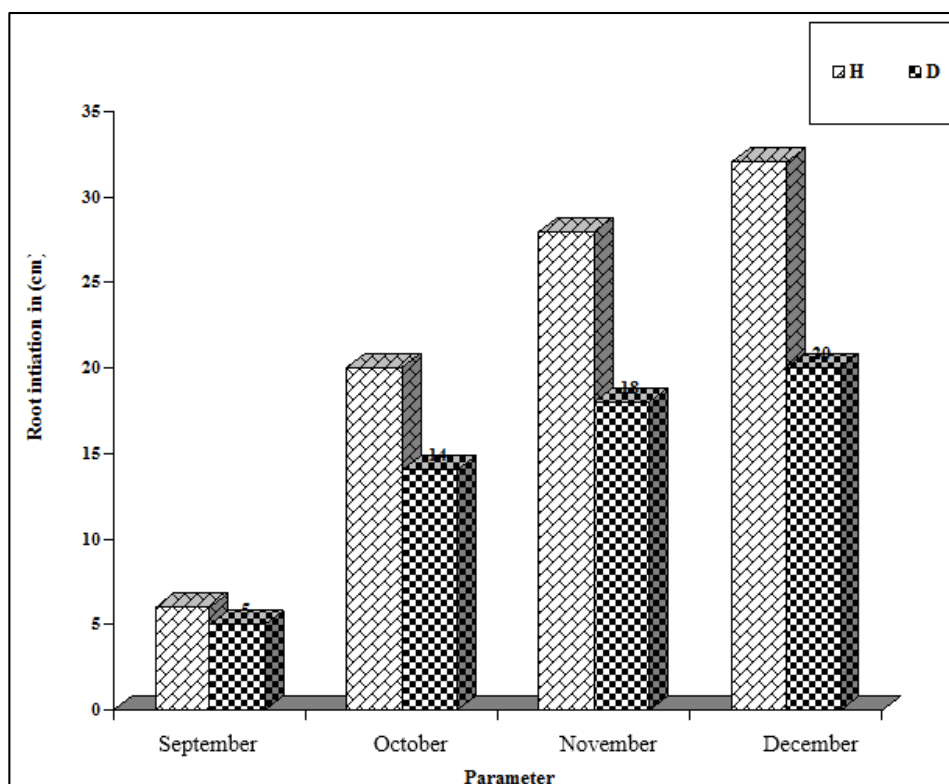
The data of three years i.e., 2009 2010 and 2011 were presented in the table 1, 2 and 3.

It is clear from the table 1, 2 and 3 that virus infection inhibited the emergence of new root initials. Root initiation (in cm) in the months of September was 6 and 5, 7 and 6 and 8 and 7 in healthy and diseased tomato plants, respectively, during the year 2009, 2010 and 2011. But as the disease increase with time difference between the root initiation in between healthy and infected plants were increased. At root maturity, the root initiation (in cm) in healthy and diseased tomato plants was 32 and 20, 31 and 19 and 34 and 24 respectively, during the year 2009, 2010 and 2011.

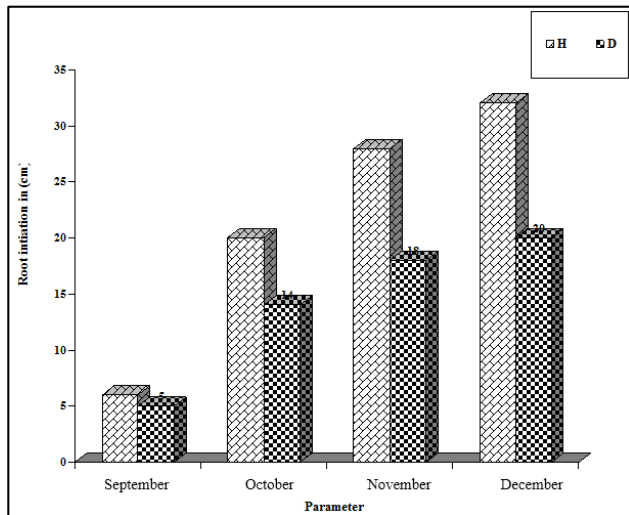
It is also evident form the table 1, 2, 3 that root elongation was also affected by the virus infection and reduction in root length was observed. In the months of September root elongation was not affected by the virus due to low disease incidence, but as the disease incidence increases, difference between the root elongation in the healthy and infected tomato plants was observed in the months of December. The difference between the root elongation (in cm) in healthy and diseased tomato plants was 72 and 28, 74 and 30 and 76 and 32, respectively during the year 2009, 2010 and 2011. The rate of elongation was invariably slowed down in the diseased tomato plants.

**Table 1:** Effect of tomato mosaic virus on root meristem of *Lycopersicon esculentum* Mill (2009)

S. No.	Parameters	September		October		November		December	
		H	D	H	D	H	D	H	D
1.	Root initiation (No. of branches in root)	6	5	20	14	28	18	32	20
2	Root elongation (in cm)	4	4	12	7	40	20	72	28



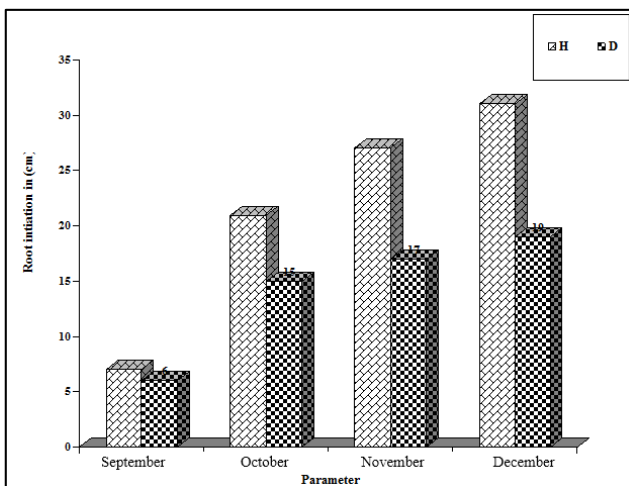
**Fig 1:** Effect of tomato mosaic virus on root meristem of *Lycopersicon esculentum* Mill. (2009)



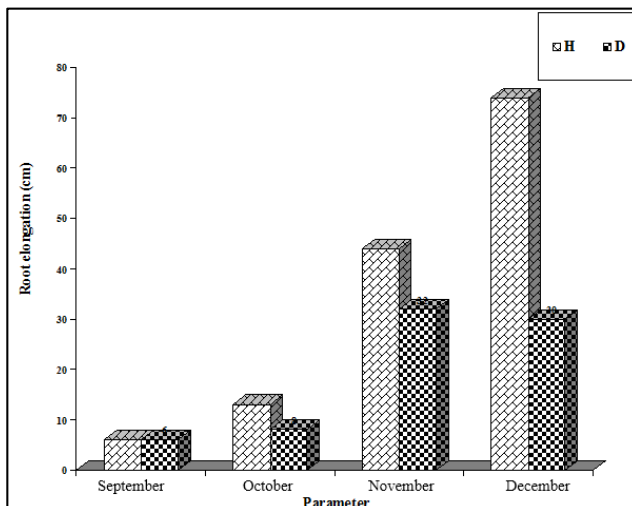
**Fig 2:** Effect of tomato mosaic virus on root meristem of *Lycopersicon esculentum* Mill. (2009)

**Table 2:** Effect of tomato mosaic virus on root meristem of *Lycopersicon esculentum* Mill (2010)

S No.	Parameters	September		October		November		December	
		H	D	H	D	H	D	H	D
1.	Root initiation (No. of branches in root)	7	6	21	15	27	17	31	19
2	Root elongation (in cm)	6	6	13	8	44	32	74	30



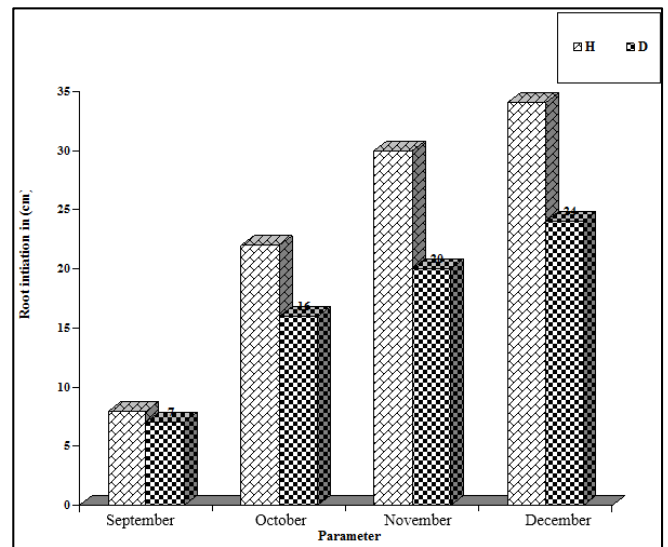
**Fig 3:** Effect of tomato mosaic virus on root meristem of *Lycopersicon esculentum* Mill. (2010)



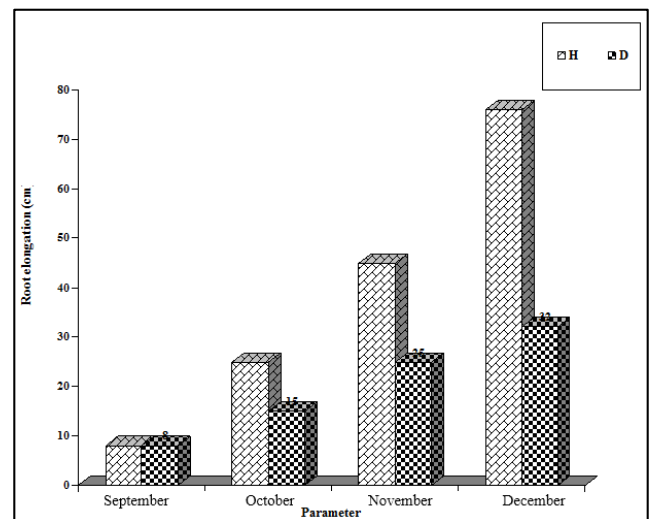
**Fig 4:** Effect of tomato mosaic virus on root meristem of *Lycopersicon esculentum* Mill. (2010)

**Table 3:** Effect of tomato mosaic virus on root meristem of *Lycopersicon esculentum* Mill (2011).

S No.	Parameters	September		October		November		December	
		H	D	H	D	H	D	H	D
1.	Root initiation (No. of branches in root)	8	7	22	16	30	20	4	24
2	Root elongation (in cm)	8	8	25	15	45	25	76	32



**Fig 5:** Effect of tomato mosaic virus on root meristem of *Lycopersicon esculentum* Mill. (2011)



**Fig 6:** Effect of tomato mosaic virus on root meristem of *Lycopersicon esculentum* Mill. (2010)

**Result and Discussion**

Tomato mosaic virus affects growth of root meristem of *Lycopersicon esculentum* Mill. In diseased plants, important anatomical changes were observed in vascular region. The size of the xylem vessels were appreciably smaller than the healthy xylem vessels. The amount of diseased phloem zone were more than the normal phloem zone, but the size of the phloem bundles were also less. The cells of epiblema became more lignified in infected roots. The cortical region of infected roots was thin as compared to healthy roots. Root elongation and root initiation were reduced due to the infection of virus. Root elongation of healthy and diseased tomato plants are 72 and 28, 74 and 30, 76 and 32 during the years 2009, 210 and 2011, respectively. At the time of germination there was not so much difference between the root initiation of healthy and infected tomato plant, but as the

intensity of disease was increased the root initiation was decreased and, thus inhibiting the emergence of new root initials. Reduced initiation of root was observed in the diseased tomato plants are 32 and 20, 31 and 19, 34 and 24 during the years 2009, 2010 and 2011 respectively.

Root initiation and root elongation in the diseased plant of tomato (*L. esculentum* Mill) were retarded in comparison to healthy ones.

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