# ONTOGENIC PREDISPOSITION OF TOMATO FOLIAGE TO EARLY BLIGHT CAUSED BY ALTERNARIA SOLANI UNDER MOUNTAINIOUS CONDITIONS OF KASHMIR


## ABSTRACT:

The young plants of potato crop show high resistance to early blight due to *Alternaria solani* as compared to the older ones. Within the same crop plants the lower leaves, which are physiologically different from middle and top ones are more susceptible to certain pathogens with resistance increasing in an acropetal direction similar work has not been done in tomato thus the work has been carried out. The effect of chronological and physiological ages of tomato plants on their susceptibility to early blight due to *Alternaria solani* (Ellis and Mart.) Jones and Grout was studied at different plant growth stages. The young plants of tomato showed high degree of resistance to early blight which decreased with an advance in age. The lower leaves of tomato plants of all ages were more susceptible. The under surface of leaves irrespective of their chronological and physiological ages was more susceptible to the disease relative to upper surface. Ontogenic host resistance is an important epidemiological variable since the epidemics are not static and also because different plant growth stages may be exposed to different conditions of the ecosystem. The disease incidence of tomato plants increased with the increase in their chronological age.



Key words: Tomato,Early blight,*Alternaria solani*,Ontogenic,Plant growth


## Introduction:

The young plants of potato show high resistance to early blight due to A. solani as compared to the older ones (Rambawale,1978). Within the same plant the lower leaves, which are physiologically different from middle and top ones(Dowley et al. 1975) are more susceptible to certain pathogens with resistance increasing in an acropetal direction.Similar work has not been done with tomato plants but some evidences suggested that plants decrease in resistance during senescence (Dorozhkin and Ivanyuk, 1976). The present work was conducted to determine if resistance to A. solani in tomato was influenced by its chronological and physiological ages.

**MATERIAL AND METHODS:**

The experiment was conducted on tomato cultivar Keck Ruth Ageti. The soil used in the experiments had 11.5, 2.8 and 85.7 per cent of clay, silt and respectively as determined by International Pipette Method(Piper,1966).

To have the plants of different chronological ages, the tomato seeds were sown regularly at 10-day intervals. When the seedlings from the last sown seeds attained the age of 20 days, the seedlings from all dates of sowing having different chronological ages were inoculated on the same day with standard-mycelial spore suspension prepared by blending 7-day old culture of *A.solani* growing on Czapek's Dox Agar medium. The standard inoculum had approximately 15-20 propagules (mycelial-spore-bits) per microscopic field. The inoculated plants were covered with water-sprayed perforated polythene bags for 24hours to ensure high humidity.The ages of the seedlings at the time of inoculation were 20,30,40,50,60,70,80,90,100,110 and 120 days. The flowering occurred at an age of 80 days and the initial fruit setting took place after 100 days. The data wererecorded at the end of 7 days. The degree of infection was based on the lesion size and the leaf area infected.There were three replications for each treatment and the experiment was conducted in double set.

Three plants per sowing date were transplanted into 18cms diameter clay pots. To study the effect of physiological maturity of the leaves on their reaction to early blight, leaf sampling was done from the potted plants. At each sampling, three leaflets were taken from top, middle and bottom sections of the plant. The standardized inoculum containing approximately 15-20 propagules per microscopic field was applied to the upper surface of detached leaves with an atomizer. In another set of the experiment, the same inoculum was also applied on the lower surface of detached leaves. The leaves were incubated in a humid atmosphere at 22+ _2 $^{0}$ C. The degree of infection was based on lesion size and leaf area infected. The incidence of the disease was recorded according to 0-5 scale (0= no disease, 5=total leaflet area infected). The disease rating in each treatment was then converted to per cent infection (Mc Kinney, 1923) and analyzed statistically for comparison.

**Results:**

The measurements of susceptibility by leaf area infected and lesion size showed very close agreement. Consequently all results are expressed only in terms of mean class of area of the leaf infected.

Effect of age of tomato plants on their reaction to early blight:

**(a) Effect of chronological age:**

The age of the plant had a significant influence on its response to early response to early blight infection. The incidence of disease was in direct relation to the chronological age of the plants at the time inoculation. The incubation period for the appearance of initial symptoms was also found to have a broad relationship with the host age.

Table-1: Effect of chronological age on the incidence of early blight of tomato

| Age of the plant(Days) | Disease Incidence(per cent) | Incubation period (hours) |
|---|---|---|
| 20 | 17.70(24.87) | 78 |
| 30 | 28.30(32.13) | 78 |
| 40 | 37.30(37.64) | 78 |
| 50 | 48.10(43.91) | 72 |
| 60 | 51.00(45.57) | 72 |
| 70 | 66.00(54.34) | 60 |
| 80 | 51.30(45.74) | 60 |
| 90 | 57.20(49.14) | 60 |
| 100 | 71.50(57.76) | 60 |
| 110 | 72.00(58.05) | 54 |
| 120 | 73.10(58.76) | 54 |

Average of 3 replication.

The figures within brackets are angular transformations.

S.Em=0.72

C.D. at 5%=1.50

C.D. at 1%=2.04

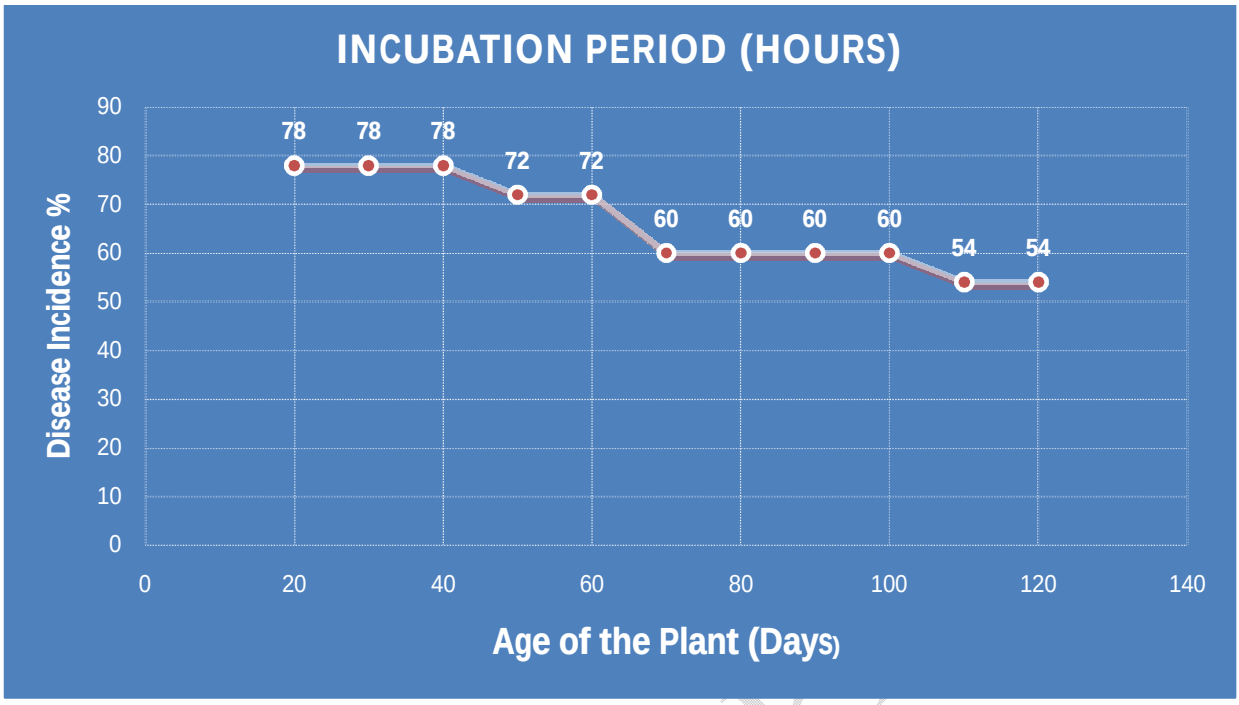


Fig 1. Graphical Representation of the Impact of Tomato Plant Age on Early Blight Incidence (%) and Incubation Period (hours)

**(b) Effect of physiological age:**

Irrespective of the chronological age of the plants, the resistance to the disease increased from lower to upper leaves of the same plant with the top leaves showing the greatest resistance.The necrosis of lower leaves was significantly more as compared to the leaves located at the middle and the top portions of the plant. The disease incidence on lower leaves was approximately four times more than that on the leaves located at the top of the plant.

The lower surface of the leaf irrespective of its chronological and physiological age was more susceptible to infection by A. solani than the upper surface. The average incidence of disease, where inoculation was done on the upper surface of the leaf was 51 per cent as compared to 61.3 per cent where inoculation was done on the lower surface. However, the incubation period invariably remained 72 hours in both the cases.

**Discussion:**

Ontogenic host resistance is an important epidemiological variable since the epidemics are not static and also because different plant growth stages may be exposed to different conditions of

the ecosystem(Bombawale,1978). The disease incidence of tomato plants increased with the increase in their chronological age Table-1).As the incubation period determines the duration of infection cycles or infection cycles completed during a given time, it is thus an important factor in the ecological succession of the pathogen on the host surface. It was found that there was a reduction in the incubation period with an advancement in the chronological age of the plants.

Differences in resistance among leaves located at direct parts of the plant were observed at all stages of its growth. The lower and older leaves which are physiologically mature were more susceptible to infection by *A.solani* than the upper leaves which are not as mature physiologically. Similar results were reported by Sohi and Sokhi(1969) on defoliation disease of tomato caused by *Septoria lycopersici*.The pathogen destroys the leaf tissue, resulting in the reduction of foliage yield and total photosynthetic area, thus decreasing the total carbohydrate level of the host (Grainger,1956).This makes the substratefavorable for the attack of a low sugar pathogen like *Alternaria solani* (Horsfall and Heuberger, 1942).

The same thing might be happening in the plants of different chronological ages where the sugar level of the mature foliage is reduced because of its translocation towards the developing fruits and the less attack of *A.solani* on younger plants might also be due to their high phytoalexin activity (Dorozhkin and Ivanyunk,1976).

The more susceptibility of lower surfaces of tomato leaves may be attributed to their morphological and physiological feature such as more number of stomata per unit leaf area, less thickness of cuticle, thin waxy coating and probably the nature of exudates (Allen 1976). Due to interplay of different epidemiological and ecological factors, the plants may show still larger susceptibility to the disease under natural conditions of growth in the field than those we have obtained in the present study.



**REFERENCES:**

Allen,P.J(1976).Spore germination and its regulation. In Physiological Plant Pathology Vol.4p. 51-85(Eds. R.Heitefuss and P.H. Williams) Springer-Verlag Berlin Heidelberg, New York, 1976 pp 890.

Bambawale,O.M.(1978). Epidemiological of Alternaria blight of potato in the Punjab. PAU, Ph.D.Dissertation pp.123

Dorozhkin,N.A., U.R. Ivanyuk(1976). Phytoalexins and resistance of tomato to early dry spot. Vestsi Akademii Navuk USSR, Biyalagichnykh Navuk (1976) No.4:60-63.

Dowley, L.I.,D.G.Routley and L.C.Peirce(1975).Ontogenic predisposition of tomato foliage to race O of Phytophthora infestans. Phytopathology 65(12):1422-1424.

Grainger, J.(1956) Host nutrition and attack by fungal parasites. Phyopathology 46:445-446.

Horsfall,J.G.and J.W.Henberger(1942) Causes,effects and control of defoliation of tomatoes. Conn.Agril.Exp.Stn.Bull. 456:182-223.

Mc Kinney,H.H.(1923). Influence of soil temperature and moisture on infection of wheat seedlings by Helminthosporium sativum. Jour.Agr.res.(U.S.)26:195-217.

Piper,C.S.(1966).Soil and Plant Analysis.Hans Publishers, Bombay. Pp368.

Sohi, h.s. and S.S Sokhi(1969). Defoliation disease of tomato caused by Septoria lycopersici Speg-1.Indian J.Hort.26:193-198.