

Phytopathology

**SYNERGISM BETWEEN *ALTERNARIA ALTERNATA* AND
SUNFLOWER MOSAIC VIRUS**

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The present interaction studies clearly demonstrate that the prior infection of *Alternaria alternata* Fr. did not in any way interfere with the infection and spread of sunflower mosaic virus except of course in the blighted portion, whereas the pre-infection of virus on the sunflower leaves stimulated a faster growth of the fungus.

INTRODUCTION

In many instances a plant may be infected with two or more pathogens, each may or may not affect the pathogenicity or the development of the other. A number of such interaction studies have been made during the last few years (Farley & Lockwood, 1964; Gill, 1965, and Lamey & Everett, 1967). In Agra, sunflower leaves have been found infected with sunflower mosaic virus (Gupta & Gupta, 1977) and *Alternaria alternata* Fr. The interaction between these two pathogens has been studied here.

MATERIALS AND METHODS

Pure culture of *Alternaria alternata* was obtained from blighted sunflower leaves and maintained on PDA. At required time, spore suspension of 15-20 days old culture was sprayed uniformly on the leaf surface. Sap inoculation procedures (Gupta & Gupta, 1977) were followed for sunflower mosaic virus transmission. Leaves of 10 days old seedlings of sunflower were selected for the experiments which were conducted in glasshouse at 25°C ($\pm 2^\circ\text{C}$). The tests were repeated four times.

Five sets of experiments were done, viz., (i) Healthy leaves inoculated with fungal spores to serve as control for blight symptoms; (ii) Healthy leaves inoculated with fungal spores and after the appearance of first blight symptoms, the virus was inoculated; (iii) Both fungal and virus inocula applied simultaneously on the same leaf surface; (iv) Healthy leaves inoculated with virus and after the appearance of mosaic symptoms, the fungal spores were sprayed on the same leaf surface; and (v) Only virus-inoculated leaves as control for mosaic symptoms.

RESULTS AND DISCUSSION

As is evident from the Table, the presence of sunflower mosaic virus in the host leaf facilitates the infection of *Alternaria alternata* Fr. When the virus inoculations were made after the appearance of the first blight symptom (Expt. II) the inoculated leaf became fully blighted about 5 days earlier than the control; but when the fungus

was inoculated simultaneously with the virus (Expt. III), the full leaf blight stage was obtained in 25 days of inoculation as compared to 35 days in control. Further evidence of increased susceptibility was obtained when the fungus was inoculated on host leaf after the appearance of viral symptoms (Expt IV), in which full leaf blight stage appeared in about half of the time taken by the control.

TABLE I
Representative results showing the effect of virus*, fungus and their combined infections on sunflower leaves

Days after fungus inoculation	Fungus inoculated on healthy leaf	Fungus inoculated on healthy leaf	Fungus & virus inoculated simultaneously	Fungus inoculated on virus-infected leaf
	Expt. I	Expt. II	Expt. III	Expt. IV
0	—	—	—	—
5	—	—	—	FBS
9	FBS	FBS VI	FBS VSA	—
10	—	—	—	HLB
16	—	—	HLB	—
17	HLB	HLB VSA	—	FLB
25	—	—	FLB	—
30	—	FLB	—	—
35	FLB	—	—	—

*Normal incubation period of virus is 8-9 days

FBS, First blight symptom appeared

HLB, Half leaf blight stage

FLB, Full leaf blight stage and leaf fall

VI, Virus inoculated

VSA, Viral symptom appeared

It is apparent that greater the time contact between the virus and the host before the fungal infection, the lesser is the time taken by the leaf to become fully blighted. These findings are, therefore, in agreement with those of Farley and Luckwood (1964), Russell (1966), and Lamey and Everett (1967) who have respectively reported an increased susceptibility to root rots in virus-infected peas, to *Alternaria* infection in beet mild yellowing virus-infected sugar beet and to *Cochliobolus miyabeanus* in hoja blanca virus infected rice leaves.

The results further emphasize that the presence of the fungus (*Alternaria alternata*) within the host (Expts. II & III) did not in any way alter the incubation period and the nature of the subsequent viral symptoms. This observation is however contrary to those of Hecht and Bateman (1964), and Gill (1965) who observed some sort of resistance induced by *Thielaviopsis basicola* and rust spores respectively to tobacco mosaic virus (TMV). Further studies on interaction between these pathogens are in progress.

ACKNOWLEDGEMENT

The senior author is thankful to the State Council of Science & Technology, U.P., Lucknow, for providing financial assistance.

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