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EFFECT OF MOSAIC VIRUS INFECTION ON GROWTH AND YIELD OF CLUSTERBEAN

BY
HASHMATHUNNISA BEGUM AND T. MADHUSUDAN
Department of Plant Pathology, Andhra Pradesh Agricultural University, Rajendranagar, Hyderabad 500 030

Studies on the physiolgy and growth parameters of clusterbean mosaic virus infected plant indicated that the clusterbean mosaic virus is harmful to the plants. It reduced the plant height, number of leaves, leaf area per plant, phytomass accumulation in leaves and the whole plant significantly. The root nodulation was very poor. There was a tremendous reduction in number of flowers per plant and the pollen viability was 80% compared to 98.8% in the healthy plants. Leaves of unaffected plants had substantially higher chlorophyll content and carbohydrates. The number of pods/plant and seeds/pod were also much higher and thus the per plant seed yield was singnificantly more showing a difference of 67.5% over the yield from virus infected plants.

Key words : Mosaic Virus, Growth, Yield, Clusterbean.

INTRODUCTION

Clusterbean (*Cyamopsis tetragonaloba* L. Taub) is an important vegetable crop grown for its green tender pods and is economically valued high for the commercial exploitation of gum. Though the crop is known to be less susceptible to most of the pests and diseases, clusterbean mosaic virus has been identified as one of the most important yield limiting factor (Vani *et al.*, 1983). Systematic studies on growth and yield of clusterbean and the biochemical changes if any in relation to the virulence of this isolate are therefore very important. To this end a pot culture study was made in the glass house.

MATERIALS AND METHODS

Seeds of clusterbean cultivar 'Navbahar' were grown in earthen pots filled with a mixture of soil and FYM. Fertilizers were applied @ 25 g urea and 30 g single super phosphate to each pot. Two hundred pots were maintained in the glass house such that 100 each were partitioned separately. Ten days after sowing only one seedling was retained in each pot. Initial culture of the clusterbean mosaic virus was obtained from the naturally infected plants. Standard inoculum was prepared by thoroughly washing the infected leaves that were then macerated with pestle and mortar using 0.01M, pH 7.0 phosphate buffer @ 1 ml g tissue

(Noordam, 1973). The extract so obtained was filtered and inoculated to the 10 day old seedlings in 100 pots. The conventional leaf rubbing method was followed using celite 503 @ 0.7 mg/ml sap as an abbrasive for inoculation. The series of control plants in 100 pots partitioned separately were all treated with a suspension of celite in the buffer.

The inoculated plants manifested the typical symptoms of clusterbeam mosaic virus ten days after the inoculation. Systematic measurements on growth chracteristics of 10 sample plants from each of the inoculated and uninoculated series were made at fortnightly intervals starting from 15 to 60 days from the day of inoculation treatment. The chlorophyl content of leaves-a, b and total were estimated following the procedure outlined by Smith and Benitez (1955). Reducing and the total sugars in leaves were estimated by following the procedure given by Nelson (1944) and non reducing sugars were estimated by following the method described by Inmann (1962). The data were statistically analysed by the paired 't' test to delineate the significant effects if any by the virus inoculated.

RESULTS AND DISCUSSION

The growth of virus inoculated plants was severely affected (Table 1). The plants were dwarf owing to a significant reduction in height to the extent of 40-54%. This effect was consistent from 15 to 60 days after the inoculation treatment. The plants developed a poor canopy due to substantially less number of leaves and a drastic reduction in the leaf area displayed per plant. As such the leaf phytomass accounted for over 50% loss at different samplings as compared to the inoculated control. The short statured plants with low canopy development reflected in a significant reduction in total phytomass accumulated per plant. Such ill effects

Table 1. *Effect of mosaic virus infection on vegetative growth parameters and flowering of clusterbean*

Days of Observation	Plant height (cm)		No. of leaves/plant		Leaf area/plant (cm²)	
	uninoculated	inoculated	uninoculated	inoculated	uninoculated.	inoculated
1	2	3	4	5	6	7
15	27.43	14.18**	7.0	3.6**	212.00	108.50**
30	49.03	22.24**	12.4	7.2**	795.20	380 25**
45	71.06	38 52**	17.6	11 2**	1130.80	551.50**
60	90.50	51.78**	30.8	18.4**	1437.90	758.50**

Days of Observation	Leaf phytomass/plant (g)		Phytomass/plants (g)		Number of flowers/plant	
	uninoculated	inoculated	uninoculated	inoculated	unionoculated	inoculated
	8	9	10	11	12	13
15	0.82	0.38*	1.19	0.72**	12.8	3.4**
30	1.98	0.88**	2.95	1.52**	37.4	11 6**
45	2 65	1.07**	6.25	2.99**	9.6	3.6**
60	3.12	1.42**	8.75	4.00**	—	—

Table 2. *Effect of mosaic virus infection on yield components and on nodulation of clusterbean*

Parameters	Treatment	
	uninoculated	inoculated
Yield components		
No. of pods/plant	26.85**	10.20
No. of seeds/pod	7.80**	2.90
Seed yield/plant (g)	0.59**	0.19
Nodulation		
No. of nodules/plant	36.00**	10.20
Fresh weight of nodule/plant (g)	0.61**	0.10
Dry weight of nodule/plant (g)	0.20**	0.05

Table 3. *Effect of mosaic virus infection on the biochemical constituents in the leaves of clusterbean*

	Chlorophyll (mg/g)					
Days of Observation	Chlorophyll a		Chlorophyll b		Total	
	uninoculated	inoculated	uninoculatd	inoculated	uninoculated	inoculated
1	2	3	4	5	6	7
15	1.70	0.87**	1.01	0.32**	2.71	1.19*
30	2.24	1.45**	2.00	1.02**	4.24	2.47**
45	2.70	1.94**	2.47	1.57**	5.17	3.50**
60	2.00	1.26**	1 67	0.56**	3.00	1.82**

	Carbohydrates (mg/g)					
Days of Observation	Reducing sugars		Non reducing sugars		Total	
	uninoculated	inoculated	uninoculated	inoculated	uninoculated	inoculated
	8	9	10	11	12	13
15	3.15	2.70**	1.97	1.39**	5.13	4.09**
30	—	—	—	—	—	—
45	—	—	—	—	—	—
60	—	—	—	—	—	—

on the virus infected plants might perhaps be attributed to the synthesis of growth inhibiting substances (Mohanty *et al.* 1979) and to an imbalance in the endogenous hormones (Mahadevan, 1984). Unlike profuse flowering ranging from 9.6 to 37.4 at different stages of growth, the infected plants produced 3.4 to 11.6 flowers. The viability of pollen grains was also reduced to 80% from 98.8% recorded in the healthy plants. The number of pods per plant were therefore limited to 10.20 against 26.85 recorded on the uninoculated plants (Table 2). The size of the pods was also very much reduced with significantly less number of seeds (2.90) per pod than in the latter (7.80). The difference in seed yield per plant was thus highly significant showing a loss of 67.5%. The nodulation of infected plants was severely impaired (Table 2) The affected plants developed 17.6% less number of nodules. Also the nodules of healthy plants weighed 5 and 10 times more than the dry and fresh weight recorded in the infected plants.

The biochemical constituents of the leaves assayed were significantly affected by the virus infection. The chlorophyll-a and-b as well as the total chlorophyl was drastically reduced by 28-49, 37-69 and 32-56% over those in the healthy plants at different stages of crop growth (Table 3). The deletorious effect of the infection was more on chlorophyll-b than on-a. The reducing, non-reducing and total sugars estimated at 15 days after the inoculation also showed a highly significant reduction. The non-reducing sugars were affected more (30.98%) than the reducing sugars (14.26%).

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