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GROWTH AND PHYSIOLOGICAL CHANGES IN PIGEONPEA PLANTS INFECTED BY STERILITY AND YELLOW MOSAIC VIRUSES

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Field experiments conducted to study the effect of viral disease on the physiology of pigeonpea during summer season of 1984-85 revealed that sterility mosaic virus infected plants recorded lesser drymatter than healthy and yellow mosaic virus infected plants. The healthy plants recorded higher chlorophyll content and photosynthetic rate as compared to diseased plants. An increase in the content of reducing sugars in infected leaves was also observed.

Pigeonpea is an important dryland pulse crop in Tamil Nadu where it occupies nearly 87,056 ha. Yellow and sterility mosaic are the two major diseases of pigeonpea in Tamil Nadu. The leaves of infected plants show different grades of colour with reduced photosynthetic efficiency (Hopkins and Hampton. 1969). As both diseases are directly affecting the photosynthetic surfaces, reduction in growth as well as yield are well established (Gurha *et al*. 1983). The present study was conducted to find out the growth and physiological attributes which are either directly or indirectly altered by yellow and sterility mosaic virus diseases.

MATERIALS AND METHODS

The experiment was conducted in Millet Breeding Station, Tamil Nadu Agricultural University, Coimbatore during summer season of 1984-85 which had severe incidence of these diseases. The cultivars selected were CO 5, CORG 5 and CO 3. Plants were spaced 45x45 cm in plots of 3.6x2.25 M with five replications. The natural infection of yellow and sterility mosaic viruses were repiced at peak vegetative stage in all the three varieties. Five affected plants from each plot were pulled out with least root damage and analysed for its growth and physiological components at 50% pod filling stage. Fully expanded top most leaves were used in various physiological measurements (Kuo *et al*., 1977). The leaf area was measured with photosensitive Automatic portable Area meter, Model LI-3000 manufactured by Li-Cor Inc./Li-Cor, Ltd., Nebraska, U.S.A. Total chlorophyll was estimated by the method described by Yoshida *et al*., (1971). Photosynthetic rate was measured in Infra Red Gas Analyser (IRGA), model 225-2B-SS Gas Analyser by the Analytical Development Company, Hoddesdon, England employing differential measurement technique while reducing sugar was estimated by the method suggested by Somogyi (1952).

RESULTS AND DISCUSSION

The results showed that there was a reduction in dry matter production of diseased plants. It was interesting to note that the sterility mosaic virus infected plants recorded lesser dry matter than the yellow mosaic virus infected plants in all the three varieties (Table 1). Bedbrooke and Mathews (1972) reported similar results in Chinese cabbage. With regard to dry matter distribution, not much of variation was noticed in root, stem and reproductive parts. But in the case of leaves, the

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Table 1. Dry matter production and its distribution among various organ in healthy, yellow mosaic and sterility mosaic infceted pigeonpea plants

Cultivars	Total DMP (g/plant)			Dry matter distribution among organs (%)											
				Root			Stem			Leaves			Reproduction organ		
	H	S	Y	H	S	Y	C	S	Y	C	S	Y	C	S	Y
CO 5	66.10	41.16	61.01	5.75	8.33	7.42	37.72	50.12	44 60	12.96	41.55	18.73	43.57	—	29.25
CORG 5	36.87	49.06	77.27	7.56	11.06	11.04	39.52	52.39	44.61	16.46	36.55	15.92	36.46	—	28.43
CO 3	110.17	61.87	92.51	8.32	10.83	8.97	41.18	39.06	45.04	15 73	50 11	19.21	34.77	—	26.78

CD for varietal mean = 0.257 (1%)
CD for diseased mean = 0 257 (1%)
CD for varietal x disease = 0.336 (5%)
H = Healthy plant; s = Sterility Mosaic affected plant; Y = Yellow mosaic affected plant

Table 2: Biochemical and Physiological Parameters in Healthy, Yellow mosaic and Sterility Mosaic infected Pigeonpea Plants

Cultivars	Leaf Dry Matter g/plant				Total chlorophyll mg. g^{-1} fresh weight				Photosynthetic rate mg. Co_2. dm^{-3} h^{-1}				Reducing sugars mg/g^{-1} fiseh weight			
	S	Y	H	Mean	S	Y	H	Mean	S	Y	H	Mean	S	Y	H	Mean
CO 5	17.10	13.30	8.60	13 00	0.5038	0 3147	0 8771	0.5652	15.32	13.65	29.76	19.58	25.7	19.9	14.4	20.0
CORG 5	17.90	12.30	14.30	14.83	0.3390	0.2606	0.5789	0.3928	15.11	12.80	27.44	18 45	25 8	22.6	20,4	22.9
CO 3	31.00	17.80	17.30	22.03	0.6107	0.3352	0.8367	0.5942	16.62	12.80	28.61	19.34	19.6	17.6	13.9	17.0
Mean	22.00	14.47	13.40	—	0.4845	0.3035	0.7642	—	15.68	13.08	28 60	—	23.7	20.0	16.2	—
CD for varietal mean				3.54 (1%)				0.1040 (1%)				N.S				3.2.4 (1%
CD for Disease mean				3.54 (1%)				0.1040 (1%)				2 49 (1%)				3.24 (1%)
CD for varietal x Disease				4.45 (5%)				0.1306 (5%)				N.S.				N.S

H — Healthy plant
S — Sterility Mosaic affected plant
Y — Yellow mosaic affected plant.

sterility mosaic virus infected plants recorded higher leaf dry matter than the other plants This may probably due to the diversion of photosynthates to leaves rather to the reproductive part which is absent in sterility mosaic virus infected plants This was very well explained by the leaf mean weights (22 0, 14.47, 13.40 g/plant) which were higher than the healthy plant (Table 2). The statistical analysis also showed significance at 1% level for above growth attributes. The chlorophyll content showed an opposite trend to that of leaf dry matter. The healthy plants recorded high chloropyll content (0.7642 mg/g) as compared to diseased plants. The yellow and sterility mosaic infected plants recorded 0 3035 and 0.4845 mg/g respectively. Singh and Suhag (1982) noticed greater reduction in both chlorophyll 'a' and 'b' contents in plants affected by mung bean yellow mosaic virus. The photosynthetic rate also indicated a trend similar as that of cholroophyll content A significant (1% level) reduction could be noticed in the case of infected plants (28.60 to 15 68 to 13 08 mg CO_2-dm^2.-hr^{-1}) Recent biochemical investigations had provided evidence that systemic virus infection decreased the rate of leaf photosynthesis through the decreased photophosphorylation of the chloroplasts (Platt *et al*, 1979). The results confirm the findings reported in tomato plant infected by yellow mosaic virus (Leal and Lastra, 1984).

An increase in the content of reducing sugars in infected leaves was also observed Tha maximum was noticed in sterility mosaic infected plant (23.7 mg/g) while lesser quantities were recorded in yellow mosaic (20.0) and healthy plants (16 2) Presumably breakdown of starch into sugar fractions can be attributed for the above phenomenon (Mishra and Jha, 1972).

The results indicated that the growth of pigeonpea plant was the expression of biochemical and physiological events which were interlinked each other. Clearly demarcated differences could be observed between healthy and virus infected plants with regard to various physiological and biochemical parameters.

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