ANALYSIS OF THE INFECTION EFFECT OF SOYBEAN MOSAIC VIRUS ON GROWTH SOYBEAN

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I. INTRODUCTION

Growth of any organism is the ultimate result of the interaction between many factors which include both environmental and physiological. When a plants is colonised by a pathogen the resulting physiological disturbances are finally reflected on growth pattern of the host plant. It was, therefore, thought wortwhile to study as to how far the collective effect of all physiological changes that are brought about by soybean mosaic virus on soybean could affect the overall rate of gruwth of the plant.

In this study growth was measured as changes in leaf area, leaf area ratio, relative growth rate and net assimilatory rate of affected leaves of soybean. An isolate of soybean mosaic virus (SMV) from the culture collection of this laboratory was taken for the present study.

II. MATERIALS AND METHODS

The experiments were carried out in an insect proof glass house. Single plants of soybean (Glycine max [L.] Meer.) var. Bragg were raised in 10 cm. earthen pots. Seedlings were inoculated with SMV at first trifoliate stage. The leaf area, fresh weight and dry weight of leaves of healthy and inoculated plants were determined separately on 0, 5, 10, 15, 20 and 30 days after inoculation. Growth rate was measured by growth analysis technique of Watson (11) with slight modification. The leaf area of initial as well as the subsequent samples were determined by tracing the outline of leaves on centimeter graph paper and counting the total number of squares. During each stage a single plant selected at random served as unit. Three replications were included. From the data thus recorded the following were computed.

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$$\text{Leaf area ratio} = \frac{A_2 - A_1}{\log_e A_2 - \log_e W_1} \times \frac{\log_e W_2 - \log_e W_1}{W_2 - W_1}$$

Unit : Sq/Cm/g

$$\text{Relative growth rate} = \frac{\log_e W_2 - \log_e W_1}{t_2 \quad t_1}$$

Unit : g/g/day

$$\text{Net assimilatory rate} : \frac{W_2 - W_1}{t_2 - t_1} \times \frac{\log_e A_2 - \log_e A_1}{A_2 - A_1}$$

Unit : mg/ sq Cm/day

Where, W_1 is initial and W_2 is final weights of leaves
A_1 is initial and A_2 is final areas of leaves
t_1 is initial and t_2 is final time limits in each stage of sampling

III. CONCLUSION

Observation made in the present investigation indicates that soybean mosaic virus infection has a pronounced effect on the growth of the leaves of soybean plant. The leaf area of infected soybean was reduced (Table I and Fig. 1) because leaves of infected plants were smaller and fewer. This reduction of leaf size might be due to changes in cell number or cell size. Clinch (1), and Joshi and Dubey (7) reported such reduction of palisade cells in the virus infected leaves. There are reports (Dimfote, 2; Jeyarajan and Ramakrishnan, 5; Harman et al., 3 that virus infection adversely affects the carbohydrate metabolism of diseased plants. Further Stanley (9); Holden and Tracey (4); Narayanaswamy and Ramakrishnan (8); Jeyarajan and Ramakrishnan (6) have observed deranged nitrogen metabolism in virus diseased plants. The authors have also recorded such observations in soybean affected by SMV (unpublished). This metabolic disturbances caused by SMV infection might be responsible for the reduction in the leaf area of diseased soybean. Due to reduction of leaf area, the leaf area ratio was also reduced in infected plant (Table II; Fig. 2). On the other hand, the net assimilatory rate (Table IV and Fig. 4) and relative growth rate (Table III and Fig. 3) of infected leaves were increased. The factors such as reduced foliage and depleted carbohydrate contents might be responsible for the increased net assimilatory rate and relative growth rate of infected leaves, because they directly influence the rate of photosynthesis. According to Sweet and Wareing (10) reduction in leaf area increase in net assimilatory rate and relative growth rate of leaves were probably due to "the metabolic sink"

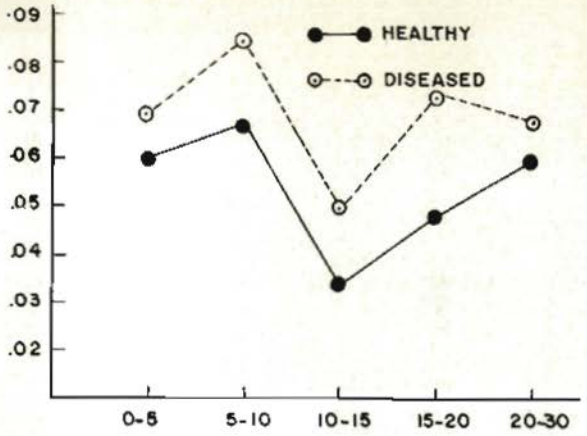

FIG. 3.- BETWEEN DAYS AFTER STMV INOCULATION

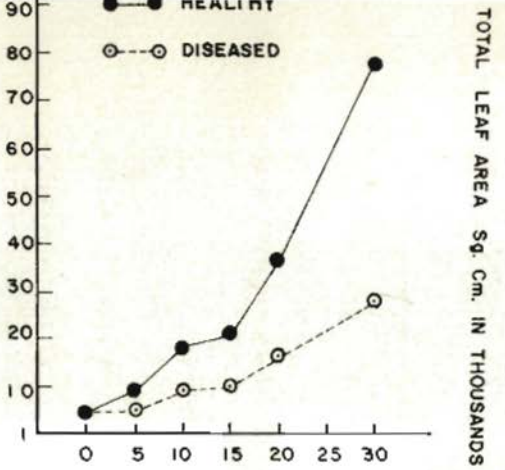

FIG. 1.- DAYS AFTER SMV INOCULATION

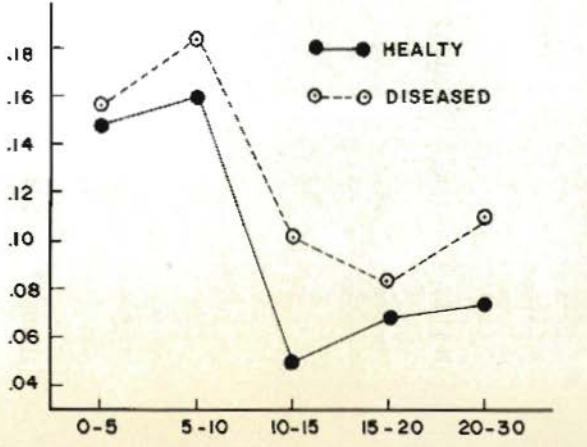

FIG. 4.- BETWEEN DAYS AFTER SMV INOCULATION

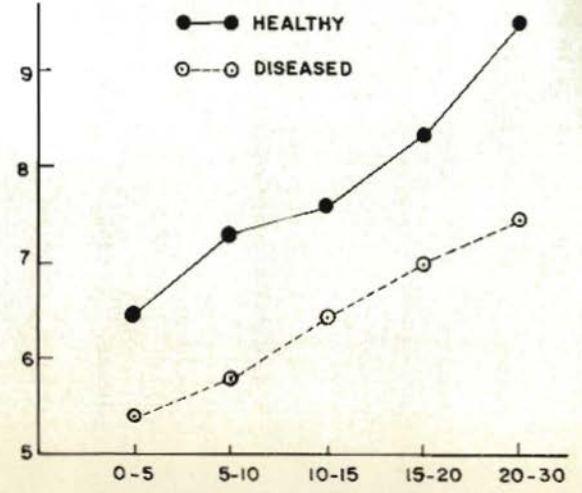

FIG. 2.- BETWEEN DAYS AFTER SMV INOCULATION

TABLE I

Total leaf area (Sq. cm) of soybean infected with soybean mosaic virus

Treatment	Days after SMV inoculation					
	0	5	10	15	20	30
Healthy	4725	8756	17859	21119	36875	78270
Diseased	4725	5120	9729	10475	16175	28190

TABLE II

Leaf area ratio (Sq Cm/g) of soybean plant infected with soybean mosaic virus

Treatment	Between days after SMV inoculation				
	0 – 5	5 - 10	10 – 15	15 – 20	20 – 30
Healthy	6456.5	7346.8	7647.3	8371.5	9523.4
Diseased	5418.8	5815.6	6492.9	7015.8	7487.8

TABLE III

Relative growth rate (g/ g/ day) of soybean leaves infected with soybean mosaic virus

Treatment	Between days after SMV inoculation				
	0 – 5	5 – 10	10 – 15	15 – 20	20 – 30
Healthy	.0608	.0672	.0349	.0480	.0597
Diseased	.0692	.0851	.0491	.0728	.0680

TABLE IV

Net assimilatory rate (Sq Cm/dry) of soybean leaves infected with soybean mosaic virus

Treatment	Between days after SMV inoculation				
	0 – 5	5 – 10	10 – 15	15 – 20	20 – 30
Healthy	.1483	.1610	.0518	.0687	.0744
Diseased	.1562	.1859	.1023	.0841	.1102

effect or due to increased production of auxin like IAA. Watson and Watson (12) and Watson and Wilson (13) reported a decreased net assimilatory rate in sugar-beet plants affected by yellows virus. In general yellows type of viruses disrupt the host metabolism in a way that is just the opposite of mosaic viruses. The present observations made with soybean mosaic virus are in agreement with the above fact.

IV. SUMMARY

Observations made on the analysis of the effect of soybean mosaic virus infection on the growth of soybean leaves show that diseased leaves had reduced leaf area and leaf area ratio, but net assimilatory rate and relative growth rate were increased. It is concluded that disturbances in the metabolism of leaves of diseased plants might be responsible for these changes.

V. LITERATURE CITED

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