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Physiology of *Phaseolus mungo* L. affected by Urd bean mosaic virus

II. Effect on carbohydrate and phosphorus

By

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Introduction

Survey of literature reveals that a number of studies have been carried out on the metabolic disturbances of virus infected plants (DIENER 1963, BAWDEN 1964, OPEL 1965). However, no work about the physiology and biochemistry of virus infected *Phaseolus mungo* L. (Black gram) plants has been done. In this series II ²⁾ the results of the studies carried out on the changes of different fraction of carbohydrate and total phosphorus of urd mosaic virus infected *P. mungo*-plants are given here.

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Materials and Methods

Phaseolus mungo L. cv. Type 9 (U. P.) was used as a host and urd mosaic virus as a virus throughout the present work. Urd mosaic virus has a dilution end point 1 : 1000,000, thermal inactivation point 95° C and longevity „in vitro“ 35 days (5—7° C). It only infect *Phaseolus radiatus* ROXB. and *P. mungo* L. and produces systemic symptoms in host plants. The seed was grown at the rate of five seeds per clay pot (20 cm size) in a unsterilized compost soil. Two sets of fifty plants each were taken. One set was inoculated with the virus inoculum mixed with 400 mesh carborundum powder and the other set was similarly treated with carborundum mixed distilled water. The plants were inoculated after ten days of germination. A random method of composite sampling was used for taking the leaf, stem and root samples. The sampling was done after 0,7 and 15 days after inoculation. Different

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plant parts after collection were kept in oven at $90^{\circ} \text{C} \pm 1$ for drying. The sugars and starch were determined by the Anthrone colorimetric method described by PEACH & TRACEY 1955 and SNELL & SNELL 1949. Total phosphorus was also found out by a colorimetric procedure described by MISRA 1968.

Table 1

Effect of urd mosaic virus on different fractions of carbohydrates in *P. mungo*. Average of three samples. (mg/100 mg dry weight)

Days after inoculation	Carbohydrate fractions	Leaf		Stem		Root	
		Healthy	Infected	Healthy	Infected	Healthy	Infected
0	Total sugar	14.00	14.00	13.00	13.00	10.00	10.00
	Reducing	12.00	12.00	10.00	10.00	9.00	9.00
	Non-reducing	3.00	3.00	2.00	2.00	1.00	1.00
	Starch	3.00	3.00	2.00	2.00	2.45	2.45
7	Total sugar	16.00	18.00	14.00	15.00	12.00	13.00
	Reducing	10.00	12.00	9.00	10.00	10.00	10.40
	Non-reducing	6.00	6.00	5.00	5.00	2.00	2.60
	Starch	3.875	2.700	2.300	2.200	2.800	2.500
15	Total sugar	17.00	20.00	16.00	17.00	14.00	14.00
	Reducing	9.00	13.00	9.50	11.00	12.00	13.50
	Non-reducing	8.00	7.00	6.50	6.00	2.00	1.50
	Starch	3.87	2.75	2.50	2.30	3.70	3.00

Results

The results (Table 1) indicate that the amount of total sugar increased with age of the plants with infection. It was higher in diseased plant parts than their healthy counterparts. The highest percentage of total sugar was in the infected leaves followed by stem and root. The lowest total sugar content was in the healthy plant root. The percentage of reducing sugar was also higher in diseased plant parts. Just after inoculation the amount of reducing sugar was more in leaf, then in stem and root but at seven days after inoculation it was equal in leaf and root but lowest in the stem. The maximum concentration of reducing sugar was at fifteen days in diseased root followed by leaf & stem. The percentage of non-reducing sugar was higher in healthy plant parts than diseased one except in infected root at seven days after virus infection. The amount of starch was higher in healthy plant parts than their diseased counterparts. Like starch content the percentage of total phosphorus was also maximum in healthy leaf, followed by stem and root (Table 2).

Discussion

Present study shows a general increase of sugar, starch, and phosphorus contents in leaf, stem and root throughout the experimental period in both healthy and diseased samples. The total and reducing sugars were higher in diseased plant samples and non-reducing sugar and starch were lower in them over their healthy counterparts. Probably due to active synthesis, the carbohydrate percentage is more in leaves than other plant parts. Like present findings NARAYANASAMY & RAMAKRISHNAN 1965 also found an altered ability to synthesize carbohydrates in PSMV-infected pigeon pea leaves and con-

Table 2

Effect of urd mosaic virus on total phosphorus in *P. mungo*. Average of three samples. (mg/100 mg dry weight)

Days after inoculation	Treatment	Leaf	Stem	Root
0	Healthy	0.035	0.028	0.025
0	Infected	0.035	0.028	0.025
7	Healthy	0.041	0.040	0.030
7	Infected	0.040	0.038	0.028
15	Healthy	0.038	0.036	0.026
15	Infected	0.036	0.034	0.024

cluded that the translocation of photosynthates from leaf to the other parts was affected by virus infection. The present finding of a reduced level of non-reducing sugar, starch with an increase in the level of reducing sugars is in conformity with the observations of NAMBIAR & RAMAKRISHNAN 1968. ESKARONS & NAGUIB 1964 could not find any difference in the level of total carbohydrate or carbohydrate fractions between healthy and tobacco mosaic virus infected plants. WATSON & WATSON 1951 was of the opinion that accumulation of carbohydrate is due to some effect of virus infection on the cells of the leaf, possibly involving the activity of the enzyme systems controlling the interconversion of the different forms of carbohydrate. The decrease in total phosphorus percentage in diseased plant parts over healthy indicates that in the infected plant the virus synthesis was at the expense of available phosphorus present in the plant. HOLDEN & TRACEY 1948 also found decrease in total phosphorus content per plant in TMV infected tobacco plant.

Summary

Effect of urd mosaic virus infection on *Phaseolus mungo* L. carbohydrate fractions and total phosphorus was studied. The percentage of total and reducing sugar was higher in the diseased plant part than their healthy

counterparts. The percentage of nonreducing sugar, starch and phosphorus was higher in the healthy plant parts than infected one. The different carbohydrate fractions and total phosphorus were maximum in leaf followed by stem and root.

Zusammenfassung

Das Ergebnis der Infektion von *Phaseolus mungo* L. mit dem Urd-mosaic-virus wurde bezüglich der Kohlehydratfraktionen und des Phosphorgehalts untersucht. Der Prozentsatz an gesamtem und an reduzierendem Zucker war in den erkrankten Pflanzenteilen höher als in den gesunden. Der Prozentsatz an nichtreduzierendem Zucker, an Stärke und an Phosphor war in den gesunden Pflanzenteilen höher als in den infizierten. Die verschiedenen Kohlehydratfraktionen und der gesamte Phosphor erreichten ihren Höchstwert im Blatt, dann erst im Stamm und in der Wurzel.

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