

## Changes in the levels of chlorophyll and carbohydrate associated with the leaf spot disease of rubber plants infected by *Phytophthora palmivora*

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Quantitative estimation of total chlorophyll and carbohydrate content of healthy and infected leaves of rubber plants (*Hevea brasiliensis* var. RRIM 105) caused by *P. palmivora* was made. Considerable reduction in both the contents was noticed in the host tissues during the course of infection as compared to the healthy ones.

**Key words :** Rubber, chlorophyll, carbohydrate, *Phytophthora palmivora*

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### INTRODUCTION

Natural rubber as obtained from *Hevea brasiliensis* is gaining increased importance owing to its increased demand in daily life and as a matter this has resulted not only in intensive cultivation of rubber plants in our country but has also instigated for a search for new improved varieties in future. Leaf spot disease of rubber plants incited by *Phytophthora palmivora* (Butl) Butl. appears to be prominent in the young nursery beds thereby causing tremendous loss to the total photosynthetic area of the plants. Many plant pathogens that cause disease directly affect the photosynthesis of the hosts by inducing chlorosis. Reports are available showing decrease in the level of total sugar content (Krog *et al.*, 1961). The present paper aimed at to study the levels of chlorophyll and carbohydrate contents of leaves of rubber plants infected by *P. palmivora*.

### MATERIAL AND METHODS

Chlorophyll content of healthy and infected leaves of *H. brasiliensis* var. RRIM 105 was estimated spectrophotometrically following the method of Pandeya *et al.* (1968). The amount of chlorophyll (A & B) was calculated in terms of mg/litre through Arnon's expression as follows :

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Chlorophyll (A & B) = Optical density at 700 nm / 34.5 × 1000 = mg/litre

The data were represented on dry weight basis and replicated at least five times with comparable results.

Total carbohydrate content was estimated quantitatively following the methods described by Viles and Silverman (1949) and McCready *et al.* (1950) with slight modifications. The total carbohydrate content was expressed in terms of mg glucose /100 mg dry tissues by comparing the observed values with a standard curve made from analar glucose.

## RESULTS AND DISCUSSION

It is evident from the result that the total chlorophyll content in healthy tissues varied from the infected ones. Chlorophyll values showed a general decline in the infected leaves after ten days of infection from the healthy leaves. Similar corroborative results under pathogenic condition were reported by Padmanabhan *et al.* (1974) and Main (1971). Sakari and Misawa (1974) showed that with gradual decrease in the activity of the enzyme, chlorophyllase, the chlorophyll content declined rapidly with the progress of infection. With the progress of infection the chlorophyll content of the infected leaves decreased significantly in present case also.

**Table 1-** Changes in the levels of chlorophyll and carbohydrate of healthy and infected leaf tissues of *H. brasiliensis* var. RRIM 105 caused by *P. palmivora* after different days of infection

Days of infection	Chlorophyll (A & B) [mg/100 mg dry tissue]		Loss (%)	Total carbohydrate (mg glucose /100 mg dry tissue)		Loss (%)
	Healthy	Infected		Healthy	Infected	
10	2.120	1.521	28.254	19.00	16.30	14.210
20	2.123	1.382	34.903	19.80	15.00	24.242
30	2.121	1.118	47.289	19.82	13.90	29.868

Carbohydrate content, on the otherhand, showed a decline in its value under pathogenic infection. Such changes under pathogenic condition were also reported by Dayal and Joshi (1968) and Vidhyasekaran and Ramadoss (1973). With progress of the disease there was a corresponding decrease in the level of carbohydrate. The reduced photosynthetic activity as a result of loss of chlorophyll content was evident from the result and coupled with increased respiratory activity observed generally in tissues infected by facultative parasites seems probably responsible for the decline in carbohydrate level (Swamy, 1964). Inman (1965) reported that the depletion of sugars in the infected tissue may be due to the utilization of sugars by pathogen.

## REFERENCES

- Dalyal, R. and Joshi, M. M. (1968). Post-infection changes in the sugar content of leaf spot infected barley. *Indian Phytopath.*, **21** : 221-222.
- Swamy, R. E. (1965). Quantitative sugar changes in barley infected with a facultative parasite. *Phytopath.*, **55** : 341 - 345.

- Krog, N. E., Tourneau, D. L. and Hart, H. (1961). The sugar content of wheat leaves infected with stem rust. *Phytopath.*, **51**, 75-77.
- Main, C. E. (1971). Pathogenesis and halo formation of tobacco brown spot lesion. *Phytopath.*, **41** : 1437 - 1443.
- McCready, R. M., Guggolz, J., Silveira, V. and Owens, H. S. (1950). In *Modern Methods of Plant Analysis*, (eds. Paech, K. and Tracey, M. V. ), Vol.2, pp. 159. Springer - Verlag, Berlin.
- Padmanabhan, D., Vidhyasekaran, P. and Soumini Rajagopalan, C. K. (1974). Changes in photosynthesis and carbohydrates content in canker and halo regions in *Xanthomonas citri*, infected citrus leaves. *Indian Phytopath.*, **27** : 215 - 217.
- Pandeya, S. C., Puri, G. S. and Singh, J. S. (1968). *Research Methods in Plant Ecology*, Asia Publishing House, Bombay, pp. 233 - 249.
- Sakari, K. and Misawa, T. (1974). Studies on the infection and the multiplication of plant viruses : VII. The breakdown of chlorophyll in tobacco leaves systematically infected with Cucumber mosaic virus. *Ann. Phytopath. Soc. Japan*, **40** (1) : 14 - 21.
- Swamy, R. E. (1964). Respiration in *Cercospora* infected ground nut tissues : Part II. Effect of some enzyme inhibitors and 2, 4 - dinitrophenol on respiration. *Indian J. Exp. Biol.* **2** : 193 - 197.
- Vidhyasekaran, P. and Ramadoss, N. (1973). Quantitative and qualitative losses in paddy due to helminthosporiose epidemic. *Indian Phytopath.*, **26** : 479 - 484.
- Viles, F. J. and Silverman, L. (1949). In *Modern methods of Plant analysis*. (eds. Paech, K. and Tracey, M. V. ), Vol. 2, pp. 162 - 163. Springer - Verlag, Berlin.

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