Bangladesh J. Sugarcane, 21 : 101-104 *July, 1999*

Effect of White Leaf Disease on Chlorophyll Content of Sugarcane Leaf

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Received on 2.3.98

ABSTRACT

An experiment on the effect of white leaf disease on chlorophyll contents of sugarcane leaves was conducted during 1992-93 cropping season at Bangladesh Sugarcane Research Institute (BSRI) farm with the two varieties Isd 16 and Isd 20. In general white diseased plant showed a highly significant ($P<0.01$) reduction in total chlorophyll content as compared to healthy ones in both the test varieties. In full symptom expression stage of the plant i.e. at the age of 7-8 months, the diseased plants of both the varieties were found to be almost devoid of chlorophyll. In the diseased plants of Isd 16 and Isd 20, total chlorophyll, chlorophyll 'a' and chlorophyll 'b' were found to reduce by 96.53 to 96.96%, 96.92% and 96.52 to 97.11% respectively, compared to their respective healthy ones.

Key words : Sugarcane, white leaf disease (WLD), chlorophyll contents.

INTRODUCTION

White leaf disease (WLD) of sugarcane is a serious mycoplasmal disorder in Bangladesh (Talukder *et al.* 1989). The disease is characterized by the production of increased number of lanky tillers with narrow leaves having varying degree of chlorophyll loss ranging from partial white to pure white. Leaf chlorosis is the characteristic symptoms very often found associated with mycoplasmal disease of plants (Martha *et al.* 1989; Thompson and Pietersen, 1988). Like other mycoplasmal disease, leaf chlorosis is one of the diagnostic characteristic symptoms of white leaf disease. The information on loss of chlorophyll in the White leaf disease infected sugarcane is not available in the country. Hence a comparative studies on the chlorophyll content in the white leaf disease infected and healthy leaves of sugarcane were done and presented in this paper which is a preliminary of symptomatological research on sugarcane white leaf disease.

MATERIALS AND METHODS

Chlorophyll of the healthy and white leaf diseased leaf tissues was estimated following the method described by Mahadevan and Sridhar (1982). Third leaves from the top were collected randomly from healthy and diseased plants of 7-8 months old cane of varieties Isd 16 and Isd 20. Samples were taken three times at 15 days interval and leaves from each category for each sampling time were analyzed is a composite sample. Fresh leaf samples of 0.5g each was drown from each composite sample and homogenized in a mortar by pestle with 80% acetone. Supernatant was decanted off and filtered through a Buachner funnel using Whatman No. 42 filter paper. Sufficient quantity of 80% acetone was added with the residue and the process was repeated. The content from the mortar was transferred to the Buchner funnel and the brie with acetone until colour less. The filtrates were pooled and volume was made to 100 ml with 80% acetone in a volumetric flask. Optical density of the

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sample was measured at 663 and 645 nm in Spectrophotometer (Model - Spetronic-1201, Milton Roy, USA). Amount of total chlorophyll, chlorophyll 'a' and chlorophyll 'b' were calculated on a fresh weight basis employing the following formulae (Mahadevan and Sridhar, 1982).

$$\text{Total chlorophyll (mg/g)} = \frac{20.2A645+8.02A663}{a \times 1000 \times w} \times v$$

$$\text{Chlorophyll 'a' (mg/g)} = \frac{12.7A663 - 2.69A645}{a \times 1000 \times w} \times v$$

$$\text{Chlorophyll 'b' (mg/g)} = \frac{22.9A645 - 4.68A663}{a \times 1000 \times w} \times v$$

Where, A = Optical density in each cases,
a = Length of light path in the cell (usually 1 cm)
v = Volume of the extract in ml and
w = Fresh weight of the sample in 'g'

RESULTS AND DISCUSSION

In general white leaf disease caused a significant ($P<0.01$) reduction in the total chlorophyll content in the diseased plants as compared to healthy ones of both the tested varieties (Table 1). In full symptom expression stage of the plants i.e. at the age of 7-8 months, the diseased plants of both the varieties were found to be almost devoid of chlorophyll. Decrease in chlorophyll content in both the varieties were more ore less same. In lsd 16 and lsd 20 the decrease in chlorophyll content was found to 96.96% and 96.53%, respectively in the diseased leaves compared to their respective healthy check. Similarly, the amount of chlorophyll 'a' and chlorophyll 'b' decreased significantly ($P<0.01$) in diseased leaves of both the varieties (Table 1). Diseased canes of lsd 16 and lsd 20 showed a decrease of chlorophyll 'a' by 96.92% and 96.53%, respectively compared to their respective healthy ones. Percent decrease of chlorophyll 'b' in the diseased leaves of both the varieties were also identical like chlorophyll 'a'. However, the variety lsd 20 showed to contain significantly ($P<0.01$) higher quantity of chlorophyll 'a' and chlorophyll 'b' in both the healthy and diseased leaves when the two varieties were compared (Table 1).

Table 1. Effect of white leaf disease (WLD) on chlorophyll contents in cane varieties lsd 16 and lsd 20.

Chlorophyll	lsd 16			lsd 20		
	Healthy	Diseased	% Decrease over healthy check	Healthy	Diseased	% Decrease over healthy check
Total chlorophyll*	1.1182	0.0339	96.96	1.4427	0.05	96.53
Chlorophyll 'a'	0.8354	0.0258	96.92	1.1048	0.0383	96.53
Chlorophyll 'b'	0.2831	0.0082	97.11	0.3379	0.0117	96.52
LSD at	**5%**		**1%**			
Total chlorophyll	0.015		0.023			
Chlorophyll 'a'	0.0116		0.0175			
Chlorophyll 'b'	0.0032		0.0048			

*Mean of three replicates

Mixed chlorosis to albinism is one of the diagnostic symptoms associated with white leaf disease. In the present study, chlorophyll content of infected leaf tissues was found to reduce greatly (Table 1). The results are in conformity with the results by Wu *et al.* (1969) and Chen and Chen (1974) who found about 92.35% reduction in total chlorophyll content in white leaf disease infected sugarcane leaves. Reduction in chlorophyll content up to 60.9% in pigeon pea plants affected with sterility mosaic an MLO, was reported by Narainswamy and Ramakrishnan (1966). Marked decrease in chlorophyll content in the diseased leaves suggested that the etiologic agent was perhaps interfer in the biosynthesis of chlorophyll (Shukla *et al.* 1988). According to Benson (1964) intact molecule of chlorophyll must present for proper development of chloroplast lamellae. Chen and Chen (1974) and Shukla *et al.* (1984) reported about the poor development of lamellae or irregular and distorted chloroplast in the leaves of sugarcane infected by MLO indicating the interruption of chlorophyll biosynthesis in the leaves of diseased plant. Production of both chlorophyll 'a' and chlorophyll 'b' was significantly decreased ($P<0.01$) as compared to healthy ones (Table 1). Similar results were reported by Kaley and Nagaich (1977) who found drastically reduced quantity of chlorophyll 'a' and chlorophyll 'b' in potato plants affected with purple top roll disease caused by MLO, when compared with healthy ones. According to Essau (1933) and Bawden (1956), the chlorophyll is destroyed due to virus infection but Shukla *et al.* (1984) and Chen and Chen (1974) opined that reduction in chlorophyll content in diseased plants was due to restricted development of plastid primordia and not due to destruction of chlorophyll. Chlorosis of leaf due to MLO infection was reported in other crops also by many workers (Kuske and Kirkpatrick, 1992; Martha *et al.*1989; Thompson and Pieterson, 1988).

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