

Prevalence of White Leaf disease of Sugarcane in Bangladesh

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ABSTRACT

A survey on white leaf disease (WLD) incidence of sugarcane was conducted in 6 sugar mill zones and 2 non mill zones representing all sugarcane growing areas of Bangladesh. White leaf disease was found distributed widely in all the cane growing areas. Survey report revealed that Rajshahi, Jessore, Thakurgaon and Joydebpur were more disease prone areas than other cane growing zones. The disease not only affected currently dominant commercial varieties of sugarcane like Isd 2/54, Isd 16, Isd 18, Misrimala, Co 1158, but had spread to new releases such as Isd 19, Isd 20, Isd 21 and new promising clones. None of the surveyed varieties of sugarcane was found to remain free from WLD and the incidence ranged from 0 to 40.6% of the plants. The disease incidence was examined in plant crops of 50 varieties and promising clones under field conditions, all except 13 were found affected with WLD and the disease incidence ranged from 1.13 to 15.39% of the plants. The survey revealed differential varietal behaviour as well as different agroecological effects towards WLD in plant and ratoon crops.

INTRODUCTION

In Bangladesh sugarcane is an important cash crop which occupies nearly 0.191 million hectares of arable land. Various diseases cause considerable losses to this crop and among these, white leaf disease (c.o. Mycoplasma like organism) is of considerable significance which may cause upto 59.9% yield reduction (Talukder *et al.*, 1986). This disease was first reported in Bangladesh by Rahman *et al.* (1980) in 1980 and since then the disease have been found to increase in the subsequent years and covered most of the commercial varieties of sugarcane (Anon., 1987, 1988, 1990). The disease incidence ranging from 1 to 95% were reported in plant and ratoon canes of different commercial varieties and promising lines (Anon., 1988, 1990). Among 111 germ plasms of sugarcane, 18 clones showed 5.6% to 35.7% white leaf disease symptoms (Anon., 1988, 1990.). In Taiwan, white leaf disease incidence was observed over 10% in the areas 682, 446, 365, 165, 135 and 20 hectares from the crop year 1965-66 to 1972-73 (Leu, 1986). Since reporting of white leaf disease in the country no systematic survey on the incidence of the disease in different areas of the country as well as in different varieties/clones have been done. To bridge over this gap the present survey works were undertaken and the results are presented in this paper.

MATERIALS AND METHODS

A survey on white leaf disease incidence was conducted in 6 sugar mill zones namely Jessore, Chuadanga, Rajshahi, Thakurgaon and Jamalpur representing all sugarcane

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growing zones under mill areas and in two non mill zones namely Gazipur and Chapai Nowabgonj representing greater non mill zones during 1992-93.

In the mill zones, survey was done in 3 commercial sugarcane varieties, namely Isd 2/54, Isd 16 and Isd 18. These three varieties are being widely cultivated in all sugar mill zones. In gazipur areas, survey was done in two indigenous varieties namely Misrimala and Fata tadi (Local name) which were predominant and widely cultivated in the that areas.

In Chapai Nowabgonj areas, survey was done in 3 commercial varieties viz, Q 69, Co 527 and Co 1158 which are being cultivated widely in the said areas.

From each area, 20 plots of plant crop and 20 plots of ratoon were surveyed for each variety. Low and high land planting were considered proportionately. The areas selected for survey were divided into 4 sectors such as north, south, east and west as followed by Rahman *et al.* (1980). From each sector 5 plots of each variety and category (plant and ratoon) were randomly selected and surveyed. However, it was flexible in that case if the varieties and categories were not equally represented within a single sector, and attempt was made to sample an equal number of plots of each variety and category within the area as a whole.

The disease incidence was assessed as the percentage of inspected stools. Five hundred stools were considered to be representative sample size surveyed in each selected plot. To provide a representative sample of the whole plot, the rows inspected were such that they were more or less evenly distributed across the plot. Albinism as well as premature and excessive tillering were used for identifying the disease.

Apparently healthy seed materials of 50 varieties/promising clones including commercially cultivated, indigenous, exotic and different promising lines under zonal yield trial I, II and III were obtained from breeding division of Bangladesh Sugarcane Research Institute and planted in small plots measuring 5x6m having 6 rows of sugarcane during 1992-93 cropping season. Three replications were maintained for each variety and randomised. Observations for the incidence of WLD was started after 30 days of planting and continued till harvest after 12 months of planting.

RESULTS AND DISCUSSION

White leaf disease of sugarcane, which 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 with stunting growth (Figure 1) was noticed in varying percentage in different varieties cultivated under mill zones and non mill zones in Bangladesh. The disease incidence ranged from 0- 40.6% in the three commercially cultivated sugarcane varieties -Isd 2/54, Isd 16 and Isd 18 in the six sugar mill zones namely Jessore, Chuadanga, Rajshahi, Joypurhat, Thakurgoan and Jamalpur (Table 1). Highest incidence of disease 40.6% was noticed in one ratoon plot of Isd 18 followed by another ratoon plot of Isd 16 at Rajshahi area. One of the ratoon plot of Isd 2/54 at Rajshahi also showed 39.2%. Disease incidence in Thakurgoan area 0-28% scored the

third position among the 6 sugarmill zones. In Chuadanga and Joypurhat area disease incidence was more or less similar. Average disease incidence of different varieties ranged from 0.66 to 2.79% and the average disease incidence in different locations ranged from 0.16 to 4.19%. No gross difference in incidence of disease was noticed among the three sugarcane varieties. On the basis of disease incidence, different sugarcane growing areas can be arranged in a manner, high to low disease prone areas as Jessore, Thakurgoan, Chuadanga, Joypurhat and Jamalpur (Table 1). In the non mill zones (Joydebpur and Chapai Nawabgonj) white leaf disease incidence was recorded 0-35% in five indigenous varieties of sugarcane namely Misrimala, Fata Tadi, (Local name), Q 69, Co 527 and Co 1158 (Table 2). Highest disease incidence was recorded in one ratoon plot of Misrimala at Joydebpur. In Joydebpur area 0.2-35% and 0.2-23% WLD were recorded in the varieties Misrimala and Fata Tadi, respectively. The average disease incidence of those varieties were 9.47 and 5.88% respectively. In Chapai Nawabgonj area incidence of disease was comparatively lower than Joydebpur area. The varieties Q 69, Co 527, and Co 1158 showed 0-2%, 0-2.4% and 0-2.2% diseases respectively. The average disease incidence of these varieties was 0.87, 0.37 ratoon in each variety of sugarcane (Tables 1 & 2).

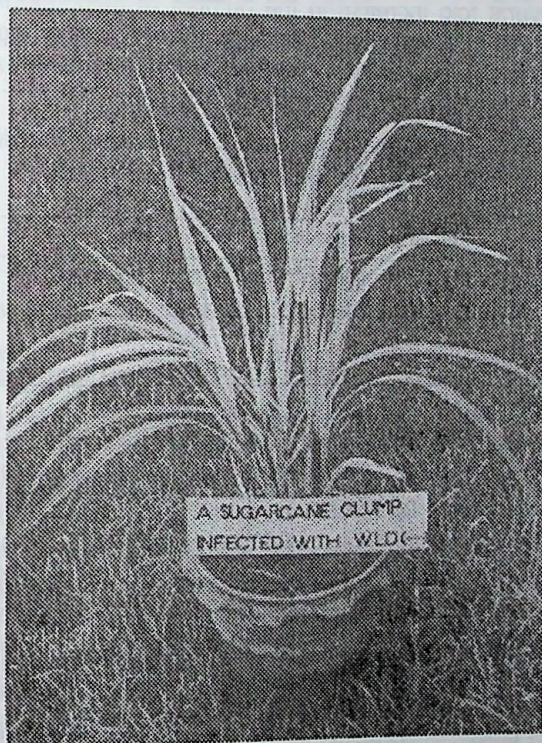


Figure 1. A sugarcane clump infected with white leaf disease (WLD).

Survey conducted in different cane growing zones (Sugar mill zones and non mill zones) of the country revealed differential varietal behaviour as well as different agro-ecological effect towards WLD in plant and ratoon crops (Tables 1 & 2). None of the

surveyed varieties found to remain free from WLD in different cane growing zones. In some places (Rajshahi, Jessore and Joydebpur) the varieties - Isd 2/54, Isd 18 and Misrimala showed much higher disease incidence (Tables 1 & 2). This shows that WLD has been a major factor responsible for decline in sugarcane yields in the country. In general, ratoon crop showed higher incidence of WLD than plant crop. This higher incidence of WLD in ratoon crop could be attributed to secondary infection or due to increased number of etiologic agent (MLO), in ratoon crop compared to plant crop, could be due to getting longer period for multiplication of etiologic agent in the ratoon crop compared to plant crop. This idea is supported by Schaper and Seemuller (1982) who concluded that MLOs associated with apple proliferation and pear decline, survive mainly in the root systems of the affected plants during winter and that they spread from there to aerial parts in the spring. Similar conclusions were also made by Tahama (1975) and Brun and Sinclair (1976). In some areas, there was lower incidence of disease in ratoon crop. The plausible reasons for the low incidence in ratoon crop as a result of death of the affected stools could be due to (i) high degree of albinism resulting in sharp decline in photosynthesis and thus affecting the whole carbohydrate metabolism (Chen, 1986; Corbett *et al* 1972; Rishi *et al.* 1973), (ii) high degree of nutritional imbalance which was reported by many workers (Singh *et al.* 1967, Dhupal and Nimbalkar, 1982), (iii) high rate of respiration due to several fold increase in the number of mitochondria (Shukla and Bhansali, 1985) and effect of toxin(s) produced by the etiological agent (MLO), as mycoplasmas are known to produce toxin(s) in the host plant (Maramorosch, 1974).

Table 1. Incidence of white leaf disease in three commercially cultivated varieties of sugarcane in different sugar mill zones.

Varieties Locations	Range of disease incidence (%)						Disease incidence range and mean in different locations
	Isd 2/54		Isd 16		Isd 18		
	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon	
Joypurhat	0- 0.8 (0.28) ⁺	0- 1.6 (0.76)	0- 0.8 (0.3)	0.2-0.6 (0.33)	0-3.2 (1.4)	0.2-4.6 (1.75)	0-4.6 (0.8)
Rajshahi	0- 4.0 (1.81)	0.2-39.2 (8.96)	0-1.8 (0.78)	0.4-40 (5.35)	0-0.8 (0.29)	1.0-40.6 (7.95)	0- 40.6 (4.19)
Thakurgoan	0- 0.8 (0.23)	0- 1.6 (0.54)	0- 1.2 (0.25)	0- 2.0 (0.86)	0- 28.0 (4.3)	0- 25.0 (3.7)	0- 28.0 (1.63)
Chuadanga	0-0.6 (0.21)	0-3 (1.5)	0-5.0 (0.73)	0-4.0 (1.33)	0-4.0 (0.58)	0.1-5.0 (1.14)	0-5.0 (0.84)
Jessore	0-0.5 (1.46)	0.8-12.0 (5.18)	0-8.0 (1.18)	0-34.0 (5.24)	0-4.0 (1.08)	0-5.0 (1.63)	0-34.0 (2.73)
Jamalpur	0-0.6 (0.11)	0-0.8 (0.23)	0-0.4 (0.09)	0-0.4 (0.12)	0-0.6 (0.14)	0-0.8 (0.24)	0-0.8 (0.16)
Disease incidence range and mean in different varieties.	0-5.0 (0.68)	0-39.2 (2.79)	0-8.0 (0.66)	0-40.0 (2.21)	0-28.0 (1.3)	0-40.6 (2.74)	

⁺ Figures in the parenthesis are means and without parenthesis are ranges.

Table 2. Incidence of white leaf disease (WLD) in different indigenous varieties of sugarcane in the non mill zones.

Location Varieties	Incidence of WLD (%)				Disease incidence range and mean of different varieties.
	Joydebpur		Chapai Nowabgonj		
	Plant	Ratoon	Plant	Ratoon	
Misrimala	0.2-14.2 (5.78) ⁺	0.6-35.0 (13.15)	- -	- -	0.2-35.0 (9.47)
Fata Tadi	0.2-12.2 (3.96)	0.8-23.0 (7.8)	- -	- -	0.2-23.0 (5.88)
Q-69	-	-	0-1.8 (0.63)	0-2.0 (1.1)	0-2.0 (0.87)
Co 527	-	-	0-0.8 (0.13)	0-2.4 (0.61)	0-2.4 (0.37)
Co 1158	-	-	0-1.2 (0.23)	0-2.2 (0.78)	0-2.2 (0.51)
Disease incidence range and mean of two locations.	0.2-14.2 (4.87)	0.6-35.0 (10.48)	0-1.8 (0.33)	0-2.4 (0.83)	

⁺ Figures in the parenthesis are the means and without parenthesis are ranges.

In the experimental trial under field condition, data recorded on white leaf disease incidence in the plant crops raised from apparently healthy seedcane of 50 sugarcane clones showed 1.13 to 15.39% of total plant population (Table 3). Out of 50 clones, infection of WLD was not observed in 13 clones. Twenty two clones showed above 4% disease incidence. The results revealed differential varietal behaviour against WLD. Thirteen varieties escaped infection in plant crop indicating a degree of field resistance (Table 3). Appearance of disease in plant crop raised from apparently healthy seed materials, could either be seed borne or secondary infection through vector(s). Sett transmission of the disease has been reported by various workers (Ling and Chuang-Yang, 1963; Lin and Teng, 1970; Shikata *et al.* 1969; Talukder *et al.* 1986; Rahaman *et al.* 1982) and this has been considered to be the main source of disease spread and its annual recurrence. Secondary infection has also been reported to play an important role in the spread of this disease under field condition (Matsumoto *et al.* 1968; Leu, 1986).

Table 3. Incidence of white leaf disease (WLD) in different varieties and promising clones of sugarcane.

Varieties/Clones	Incidence of WLD (%)	Varieties/Clones	Incidence of WLD (%)
Isd 1/53	0	I 379-85	0
Isd 2/54	4.5	I 18-85	2.03
Isd 5/55	1.22	I 543-85	3.98
Isd 9/57	1.50	I 457-85	0
Isd 15	14.00	I 525-85	1.25
Isd 16	10.20	I 44-86	2.49
Isd 20	4.22	I 126-86	5.08
Isd 21	4.44	I 144-86	5.06
I-Jaba-C	12.33	I 154-86	5.87
Isd 18	3.20	I 262-86	0
Isd 19	2.50	I 285-86	0
BO 70	1.13	I 326-86	4.49
Co 1158	11.11	BC-1	0
I 150-82	2.00	Isd 16(M)	0
I 365-85	0	I 8-87	2.58
I 48-83	10.20	I 210-87	11.25
I 177-83	8.00	I 227-87	2.09
I 197-83	7.28	I 233-87	15.39
I 226-83	5.36	I 263-87	2.05
I 49-84	7.31	I 290-87	5.67
I 123-84	1.23	I 291-87	1.33
I 87-85	0	Nagarbari	0
I 231-85	4.11	N 25-65	11.72
I 251-85	4.06	I 281-85	0
I 308-85	0	I 267-85	0

Appearance of WLD and grassy shoot disease in the plants raised from apparently healthy seed materials were also reported earlier (Anon., 1990; Satyavir and Beniwal, 1978; Shukla, 1985).

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