Occurrence of Banded Chlorosis of Sugarcane in Puerto Rico

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INTRODUCTION

Puerto Rico, a tropical Island, lies in the Torrid Zone between 17°55′ and 18°31′ north latitude and 65°39′ and 67°39′ west longitude within the Caribbean area. The annual average temperature for the Island is around 78°F. During the summer months, the average maximum temperature along the South Coast is frequently over 91°F. Thus, cane in those areas has frequently suffered damage from drought and heat. In the early part of September 1964, chlorotic bandings were first observed at the Central-Aguirre Sugar Co. on the leaves of P.R. 1059. Since P.R. 1059 is a promising sugarcane variety recently released to the sugar industry and cane growers in Puerto Rico, this unexpected trouble has caused concern. This variety has since been closely observed. This paper reports findings of reconnaissance, particularly with reference to the incidence of banded chlorosis on sugarcane.

REVIEW OF THE LITERATURE

During the winter of 1924–25, Faris (*2*)[2] observed in Cuba peculiar white bands on the leaves of yellow caledonia along the south coast of Habana Province. By keeping melting ice above the growth point of the cane and permitting the boot of the cane to stand full of cold water for a period of three consecutive nights, he reproduced the white bands on the treated plants. In Hawaii, chlorotic bandings (*3*) have been observed on leaves of varieties H-109 and D-1135 in the fields within a few weeks following periods of cold. But with cereals, Vanderpool in 1949 (*5*) observed a similar chlorotic banding on the seedlings when the soil surface was near either the minimal or maximal temperature for growth. Of still greater interest is the occurrence of such chlorotic banding on sugarcane in the tropical areas of Australia during the hot periods that occur at the start of the rainy season. Banded chlorosis has never been reported on sugarcane in Puerto Rico by the Standing Committee on Sugarcane Diseases.

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[2] Italic numbers in parentheses refer to Literature Cited, p. 81.

RESULTS

DESCRIPTION OF THE SYMPTOMS

In the fall of 1964 several seriously affected fields were found at Central Aguirre. The affected canes showed definite bands across the leaves, in which the chlorophyll had presumably failed to develop. All of the central young leaves showed yellowish discoloration at the early stage (fig. 1), but later the affected areas separated and formed more definite bands. The

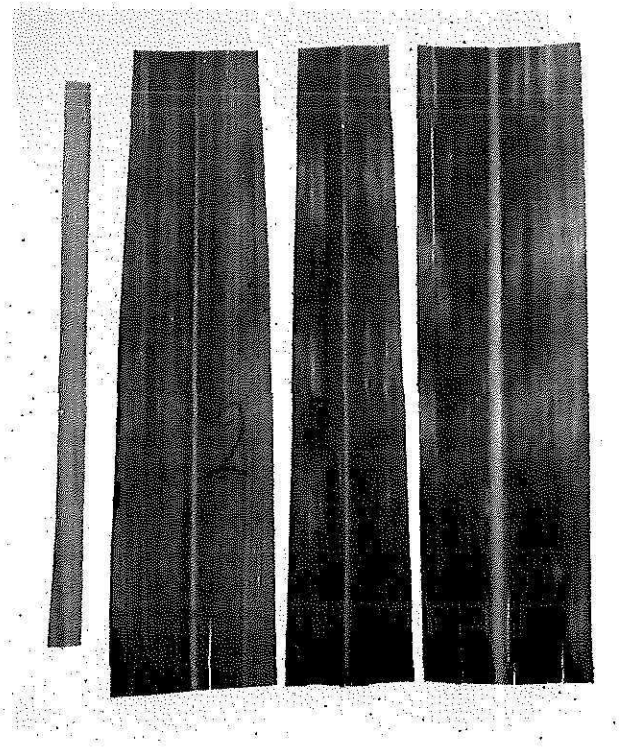

FIG. 1.—Symptoms of banded chlorosis observed at the early stage on leaves of the sugarcane variety P.R. 1059.

bands ranged from 5 to 25 inches long and varied from a 1-inch narrow stripe to a 4-inch wide band which completely crossed the leaf and gave the appearance that the injury might have occurred in the young spindle before the leaves unrolled (fig. 2).

The chlorotic bands, consisting of yellowish-green horizontal areas of chlorotic tissue occur at the base of the older leaves and progressively higher towards the tips of the successively younger leaves. These bands usually extend across the leaf on both sides of the midrib and have seldom been observed on isolated stools in the fields. The borders of the bands are irregular and often form distinct green stripes along the veins. The tissues

between bundles are sometimes split and cracked, thus leaving some necrotic areas in the centers of the chlorotic bands. All of the canes in the fields at Central Aguirre were affected more or less equally, and the bands were in similar positions on leaves of similar age. No such chlorotic bandings have been observed on other sugarcane varieties growing alongside the fields.

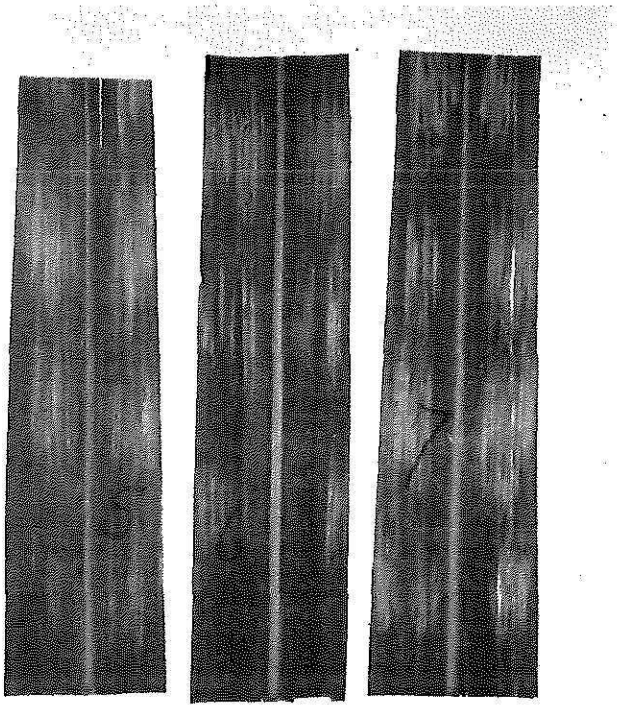

FIG. 2.—Symptoms of banded chlorosis observed at the late stage on leaves of the sugarcane variety P.R. 1059.

IDENTIFICATION OF CAUSAL AGENT

Attempts to identify the possible causal agent from either young or old lesions by means of direct microscopic examination have been unsuccessful, although some fungi, such as *Colletotrichum* sp., *Helminthosporium* sp., apparently from secondary infection, were seen in the necrotic areas.

PREVALENCE AND DISTRIBUTION

A survey was conducted to record the incidence of P.R. 1059 malady. The results showed that the extent of chlorotic bandings varied with localities. At Colonia Campanilla (Toa Baja, Colonia Ingenio, Caño Tiburones, Central Igualdad, and Central Cayey (table 1), where the average

maximum temperature in the summer of 1964 was generally under 86°F., the chlorotic bandings were not observed. But on the South Coast of Puerto Rico, as at Central Aguirre, Fortuna Substation, Central Mercedita, Lajas Valley, and Lajas Substation, where the average maximum temperature in the summer of 1964 was around 91°F., banded chlorosis was found widespread.

TABLE 1. *Incidence of sugarcane variety P.R. 1059 banded chlorosis recorded in a survey over the Island of Puerto Rico*

Localities	Age of cane	Extent of banded chlorosis observed	1964 average maximum temperature		
			May	June	July
	Months		*°F.*	*°F.*	*°F.*
Colonia Campanilla, Toa Baja	3	Not observed	—	—	—
Colonia Ingenio, Toa Baja	10	do.	—	—	—
Caño Tiburones	5–6	do.	—	—	—
Isabela	8	A few cases	86.5	85.40	85.10
Do.	6	do.	86.5	85.40	85.10
Igualdad	5	Not observed	—	—	—
Do.	4	do.	—	—	—
Central Cayey	5	do.	85.4	—	83.80
Central Aguirre	5–6	Very widespread	90.3	—	91.50
Fortuna Substation	5	do.	90.2	90.9	90.30
Central Mercedita	7	Widespread	89.8	90.40	90.20
Central Rufina	2	Not observed	—	—	
Lajas Valley	6	Very widespread	90.2	91.40	91.00
Lajas Substation	5	Widespread	90.2	91.40	91.00
Río Piedras (Solís)	9–10	A few cases	88.8	87.90	86.80
Gurabo	7–8	do.	89.8	89.60	88.30

DISCUSSION

Although the necrotic area appearing in the centers of chlorotic bandings resembles the symptoms of chlorotic streak to some extent, the regular pattern of chlorotic bandings across both sides of the midrib has not been known to be produced by chlorotic streak. According to Faris (*2*), the necrotic areas and leaf-splitting were caused by the secondary fungus parasite, *Coniothyrium* sp. In our case, the secondary fungus parasite would probably be *Helminthosporium* sp. or *Colletotrichum* sp.

The symptoms of chlorotic banding on P.R. 1059 are similar to the symptoms described by Faris (*2*), and Martin (*3*) for the banded chlorosis of sugarcane. Based on the type of symptoms observed, together with the fact that no causal agent has so far been isolated, the chlorotic banding

has been tentatively identified as "banded chlorosis" caused by high air temperatures, or a toxic substance as found by Edgerton (*1*).

Affected leaves of P.R. 1059 were sent to Dr. J. P. Martin, Principal Pathologist, Experiment Station of Hawaiian Sugar Planter's Association, Honolulu, Hawaii, for his opinion.

In his reply, Doctor Martin wrote:

> From your description of the disease occurring over the South coast of Puerto Rico on leaves of P.R. 1059, it is very likely that the trouble is a form of banded chlorosis. This condition may be brought about, usually, by low temperatures but also by high air temperatures. The horizontal bands on the affected leaves are typical symptoms of banded chlorosis and the position of the bands on the leaves indicates that the injury occurred in the young spindle before the leaves unrolled.

According to Martin (*3*), the economic losses from banded chlorosis are usually small. A change of variety may be indicated if the chlorosis develops too frequently, but specific control measures generally are not necessary. Fortunately, as the cool season advances, the symptom of chlorotic bandings disappears from the leaves of P.R. 1059.

SUMMARY

Chlorotic banding was first observed in Puerto Rico on the leaves of sugarcane P.R. 1059 at Central Aguirre. Since P.R. 1059 is a promising sugarcane variety, the trouble has caused considerable concern. A survey showed that the extent of chlorotic bandings varied with localities. A study of the records of the temperature patterns during the summer of 1964 showed that an outbreak of banding occurred mostly where high air temperatures had prevailed. As the cool season advanced, the symptom of chlorotic banding disappeared from the leaves of P.R. 1059. Since the symptoms are similar to those described for banded chlorosis of sugarcane, but no causal agent has been identified, the malady has been tentatively identified as banded chlorosis caused by high air temperatures.

RESUMEN

La enfermedad conocida como franja clorótica se observó por primera vez en Puerto Rico en la Central Aguirre en hojas de caña de la variedad P.R. 1059. Por ser ésta una variedad prometedora, la presencia de la enfermedad fue motivo de gran preocupación. Un estudio realizado reveló que la severidad de la enfermedad variaba según donde se sembrara la caña. Los records de temperatura que se registraron durante el verano de 1964 demuestran que los brotes de esta enfermedad tenían lugar mayormente cuando la temperatura ambiental era alta. Al aproximarse la temporada fresca, lossíntomas de la franja clorótica desparecen de las hojas de la variedad P.R. 1059. Por la similaridad de estos síntomas a los que se

describen en el caso de la franja clorótica de la caña de azúcar, y por no haberse aislado el agente patogénico, la enfermedad se ha identificado tentativamente como franja clorótica causada por las altas temperaturas.

LITERATURE CITED

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3. Martin, J. P., Wismer, C. A., and Hughes, C. G., Environmental Effects, Sugarcane Diseases of the World, 2nd. ed., Elsevier Pub. Co., Amsterdam, London, pp. 240-64, 1964.
4. Necombe, F., and Lee, H. A., The cause of sectional chlorosis of sugarcane, *Hawaiian Planter's Rec. 31:* 125-8, 1927.
5. Vanderpool, T. C., Chlorotic banding of cereal seedlings, *Sci. Agr. 29* (7): 334-9, 1949.

ERRATUM

The following corrections apply to the paper by A. Maretzki, C. F. Asenjo, H. J. Teas, *J.A.U.P. 50*(1): 1-9 (1966).

p. 5 lines 10-13

"... The level of ascorbic acid in acerola leaves fluctuated between ca. 22 *micro*moles/gm. at periods of active fruit development, and 10 *micro*moles/gm. during relatively dormant periods."