NOTES ON A MINOR STALK AILMENT OF SUGARCANE IN NATAL

By J. R. ANDERSON

Summary

A brownish-black marking on meristematic and bud tissues, designated as Meristematic Blotch, has been frequently observed on several varieties of sugarcane in Natal. The sub-surface tissue damage is not great, but when occurring on buds may affect germination. Several fungi and bacteria have been isolated from affected tissues and whereas bacteria failed to reproduce the marking upon reinoculation, some gave rise to fermentation of the bud tissue. The most frequent fungus isolates, *Cephalosporium sp.* and *Nigrospora sp.* gave rise to a similar marking, singly and in combination, but results were not conclusive. Two insects *Aspidiotus sp.* and *Saccharococcus sacchari* are thought to play a part in initiating the condition. Fungus spores and mycelial fragments have been observed on the former of these two insects. A yeast, isolated from the body fluids of the latter named insect failed to produce markings of a similar nature but resulted in fermentation of the underlying tissues.

Introduction

During the course of investigations into the micro-organisms associated with stalks and setts of sugarcane, a brownish-black marking on the meristematic band and bud scales was frequently observed. As far as can be ascertained no description of this, or a similar blemish has been cited for Natal sugarcanes in the past.

Description

The condition, designated here as "Meristematic Blotch", takes the form of a dark-brown to blackish discolouration of the rind and sub-rind tissues immediately in the region of the meristematic band or nodes. The condition is also not infrequently observed on bud scales.

The blotch varies in size from punctiform to an oblong patch 25 mms. (or more) long, by 10 to 15 mms. wide, the margin of which is generally irregular and diffuse but fairly well distinguishable from non-affected tissues (photos 1 and 2). The rind tissues immediately within the blotch are sometimes slightly irregular, exhibiting an undulating or "pox-effect", the central cavities of which extend into the sub-rind tissues. This undulating or pox-effect of the blackened rind tissues is however not necessarily a consistent feature of the blotch, since frequent instances of a smooth, apparently undamaged rind have been recorded.

Discolourations ranging from red, through brown, to black may be observed to varying depths below the surface marking, but in general do not exceed 5 mms. in depth, and are confined to a smaller area of tissue than the surface marking.

The occurrence of this blotch on, or adjacent to the bud, is generally associated with somewhat smaller overall dimensions and may present a slightly depressed or concave appearance. Discolorations and depth of penetration are similar to those outlined above.

Transverse sections through the affected portions reveal blackened or reddish to dark brown cells which are fairly sharply defined from the adjoining healthy tissues. No apparent cellular distortions were observed but both inter- and intra-cellular thickening may be apparent. Both inter- and intra-cellular mycelial strands are frequently observed, the presence of which may be either primary or secondary. Sections taken from tissues nearer to the surface marking may exhibit ragged, oval-shaped holes of missing cells (photo 3), the incidence and size of which decrease with depth.

The condition appears to be associated with nodes of all age groups of stalk material, but is seldom observed on internodes, and never on the growing-point proper, or the first six to eight visible nodes below this.

Distribution and Effects

The blotch has been observed on the varieties N:Co.376, N:Co.310, N:Co.339, Co.331, Co.301 and Co.290. The highest incidence was observed in a field of N:Co.376 in which 90 per cent of the stalks exhibited the blotch on nearly every node. This material was designated as seed cane. Germination counts on material affected in this manner were lower than healthy canes, the appropriate percentages being: 68 per cent germination of affected and 82 per cent germination of healthy setts. The experiment was repeated on a second occasion when it was found that 75 per cent affected, and 78 per cent healthy setts germinated.

Seasonal flunctuations, if any, and distribution in the industry, have not been determined.

Isolation of Micro-organisms from Affected Tissues

Portions of the affected tissues, surface and sub-surface, were excised by means of a sterile scalpel, dipped in 95 per cent methanol, flamed and placed on the surface of Sabarouds agar (Difco), Potato dextrose agar (Oxoid), Nutrient agar (Oxoid), and CL-nutrient* agar, media. Several species of bacteria and fungi were isolated on fresh media from the plated tissues. These isolates were then used for re-inoculation of meristematic and bud tissues of healthy stalk material. Post inoculation immersion of stalk material in bees-wax prevented drying-out of the stalk sections during incubation at room temperature or higher.

*CL-nutrient agar. This medium was devised with a view to favouring the isolation of micro-organisms associated with stalk tissues. The filtrate from 500 grams of chopped whole-stalk, boiled for one hour in 1 litre of distilled water, was used as the suspension liquid for standard nutrient agar granules (Oxoid). The suspension was melted, dispensed in appropriate quantities into flasks or test-tubes and autoclaved at 15 lbs./ 20 minutes.

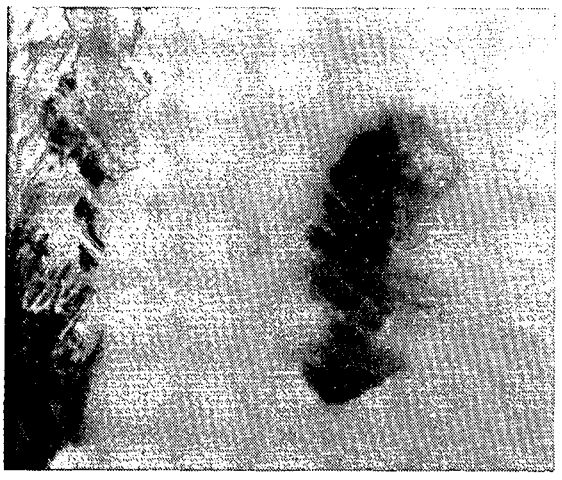

Photo: 1
Close-up of lesion on meristematic band.

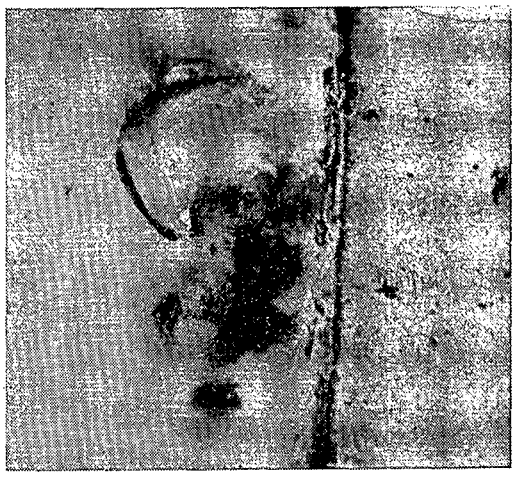

Photo: 2
Close-up of lesion on and next-to bud tissues.

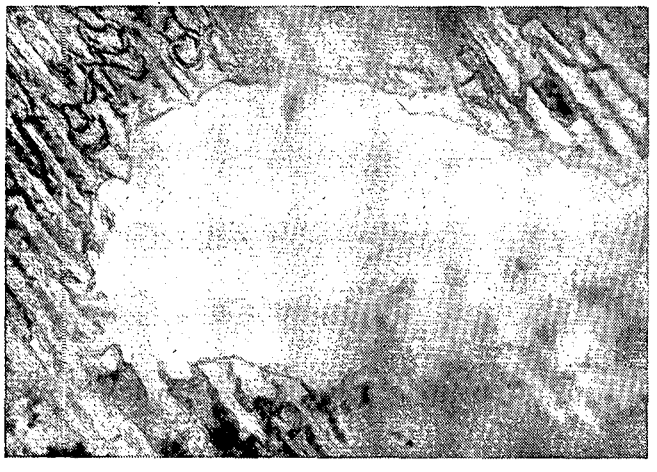

Photo: 3
Transverse section through meristematic lesion showing ragged area of missing cells.

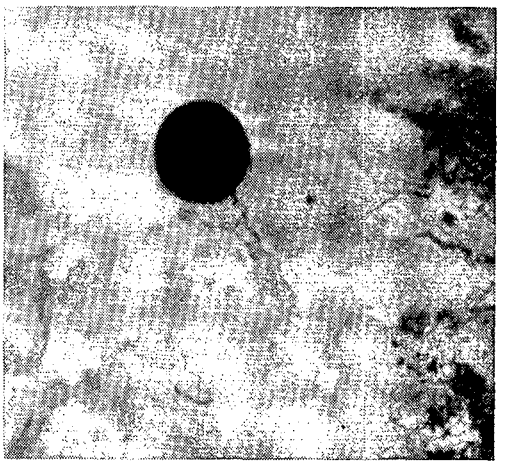

Photo: 4
Photomicrograph of spore and conidiophore of *Nigrospora sp.* in situ in meristematic lesions.

Photo: 5
Photomicrograph of *Aspidiotus sp.* showing antennae and oval-shaped spores.

Of all inoculations using bacterial isolates, none showed development of a similar blotch on meristem or bud tissues, although several resulted in fermentations of the latter tissues. Inoculations were carried out using a sterile dissection needle, the bacterial suspension being placed immediately over a surface-sterilised area of tissue and the needle passed through the suspension into the underlying tissues to a depth of up to 5 mms. Single (pure) cultures and combinations of cultures were used in this manner.

Inoculations of fungus isolates, by the same technique, involved the use of ten different fungi namely *Aspergillus spp.* (3), *Penicillium spp.* (2), *Fusarium sp.* (1), *Nigrospora sp.* (1), *Cephalosporium sp.* (1), *Hyaoloflorae sp.* (1), and *Rhizoctonia sp.* (1). Each of these isolates, singly and in combination, were inoculated into healthy stalk tissues but with disappointing results. *Nigrospora sp.* and *Cephalosporium sp.* both showed signs of producing a marking similar to that described, more especially when in combination. After incubation at room temperature, 28°C. and 30°C. for 4 weeks, however, no conclusive evidence of a similar marking could be established. Both fungi gave rise to a reddish-brown discoloration of sub-surface meristematic and bud tissues but in both cases the lesions were slight. *Nigrospora sp.* has frequently been observed in situ on the marking described (photo 4).

The inoculation of a species of yeast isolated from the body fluids of mealybugs (*Saccharococcus sacchari*) failed to produce symptoms of a similar nature to those described here, but did result in a fermentation of the node and internode tissues.

Possible Insect Associations

On several occasions it was noticed that node tissues taken from the top-most portion of stalk exhibited small puncture marks from which stalk fluids oozed. A small scale insect, *Aspidiotus sp.*, probably *destructor*[7] was observed on the meristematic band next to two such punctures. Upon removing this insect a small amount of sap was noticed to appear from the site formerly occupied by the insect, and on microscopic examination it was observed that the body contents of the insect included oval and fusiform spores as well as fragments of mycelium. The spores were also observed in the region of the mouthparts and antennae and attached in large numbers to the legs (photo 5). Whereas the puncture, presumably formed by the sucking action of this insect, was not blackened or discoloured in any way, it is postulated that this form of damage may be the means by which weakly parasitic fungi gain entrance, or are introduced, into meristematic and bud tissues. The possible influence of mealybug infestation in the initiation of this marking should not, however, immediately be discarded since the incidence of *Aspidiotus sp.* is by no means common in sugarcane in Natal.[3]

Conclusions

From the general appearance of the marking and from observations of transverse sections, as well as the finding of a scale insect on young meristematic tissues, it is possible that the condition, referred to here as Meristematic Blotch, is insect instigated. In view of the doubtful distribution of *Aspidiotus sp.* on sugarcane in Natal, the particular insect responsible must however remain unclassified in the absence of evidence of a more decisive nature.

The finding of at least two fungus species which have in the past been isolated from damaged or deteriorating stalks appears to be significant.

One of these fungi, namely *Nigrospora sp.* is believed to be similar to that described[4] in connection with a stalk rot in Louisiana. The symptoms of this disease are, however, dissimilar to the symptoms described here. *Cephalosporium sp.* has been isolated from Natal sugarcanes[6] and in spite of being confused[2] with *Gibberella moniliformis* (Sheldon) Wineland it is thought that this fungus may be a pathogen in its own right, since it has frequently been found[1] in association with deteriorating bud tissues. It is concluded that either Nigrospora or Cephalosporium, or both, may be responsible for meristematic blotch symptoms, having been inoculated into the tissues by some form of insect or having arrived purely by chance. Neither bacteria (isolated from the lesions) nor a yeast (isolated from mealybugs) are thought to be responsible for this condition.

It is not considered likely that "Meristematic Blotch" will adversely influence the growth of sugarcane, but it is possible that germination failures may become significantly greater in cases where this marking is directly associated with bud materials on a large scale.

References

[1]Anderson, J. R. (1962). Publication pending.

[2]Bourne, B. A. (1961). "Fusarium sett or stem rot" in "Sugarcane Diseases of the World", *Elsevier Pub. Co.*, London.

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[5]Martin, J. P., Abbott, E. V. and Hughes, C. G. (1961). Sugarcane Diseases of the World. *Elsevier Pub. Co.*, London.

[6]Martin-Leake, H. (1944). "Red rot of the sugarcane". Int. *Sugar Journal* 46 (541): 7-8.

[7]Munro, H. K. and Fouché, F. A. (1936). "A list of Scale Insects and Mealy Bugs and their Host Plants in South Africa". *Bulletin No. 158, Dept. of Agric. and Forestry. Rep. of South Africa.*

Mr. J. L. du Toit, in the chair, said one never knew when a minor ailment might become of great importance and therefore this paper was of real interest.

Mr. Wilson asked if Mr. Anderson had found reference in the literature to similar markings as those he had mentioned.

Mr. Anderson replied that the markings described were not to his knowledge reported elsewhere. One of the fungi, namely *Nigrospora sp.* had been reported on sugarcane stalks and leaves in the U.S.A., but the effects of this organism appeared somewhat different. The lack of description of the U.S.A. condition made it difficult to draw a comparison.