Some Observations on the Phenomenon of Revival of Sugarcane Shoots attacked by the Early Shoot Borer

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Introduction: While studying the borer incidence and borer population in cane shoots, in the Trichogramma colonisation Experimental plots at Nellikuppam a very interesting phenomenon was noticed. During the course of the studies, all the dead-hearts in the experimental plots were split open and examined. It was found that Argyria sticticraspis was responsible for most of the dead-hearts while Scirpophoga sp. and Diatrae Venosata were comparatively unimportant in producing dead-hearts. It was also observed, that the central core of most of the shoots was dead and rotton but quite surprisingly, a few shoots, showed the presence of healthy central growing point, which was even found producing a fresh central shoot pushing out the dead-heart. This observation indicated that all the borer attacked shoots may not die but that some of them may survive the attack.

Review of Previous Work: Ramakrishna Ayyar and Margabandu (1935) while discussing the possible effects of attack by Argyria on young shoots have not made any mention about the phenomenon of revival. Khan and Dabbir Singh (1942) in their studies on "Dead-hearts" caused by different species of sugarcane borers in the Punjab have mentioned that the Argyria sticticraspis larva is capable of completely severing the connection between the lower portion of the shoot and the central growing whorl of leaves but have not made any mention of the revival of the shoot. Issac (1938) has mentioned that 15% of the attacked shoots by top borer larvæ (Scirpophoga sp.) have revived, but the observation recorded does not concern the early shoot borer (Argyria sticticraspis),

As the phenomenon of revival of shoots attacked by Argyria sticticraspis, does not seem to have drawn the attention of any worker on cane a preliminary study was made in Nellikuppam (Madras State) on one variety of cane, CO 281, during two seasons (1948—1949 and 1949—1950) and the observations are summarised in this paper.

Method of Study: Twelve five cent plots were marked out in a bulk crop and in each plot two eleven feet lengths were marked on in each root at random, which works out to 3% of the area. Only primary shoots were taken for the study as facilities were limited. All the primary shoots emerging within that length were marked individually with twine and card-board slips dipped in paraffin wax. The cane setts were planted in August in 1948—1949, and in September in 1949—1950. As soon as

the borer infestation was noticed the dead-heart counts were started and continued every fortnight till the attack ceased. At every count, out of the total number of primaries, the number attacked and the number died were recorded. The dead-heart alone was pulled out at every count leaving the shoot undisturbed so that only fresh dead-hearts were taken into account at each count. Some of the plants dried up completely due to the attack and were pulled out. A few plants remained green in spite of the attack and put forth fresh shoots.

Results: The results of the observations are furnished in statements I and II.

Statements I and II show the total number of primaries at the initial stage (col. 2), the total number of dead-hearts formed (col. 3), primaries that were not attacked (col. 4) and the final stand of the primaries (col. 6). From the figures it can be seen that if all the shoots attacked had died and only the unattacked ones had developed into canes, the final stand should have been 114 in 1948—1949 and 202 in 1949—1950. But the final stand was 145 and 278 respectively. This increase is due to the revival of some of the attacked shoots. Out of 225 dead-hearts recorded in 1948—1949 forty five had revived which works out to 20% while in 1949—1950 out of 313 dead-hearts 76 revived which comes to 24·3%. So it is clear that under Nellikuppam conditions in August–September planting a rivival of 20 to 24% of the attacked primary shoots is possible in the variety Co. 281.

Discussion: It has been observed by Ramakrishna Ayyar and Margabandu (1935) that "a single Argyria sticticraspis larva may enter a shoot, tunnel it, come out again and enter fresh shoot." That is probably why a larva is not found in each and every attacked shoot. This observation has been confirmed by the examination of dead-hearts in Nellikuppam. From the above habit of the larva it is conceivable that it might enter a shoot and eat away a portion of the central shoot causing the dead-heart; but might not, in some cases, go deep enough to destory completely the growing point. Where the growing region of the shoot is left intact, inspite of tunnelling of the shoot by the borer, there is scope for further growth and it can slowly grow up after the attack and come up pushing out the dead-heart. This is probably how some of the dead-hearts have revived as noted above.

Conclusion: It is common experience that the ryot does not regard the attack of early shoot borer to be as bad for the crop as one would expect. The fact that an appreciable percentage of dead-hearts revive, may be, at least in part, responsible for the comparatively complacent view taken by the ryot. Hence this phenomenon is worth studying further in different seasons and with different varieties to get more detailed information.

Summary: A preliminary study was made in Nellikuppam, South Arcot District, on the revival of primary shoots of sugarcane (Co. 281) attacked by the early shoot borer, Argyria sticticraspis H.

It was observed that as much as 20 to 24% of the primary shoots, attacked by the above borer, revived.

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REFERENCES:

1. Issac, P. V. — Summary of the work done on sugarcane pests in India during 1938 (page 3).
2. Khan, A., Rahman & Dabbir Singh — Studies on dead-hearts by different sugarcane borers in Punjab — Indian Journal of Entomology Vol. 4 — 1942.
3. Ramakrishna Ayyar, T. V. & Margabhandu, V. — The moth borer (Argyria sticticraspis) of Sugarcane in South India — Agri & Live stock in India Vol. 4 — 1935.

STATEMENT No. I

Statement showing the number of primaries, dead-hearts, and final stand of sugarcane in 1948 – '49

Sl. No.	No. of primary shoots to start with	Total No. of Dead hearts	Primaries not attacked	Primaries attacked but revived	Final stand of the primaries	Remarks
1	2	3	4	5	6	7
1.	31	7	24	..	22	2 shoots damaged while hoeing
2.	29	21	8	11	19	
3.	38	28	10	8	18	
4.	29	22	7	3	10	
5.	45	26	19	..	19	
6.	28	21	7	8	15	
7.	29	22	7	6	13	
8.	30	29	1	5	6	
9.	25	9	16	..	13	3 do.
10.	23	22	1	3	4	
11.	21	10	11	..	2	9 do.
12.	11	3	3	1	4	
Total	339	225	114	45	145	14

159

Final stand : 159 — 14 (Damaged while hoeing) = 145

Note: 14 shoots damaged while hoeing happened to be healthy ones. But still they have not been taken into account for considering the revivals.

STATEMENT No. II

Statement showing the number of primaries, dead hearts, and final stand of sugarcane in 1949 – '50

Sl. No.	No. of primary shoots to start with	Total No of Dead-hearts	Primaries not attacked	Primaries attacked but revived	Final stand of the primaries	Remarks
1	2	3	4	5	6	7
1.	41	38	3	16	19	..
2.	32	28	4	8	12	1 damaged while hoeing and weeding
3.	40	25	15	3	18	4 do.
4.	35	18	17	2	19	1 do.
5.	45	11	34	1	35	1 do.
6.	42	24	18	5	23	1 do.
7.	51	31	20	4	24	4 do.
8.	45	20	25	4	29	3 do.
9.	44	24	20	6	26	1 do.
10.	44	22	22	4	26	3 do.
11.	45	32	13	10	23	
12.	51	40	11	13	24	
Total	515	313	202	76	278	19
			278			

Note: All the 19 shoots, damaged, happened to be infested shoots.

		1948 – '49	*1949 – '50*
1.	Total primaries attacked ..	225	313
2.	Primaries revived ..	45	76
3.	Percentage revival ..	20	24·3

Studies in Sorghum — the Fundamentals of the White and Dull Mid-rib

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Introduction: Two types of cultivated sorghums, one having white mid-rib and other having dull mid-rib occur in nature. The white mid-ribbed types are found to have pithy stalks while the dull-mid-ribbed types have juicy stalks. The inheritance of this character was worked out by Hilson (1916) and he found it to be controlled by a single gene; the factor for white mid-rib being dominant. Swanson and Parker (1931) found distinct genetic factors responsible for juiciness of stalk and sweetness of the juice but did not pursue the inheritance of the latter.

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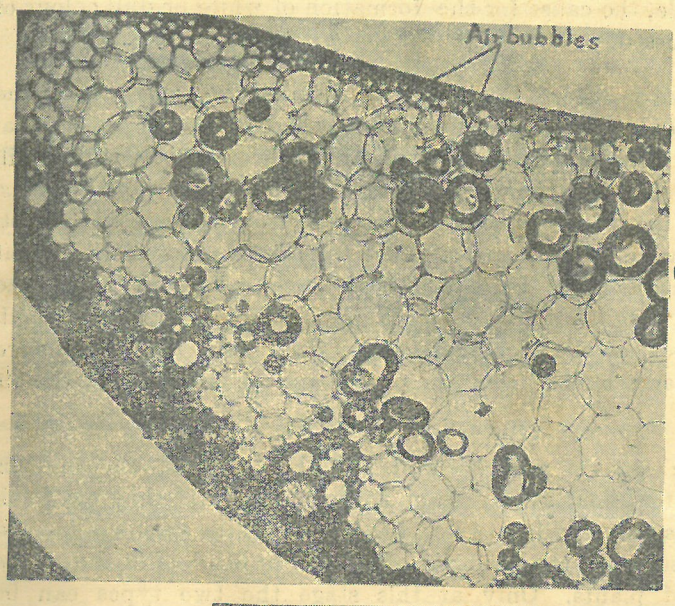

Fig. 1 (× 60)
White midrib
(note the air bubbles)

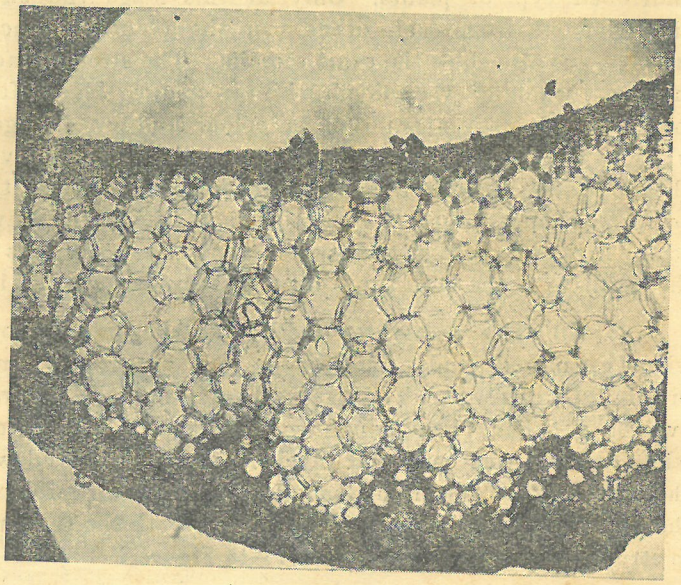

Fig. 2 (× 60)
Dull midrib

Transverse Sections of Midribs in Sorghum Leaves

Rangasamy Ayyengar *etal* (1936) found that the genes for pithy and juicy stalks to be independent of the genes responsible for the taste of juice, namely "salt" and "sweet" which is governed by a single gene. No attempt has yet been made to find out the cause of the colour of the mid rib. In this article, the cause for the formation of white or dull colour of the midrib is discussed.

Materials and method: Cholam K. 2, a vellai cholam strain of the Koilpatti tract (white midrib) and Cholam M. S. 8159 another vellai cholam selection from Coimbatore (dull midrib) were studied in detail. Both the type belong to the botanical group *Sorghum sub-glabrascens*. They were raised in separate plots and observed from sowing to harvest. When the plants were at the boot-leaf stage transverse sections of the leaf mid-ribs from the 4th leaf from the boot were examined under the microscope. The weights of entire length of the midribs from the fourth leaf from the boot (at the shot blade stage) from both the types were recorded soon after removal from the plants and after drying in the air under shade.

Experiment: (a) It was observed in both the types, the midribs are dull in colour for about 20 days from sowing i. e., untill they put forth their 9th leaf. As the seedlings grow further, a white streak is formed all along the centre of the mid-rib of the 7th or 8th leaf of the white midribbed type of plants. Only at this stage the two types can be differentiated from each other. As the plants advance in growth the other leaves also show the same streaks. The streak gradually widens to make the whole of the midrib white in colour. Even after this stage, the midribs on the leaves are dull in colour as they emerge but soon turn white as they fully emerge out. The dull midribbed variety shows no change untill about ten days after flowering. After this, the midribs begin to change colour. The midribs of the lower leaves change their colour first and those at the top, later. When the ears fully mature all the midribs of the both types become completely white in colour.

(b) The transverse section of the midribs of both the types when examined under microscope did not reveal any structural or pigmental difference. The size and position of cells were similar. However, a peculiar phenomenon was observed. Whenever the section of white midrib was mounted in glycerine and covered with a cover slip, the cells in the central portion glistened with air bubbles which was not the case in the dull midrib. But for this both the sections were identical in structure and pigmentation. (Plate Figure 1 & 2).

(c) Entire midribs of fifteen leaves (4th leaf from the top) from each of the types were removed and weighed separately at the time of shot-blade stage. They were then dried in air under shade for 10 days and were weighed again, till constant weight was obtained. The percentage

loss of weight was calculated. The loss of weight was 73·9% in the dull midrib and 57·9% in white midrib (see tables).

TABLE.

Percentage of loss due to dryage of the fourth leaf midribs to their original weight			
Nature of Midrib	White	Dull	Difference
Dryage percent	57·9	73·9	16·0
S. E.	2·7	2 0	
S. E. of the difference between means	3·2		
Significant or not	Significant		
Critical difference at 5% of level	6·6		

After drying up dull midrib shows a wrinkled appearance. Its colour also changes to white and it becomes difficult to distinguish the two types of midribs by their colour.

Discussion: Ramaswamy Ayyengar *etal* (1935) have recorded that juicy type (dull midrib) gives and extraction of 33 to 48% of juice as against 17 to 20% of juice in the pithy type (white midrib). This shows that the juicy the type has a definitely higher quantity of juice as compared to the pithy type. The experiment where the dull midrib lost 16·0% more of its weight when air dried shows clearly that the juicy stalked midrib contains more of plant juice. When this extra water content is dried up the midrib wrinkles and assumes a white colour indicating that the colour has great bearing on the juice content of the midrib. No structural or pigment differences were noted in the transverse sections of the two types of midribs. But air vacuoles were found only in the case of white midrib in the pith cells. This indicates that parenchyma cells in the white midrib are either empty or partially empty.

Summary: The real cause for the formation of the white or dull colour of the midrib in sorghum is discussed in this article. The colour is not due to any pigment, or structural arrangements of the cells. The dull colour is formed by the higher cell-sap contents.

LITERATURE CITED

1. Hilson (w1916) Agricultural Journal, India, 11.
2. Swanson and Parker (1931) Journal of Heredity, 22.
3. Rangasamy Ayyengar, G. N., *etal* Madras Agricultural Journal, 1936, 24, 247.
4. Snowden, J. D., The cultivated races of Sorghum, 1936.
5. Rangasamy Ayyengar, G. N., *etal* Madras Agricultural Joural, 23, 350.