The occurrence of biflorous spikelets was a common feature in the late formed arrows of SES 113B. These spikelets also carried the extra styles. The phenomenon may be similar to multiple seeded spikelets observed in some cultivars of sorghum[6]. The other possibility could be that the sterile flower which is represented as a delicate lemma or third glume might have developed into a fertile flower and added to the extra floret observed within the same spikelet. This lends support to the fact that the spikelets of sugarcane are fundamentally two flowered like maize, sorghum and other related grasses. It might also be due to disturbances during the fertilisation[4], which might have made even the sterile flower functional.

More than 90% of the pistils of SES 113B grown in *in vitro* developed into supernumerary ones (Fig. 2).

FIG. 2. Showing the multiple pistillate condition. From one ipsitl as many as four to five were found to develop with or without their styles. Often the styles originated with their basal portion being swollen. This might have resulted from the development of all the carpels into a ovule each accompanied by with or without the development of rudimentary sterile flower. It is also possible that each pistil has several primordia which under favourable condition can develop into flowers. Thanks are due to Dr. J. T. Rao and Dr. D. Jagathesan for encouragment.

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A CHROMOSOME MAP OF FIVE ANTHOCYANIN GENES IN RICE (*ORYZA SATIVA* L.)

RAMIAH[11] first reported a linkage group of genes controlling pigmentation in four parts, *viz.*, leaf sheath internode, apiculus and stigma. About a dozen accounts of linkage between genes determining two or three of the above characters have appeared so far in literature. They are briefly summarised below :

Linked pigment characters	Cross over estimates in percentage reported in the references
Leaf sheath — stigma	(4) 9·8
Stigma — apiculus	(13) 9·11; (10) 11·61; (7) 12·0; (9) 12·0; (8) 2·99
Leaf sheath — apiculus	(13) 11·91; (12) 18·0
Leaf sheath — internode	(5) 4·30; (12) 14·0
Stigma — internode	(6) 17·19; (7) 4·0

Note : Figures in brackets are numbers of the references given at the end of the note.

This note is meant to show the arrangement of the above genes in a chromosome map. The finding is based on F_2 data collected in reciprocal crosses between two varieties, *viz.*, Blue Belle* and Kosbhat**. The (B × K) F_2 and (K × B) F_2 had respectively 172 and 167 plants. They were scored for colour expression in leaf sheath, internode, apiculus and stigma by conventional methods. Pigment in leaf sheath could not be recorded in (B × K F_2, as the plants were in a water-logged spot where colour expression was not clear due to decay of the sheath. Since there was good homogeneity between the two crosses for the single character segregations of internode, apiculus

and stigma, the data of the two crosses for these characters were pooled. The segregation ratios were as follows :

	Coloured : Non-coloured
Leaf sheath	3 : 1
Internode	27 : 37
Apiculus	45 : 19
Stigma	162 : 94

The data for the 3 two-by-two joint segregations, not involving the leaf sheath, were also homogeneous, and hence were combined. Linkage testing was done by the χ^2 (chi-square) method. As χ_L^2 was significant for all the joint segregations, cross-over percentages were estimated by Fisher's scoring method (Bhat[1]). Expectations for class frequencies were worked out by the method suggested by Bhat[2]. The estimates were as below :

	Per cent
Leaf sheath — stigma	$5 \cdot 66 \pm 0 \cdot 062$
Stigma — apiculus	$0 \cdot 51 \pm 0 \cdot 018$
Apiculus — internode	$9 \cdot 45 \pm 0 \cdot 012$
Leaf sheath — apiculus	$6 \cdot 00 \pm 0 \cdot 031$ (6·14 p.c.)
Stigma — internode	$10 \cdot 56 \pm 0 \cdot 019$ (9·94 p. c.)
Leaf sheath — internode	$11 \cdot 40 \pm 0 \cdot 013$ (15·26 p.c.)

These estimates are very precise as their scores are near about zero as required and are suggestive of the following linear order of genes (for the four pigment characters) in the relevant charomosomes :

Leaf sheath → Stigma → Apiculus → Internode

Estimates for the two joint segments of the chromosome, *viz.*, (i) leaf sheath—apiculus and (ii) stigma—internode are in very good agreement with expectations (given in brackets above) made by Kosambi's formula (Bhat[1,2]). This confirms the order of the genes as suggested above. But, the estimates of the entire segment from leaf sheath to internode is much lower (11·40 p.c.) than the expected (15·26 p.c.). However, the deviation does not appear to be high. At 11·40 p.c. C.O. the score is +0·062, but even at 15·26 p.c. C.O. the score is only +1·05. So 11·40 p.c. C.O. may be taken as a fairly satisfactory estimate.

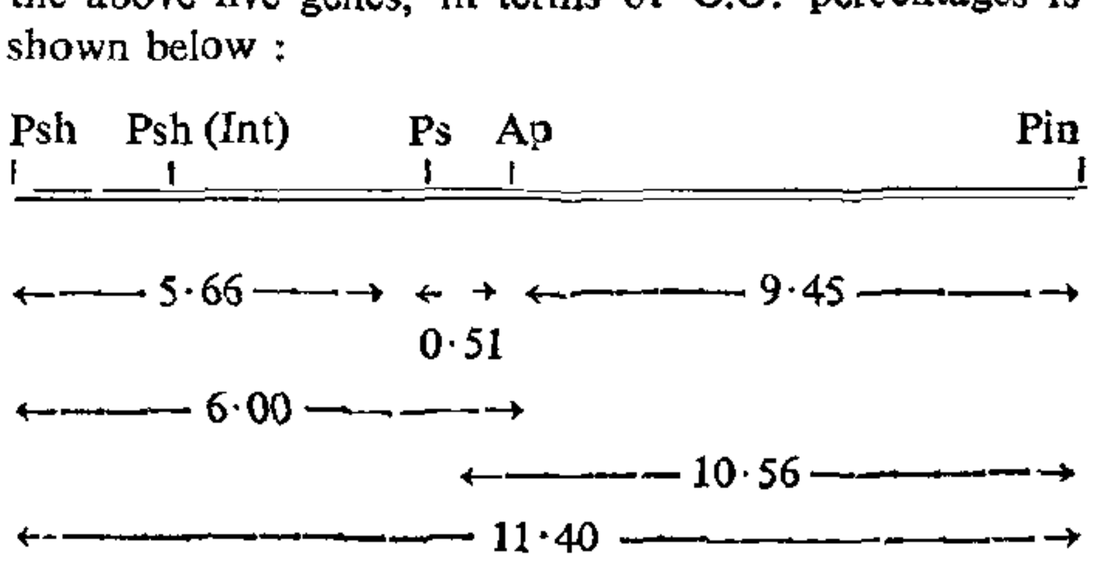
It is to be pointed out that the genes for apiculus and stigma involved in linkage are basic complementary genes and not complementary duplicates as the expectations for the latter do not lead to any estimates with the (basic) gene for leaf sheath.

Referring to the estimates reported by various authors as tabulated above, it is to be pointed out that none of them deals with all the genes included in this study. Also no two authors are in agreement with one another. Neither our estimates agree with any of them except with that for leaf sheath—internode (Psh–Pin 14·00 p.c.) reported by Richharia *et al.*[12]. There could probably be two reasons for such wide differences; one, the different geneologies of the varieties used in the crosses which might have involved diverse chromosomal changes and two different methods employed in esti mation.

In this investigation, it has been found that the genes controlling the two characters, *viz.*, colour in leaf sheath exterior and colour in leaf sheath interior are different. The total number of plants studied for both characters was 167 and in both cases, the segregation ratio was monogenic. Taking leaf sheath (Ext) as the first and leaf sheath (Int) as the second character and denoting presence and absence of colour by + and − signs respectively, the joint segregation was as below :

++	+−	−+	−−	Total	χ_L^2	Probability
119	2	1	45	167	176·46	$< 0 \cdot 01$

The χ_L^2 and the probability for a 9 : 3 : 3 : 1 segregation are also given in the same line. Their joint segregation (with $\chi_L^2 = 176 \cdot 463$) gave an estimate of 1·75 p.c. C.O. It has not been thought worthwhile to make estimates afresh for joint segregation between leaf sheath (Int) on one side and internode, apiculus and stigma on the other as they would be very nearly the same (but very slightly on the lower side as between leaf sheath (Ext) and the other three characters; becuase, in the former case, in each of the joint segregations, the number of cross-over plants is only one less (59 *vs.* 60; 14 *vs.* 15; and 21 *vs.* 22) respectively. The locus for the gene for leaf sheath (Int) which may tentatively be symbolised as Psh (Int) would be close to the gene, Psh, towards the gene, Pin. A chromosome map of the above five genes, in terms of C.O. percentages is shown below :



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* Blue Belle is introduced from Texas, U.S.A.

** Kosbhat is a derivative of the cross (Mtu-3 × T.N. 1).

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INFLUENCE OF CARBON SOURCES ON IAA SYNTHESIS BY TWO SEED BORNE FUNGI

A WIDE variety of micro organisms are known to produce growth promoting substances under various conditions, such as pathogenesis, microbial interactions, mycorrhizal associations and rhizosphere[1–3]. Out of 112 fungal species *representing saprophytic* and parasitic, screened by Vyas and Jain[10] 61 species were found to produce growth promoting substances. A number of investigators[4–7] have reported the IAA synthesis, from tryptophan, a precursor of IAA. Sequeira[2] however pointed out that different organisms may have evolved different pathways of IAA synthesis involving precursors other than tryptophan. Hence a detailed investigation has been undertaken to study the IAA synthesis in the absence of tryptophan in different carbon sources by two seed borne fungi.

Monosporic cultures of *Phoma exigua* Desm. and *Graphium penicillioides* Corda *isolated from* seeds of *Phaseolus aureus* Roxb. and *Cyamopsis tetragonaloba* Taub, respectively were grown on 25 ml of Asthana and Hawker's liquid medium. Various carbon sources such as fructose, sorbose, sucrose, maltose, dextrin and starch were substituted for glucose of the basal medium. The sterilised flasks were inoculated and incubated at 25 ± 2° C. At the end of 4, 8 and 12 days of incubation, the mycelium was harvested and the culture filtrate was analysed quantitatively for IAA production by the method suggested by Bentley[9]. The uninoculated culture broth *plus reagent served* as control.

The results are presented in Table I. From the the table it is clear that *P. exigua* synthesised more IAA than *G. penicillioides* on all carbon sources. The efficiency of synthesis varied with the carbon source.

TABLE I

The IAA synthesis by P.. exigua *and* G. penicillioides *on different carbon sources at* 4, 8 *and* 12 *days of incubation*

Carbon Source	Days of incubation	IAA in µg/ml	
		P. exigua	*G. penicillioides*
Glucose	4	27·5	77·5
	8	573·0	257·5
	12	660·0	377·5
Fructose	4	20·5	..
	8	181·0	52·5
	12	252·5	137·5
Sorbose	4	..	..
	8	..	..
	12	..	..
Sucrose	4	7·5	..
	8	252·5	27·5
	12	410·5	202·5
Maltose	4	257·5	52·5
	8	407·5	132·5
	12	482·5	285·5
Dextrin	4	25·0	..
	8	102·5	74·5
	12	110·0	98·0
Starch	4	57·5	..
	8	87·5	89·5
	12	112·5	147·5

In general glucose favoured substantial IAA synthesis. Sorbose, a toxic monosaccharide for most of the fungi, did not allow IAA synthesis at any incubation period. The two oligosaccharides varied in their efficiency.