THE RELATION OF ANTHER COLOR AND THE PROPORTIONS OF STARCH FILLED POLLEN GRAINS IN THE SUGAR CANE

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The arrowing or flowering of most commercial sugar cane varieties in Puerto Rico takes place from the last week in October to the middle of January. The most effective period for crossing work extends from the middle of November to mid-December. Previous to this period the numbers of arrows are limited and after this period the condition of the arrows is not so good. Emergence from the sheath or boot is slower, in many instances incomplete, irregular, and slower.

Within the limits of the material available it is desirable to obtain as many new combinations and as large a number of crosses within the combinations as possible. Where trained help is scarce it is desirable to have some rapid method of determining pollen fertility of the varieties to serve as males. Bannier (1) describes a suitable method but it requires more personnel than the writer has had available in carrying out his work at Río Piedras, P. R. During the years 1929 and 1930 the arrows and attached canes were cut in the late afternoon, brought to the laboratory, and placed in quart Mason jars with water and a quantity of 6 per cent H_2SO_3 sufficient to approximate a 1 : 3000 solution. The following morning when pollen shedding took place, samples were collected on slides and examined microscopically in a saturated solution of iodine in chloral hydrate. Counts of iodine positive and iodine negative staining pollen grains were recorded. Anther color was noted under field conditions. In 1931 with a larger number of unknown potential males coming into bloom it was realized that our methods would not permit us to do much more than make pollen observations if the methods were not changed. Hence the arrows were cut without the attached canes. Small samples were examined microscopically from florets unopened but just below those which shed pollen for that day. The arrows were then placed in sheets of newspapers between blotters and dried for 10 days to two weeks. Blotters were changed every 2–5 days. Further samples were taken at a later date and comprise the data presented in table II.

Pollen counts

In crossing campaigns previous to 1930 it was noted that varieties with purple or purplish anthers seemed to give larger counts of iodine positive grains than those with yellow. In order to observe any relation between degree of color of anther and iodine reaction a number of varieties were examined. They were grouped into three classes with respect to color of anthers. In 1930 pollen counts were made of 15 varieties. All arrows were taken from field plantings unless otherwise noted.

TABLE I

RELATION OF ANTHER COLOR AND IODINE REACTION 1930

Variety	No. of pollen grains counted	Per cent Iodine Positive in		
		Purple Anthers	Med. Pur- Anthers	Yellow Anthers
P.R. 358	1069	.....	37.04	.....
Co-281	1487	.....	54.67	.....
SC 12-4 (Drums)	1439	.....	57.19	.....
SC12-4	1335	89.97	.....	.....
POJ-2878	1399	.....	82.13	.....
P. R.-492	205	.....	56.10	.....
POJ-2725 (Collection)	1110	.....	.....	3.93
POJ-2725	No count.	.....	.....	Less than 1
Kassoer	740	51.61	.....	.....
Tuc-472	1349	72.45	.....	.....
POJ-2364	869	.....	.....	1.62
Badilla	555	.....	49.91	.....
POJ-36	No count.	.....	.....	Less than 1
D-1135	1204	66.03	.....	.....
Tuc-450	613	66.07	.....	.....
Tuc-454	513	.....	51.85	.....
T-2009	1028	.....	77.62	.....
Average	.....	71.74	60.25	2.91
Maximum	.....	89.97	83.13	3.93
Minimum	.....	51.61	37.04	1.62

The assistance of Miss Ana Molina, Inst. in Biology, U. P. R., in making most of the counts in table I is hereby acknowledged.

In general the data seem to show that intensity of purple coloration of the anthers is some indication of the fertility of the enclosed pollen grains. Undoubtedly as between yellow and purple of medium or better, the latter are to be preferred for use as males. It is interesting to note that in the case of SC 12-4, pollen from field grown plants had a higher percentage of iodine positive pollen grains and more intense purple color than those grown in drums.

In 1931 notes were available on 41 varieties and they were grouped according to anther coloration into 4 classes. The data presented in table II are based on the sum of the counts of the first and second samples as mentioned above. There is essentially no difference between the counts made in November 1931 and those made in August

1932. The correlation coefficient between the two series of observations was $0.642 \pm .059$. See table II.

TABLE II

RELATION OF FRESH AND DRY FLOWERS

Percent Positive November 1931	Percent Positive August 1932									
	0–10	11–20	21–30	31–40	41–50	51–60	61–70	71–80	81–90	
0–10	14	1	1	.....	1	.....	.....	.....	.....	17
11–20	1	.....	.....	1	.....	.....	.....	.....	.....	2
21–30	.....	.....	3	2	1	.....	.....	.....	.....	6
31–40	1	.....	.....	1	1	.....	.....	.....	.....	3
41–50	.....	.....	.....	1	2	.....	1	.....	.....	4
51–60	.....	.....	.....	.....	3	3	.....	.....	.....	6
61–70	.....	.....	.....	.....	1	.....	.....	1	1	3
71–80	.....	1	1	.....	.....	.....	.....	.....	.....	2
	.....	.....	.....	.....	.....	1	.....	1	.....	2
	16	2	5	5	9	4	1	2	1	45

NOTE: The discrepancy in total observations between tables II and III is due to the fact that anther color determinations were lacking in 4 cases.

TABLE III

RELATION OF ANTHER COLOR AND IODINE REACTION 1931

Purple Anthers			Med. Purple Anthers			Tinged and Light Purple Anthers			Yellow Anthers		
Variety	No. Pollen grains	Per cent Iodine Positive	Variety	No. Pollen grains	Per cent Iodine Positive	Variety	No. Pollen grains	Per cent Iodine Positive	Variety	No. Pollen grains	Per cent Iodine Positive
PR 26-14	930	69.9	POJ-2878	718	27.0	PR-334	500	47.0	POJ-36	750	0.0
PP-26-8	772	59.3	Al-32	506	30.2	PR-358	474	34.8	G-119	750	0.0
			PR-507	649	55.5	PR-422	849	56.5	POJ-2883	700	0.0
			US-875	577	52.4	PR-202	705	35.2	PR-728	435	24.2
			PR-702	732	50.0	Al-15	1408	0.59	Tuc-521	425	2.8
			Co-281	859	37.0	Tuc-450	556	5.8	POJ-2364	750	0.0
			PR-701	717	74.9	PR-547	1180	47.2	Tuc-491	500	0.0
			PR-208	421	74.6	Tuc-472	1294	11.2	POJ-2725	500	0.0
			PR-207	638	70.9	Tuc-454	1016	0.17	CP-807	850	0.0
			PR-357	547	32.0	PR-720	725	54.0	PR-440	763	11.7
			PR-26-187	735	45.0	Co-213	576	26.4	POJ-36M	700	0.0
			PR-338	613	44.0	POJ-2822	879	35.0	CH-64-21	700	0.0
						Ba-11569	1026	8.0	Merthi	700	0.0
									PR-807	700	0.0
Total	1702	65.1		7712	48.9		11188	27.7		9223	2.25
Maximum		69.9			74.9			56.5			24.2
Minimum		59.3			27.0			0.17			0.0

The 1931 data show a similar trend of the average per cent of positive reacting pollen grains to increase with the increase in intensity of the anther color. The range and therefore the variability is very high in both years.

If we may assume that arrows with 50 per cent fertility as indicated by the iodine test are worth using as parents then anything below medium in color should be only used after a microscopical examination with iodine has been made. Of course all varieties used as males should be checked up for pollen fertility by the iodine test sooner or later.

SUMMARY

1. It has been shown that within rather wide limits there is a positive relationship between pollen fertility as indicated by the iodine test and the degree of anther coloration in the sugar cane.

2. That pollen samples taken from dried flowers nine months after the fresh samples have been taken are similar in their iodine reaction has also been demonstrated.

REFERENCES

(1) Bannier, J. P. De Rietveredeling aan het suiker proefstation te Pasoeroean; Techniek, richting en resultaten van 1893–1925. Archief v. Suikerind. Ned. Indie, Meded. Proefstation Java suikerindustrie. Jaargang 1926 No. 19.