

Estimation of Pollen Production in Fruit Crops*

by

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Synopsis: The use of the haemocytometer for the estimation of pollen production in papaya, pomegranate and sapota is dealt with in this paper. The marked variation in the pollen output among the varieties has been brought out. The number of pollen grains per anther varied from 682 to 3,297 in the sapota, 8,950 to 12,465 in the papaya and from 15,982 to 23,170 in the pomegranate.

In the course of investigations on the pollination of some fruit crops at the Agricultural College and Research Institute, Coimbatore, the authors observed a marked difference in the quantity of pollen produced in the different kinds and varieties of crops. Some were characteristically deficient in pollen while certain others had an abundant quantity of it. The amount of pollen also varied with the variety and the season. Oberle and Goertzen (1952) have reported a similar disparity in pollen production in varieties of apple, plum etc., at the Virginia Agricultural Experiment Station. They have described a method for evaluating the pollen content of the anthers by the use of the haemocytometer, which they state, offers an accurate measure of the pollen output. They have also cited the work of Pohl who counted the grains in a fractional portion of pollen suspension in water and of Erdtman who used chemicals to dissolve the structure of entire flowers or anthers except the exines and then counted the exines. In a recent communication, Gangolly *et al* (1961) have described a method more or less similar to that of Pohl's for estimating the pollen output in the coconut. According to them the mean content of pollen in individual flowers in the different varieties of coconut ranged between 11,678 to 26,245.

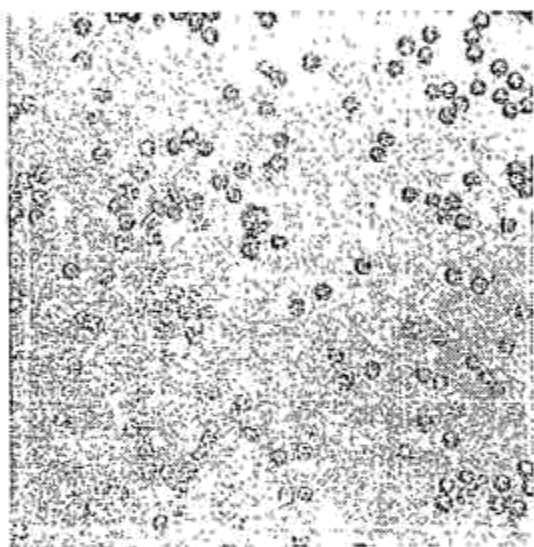
Materials and Methods: The present work deals with the use of the haemocytometer for the estimation of the pollen production in three of the tropical fruits, viz., papaya, pomegranate and sapota. Three varieties in each were tested. The procedure of estimation was more or less similar to that of Oberle and Goertzen (1952). From flower buds of each variety collected just prior to anther dehiscence, one hundred anthers were gathered in vials and stored in a desiccator for a few hours. After dehiscence, two and a half millilitres of water containing 0.05 per cent teepol was added and the contents thoroughly stirred in order to obtain an even dispersion of

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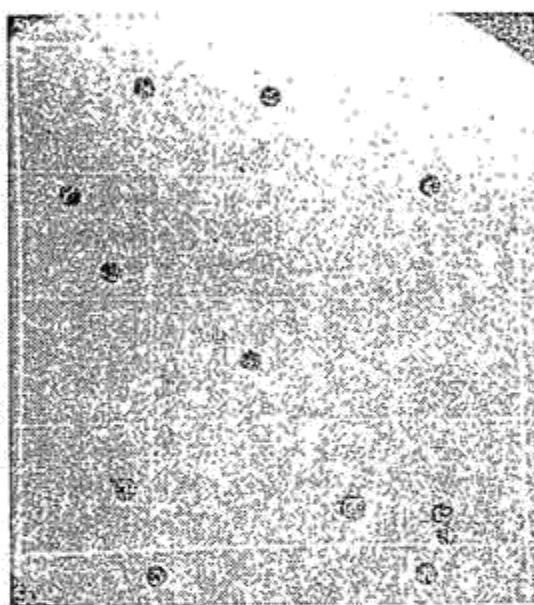
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the grains in the suspension. Teepol was used in place of calgonite employed by Oberle and Goertzen (1952). A drop of this suspension drawn in a fine pipette was transferred to each of the two counting chambers of a Spencer Bright Line Haemocytometer. Each chamber has an area of nine square millimetres ruled into square millimetre areas. Each of the four corner square millimetre areas is ruled into 16 areas (plate I), while the other five square millimetre areas are ruled into smaller divisions. The counting chambers are 0.1 mm in depth so that the volume of solution over a square millimetre is 0.1 cubic mm. On this basis, the number of pollen grains can be derived as follows:



Pollen grains of papaya as seen in one of the four corner squares of the Spencer's Bright Line haemocytometer.



Pollen grains of sapota as seen in one of the four corner squares of the Spencer's Bright Line haemocytometer.

The contents of 100 anthers are suspended in 2.5 ml of solution. Thus the contents of each anther are suspended in 0.025 ml of solution or 25 cubic mm.

If N = average number of pollen grains counted per corner square and
 X = number of grains per anther,

$$N : X = 0.1 : 25$$

$$0.1X = 25 N$$

$$\text{therefore } X = 250N$$

The pollen grains in each of the four corner squares of each counting chamber were counted with the help of a hand tally counter using the low power objective of the microscope.

For each of the three varieties in each crop, ten such estimates were made so that the number of anthers involved per variety was $10 \times 100 = 1000$.

Results: The mean number of pollen grains recorded per anther in the three crops given in table I shows that the crops differ markedly in respect of their pollen output. The highest number of grains has been recorded in pomegranate followed by papaya and sapota.

TABLE I.
Mean number of pollen grains per anther

Kind	Variety	Mean number of grains counted per corner square (0.1 c. mm)	Number of grains per anther (N x 250)
Sapota	Long Oval	12.75	3,187
	Dwarapudi	13.19	3,297
	Gavarayya	2.73	682
Papaya	Co. 1	46.36	11,590
	Red Fleshed	35.80	8,950
	Washington	49.86	12,465
Pomegranate	Kashmir	92.68	23,170
	Kabul	63.93	15,982
	Vellodu	81.49	20,372

The statistical analysis of the data on the degree of variation among the three varieties in each crop are presented in tables II, III and IV. In all the three crops, the variation among the varieties has been found to be highly significant.

TABLE II—*Sapota*
Analysis of variance

	Degrees of freedom	Sum of squares	Mean sum of squares	F
Between estimates and within varieties	27	5,217	193.22	
Varieties	2	5,729	2864.507	58.88**
Error	210	10,217	48.65	
Total	239	21,163		

SUMMARY OF RESULTS
Comparison of Varieties

Variety	Mean	S. E. of means	C. D. (p=0.05)
A Long Oval	12.75		
B Dwarapudi	13.19	0.78	2.16
C Gavarayya	2.73		

Conclusion: $\overline{B \ A} \ C$

TABLE III—*Papaya*
Analysis of variance

	Degrees of freedom	Sum of squares	Mean sum of squares	F
Between estimates and within varieties	27	66680.7	2469.65	
Varieties	2	8575.2	4287.607	5.171**
Error	210	174120.1	829.14	
Total	239	249376.0		

SUMMARY OF RESULTS
Comparison of Varieties

Variety	Mean	S. E. of means	C. D. (p=0.05)
A Co. 1	46.36		
B Red Fleshed	35.80	3.22	8.92
C Washington	49.86		

Conclusion: $\overline{C \ A} \ B$

TABLE IV—*Pomegranate*
Analysis of variance

	Degrees of freedom	Sum of squares	Mean sum of squares	F
Between estimates and within varieties	27	337877	12513.96	
Varieties	2	33604	16802.007	8.33**
Error	210	423428	2016.32	
Total	239	794909		

SUMMARY OF RESULTS
Comparison of Varieties

Variety	Mean	S. E. of means	C. D. ($p = 0.05$)
A Kashmir	92.68		
B Kabul	63.93	5.02	13.91
C Vellodu	81.49		

Conclusion: $\overline{A \quad C} \quad B$

Discussion: The results of the investigation indicate the utility of the haemocytometer in estimating the pollen production in fruit crops with a greater degree of accuracy than has been possible hitherto with the available techniques. While varietal, seasonal and other environmental factors may exert an influence on the quantity of pollen produced, the technique described here could be used for determining the pollen production in any given set of conditions.

The wide range of variation in the pollen content in the varieties dealt with in this investigation emphasise the need for extended studies with other kinds and varieties of horticultural crops.

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