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Pollen Germination in the Avocado

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The reasons for the erratic and unsatisfactory bearing of certain avocado varieties in California are not altogether clear though considerable work has been done on this problem. In the case of the most important variety, Fuerte, a temperature relation seems to have been established (3) in that bearing is poorest in the coastal regions, where lowest mean temperatures occur during the period of flowering and fruit setting. The suggestion naturally occurs that lack of viable pollen or poor viability and germination may be responsible for this behavior. The purpose of this study is to determine the viability of avocado pollen and its germination at relatively low temperatures.

Numerous attempts to germinate avocado pollen by ordinary techniques using sugar solutions were tried, but failure resulted in all cases even where other pollens germinated. This indicates that possibly some substance essential to the growth of avocado pollen was lacking. Moreover, the fact that avocado pollen was found to germinate on the stigmas of a number of other plants and that pollens from other plants germinated on avocado stigmas (Table I) further indicates that the artificial medium lacked some essential substance or condition necessary to avocado pollen tube growth. Supplementary substances such as yeast extract, vitamin B_1, and crushed stigmas added to the sugar solutions, however, failed to cause pollen germination.

TABLE I—Germination of Various Pollens on Avocado Stigmas and of Avocado Pollen on Other Stigmas

Pollen	Stigma	Germination*
Apple	Avocado	+
Feijoa	Avocado	+
Passiflora	Avocado	+
Boysenberry	Avocado	+
Papaya	Avocado	+
Citron	Avocado	0
Hibiscus	Avocado	0
Avocado (Fuerte)	Feijoa	0
Avocado (Fuerte)	Apple	+
Avocado (Leucadia)	Papaya	+
Avocado	Citron	0
Avocado	Carnation	+
Avocado	Passiflora	+
Avocado	Sterculia	+
Avocado	Lily	0

*+ Indicates one or more grains germinating distinct pollen tubes.

Satisfactory results were finally obtained, by germinating the pollen grains directly on stigmas, using a modification of the technique employed by Buchholz (1) and Chandler (2). The technique used was briefly as follows: Pollen was transferred to unpollinated, freshly matured stigmas. After a given time, in most cases about 12 hours, the pistils were collected, killed and fixed for about an hour in a solution of 100 parts of 70 per cent alcohol and 7 parts of commercial formalin. Staining was done on the slide with equal parts of saturated aqueous solution of light green and aceto-carmine for 10

minutes. The pistils were then rinsed quickly with 95 per cent alcohol and mounted in a drop of glycerine, at which time pressure was applied to the coverslip to crush the pistils flat for better observation.

This technique is useful only as a qualitative indication of pollen germinability because of the varied environment provided for the grains on the highly papillose stigma. However, the data thus obtained on pollen temperature and storage tolerances may be useful to the horticulturist and the plant breeder. Furthermore, this method is adapted to pollen germination studies under conditions in the field. As in all such studies the data obtained merely indicate the germinability of the pollen and do not measure its effectiveness in fecundation.

The present studies have shown that avocado pollen germinates over a wide range of temperatures. Flowers kept at 40 degrees F for 150 hours before pollination produced pollen which germinated readily at the same temperature. Higher temperatures produced good germination. Since the temperature in the avocado growing areas in California during the bloom period seldom reaches 40 degrees F there seems little probability that low temperature is a factor in pollen germination under field conditions. However, the ultimate fate of the pollen tube and the functioning of the pollen nucleus at this low temperature is as yet undetermined.

Naturally pollinated flowers taken from trees in the field from localities where fruit set is usually light showed many pollen grains and a high percentage of germination on the stigmas indicating that adequate pollination and germination probably occur under field conditions in the coastal regions of Southern California.

Storage experiments have demonstrated that avocado pollen retains its viability for a moderate period of time. Pollen of the Leucadia variety germinated readily after storage for 32 days at 40 degrees F in a desiccator over calcium chloride. Under the same conditions Nabal pollen germinated after 89 days storage and in one experiment Fuerte pollen germinated after 153 days storage at 59 degrees F. The critical conditions for and time limits of pollen storage of the many avocado varieties are not known, but the data obtained in this study indicate that viability is not quickly lost in storage, a fact which may be decidedly helpful in breeding work.

SUMMARY

Investigations on avocado pollen indicate that it does not germinate in ordinary sugar solutions, but that the pollen is viable and will germinate on stigmas at temperatures of 40 degrees F and higher. This viability is retained for several weeks when the pollen is stored. Avocado pollen also germinates on stigmas of certain other plants and likewise other pollens will germinate on avocado stigmas.

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