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ELECTROSTATIC EFFECTS WITH AVOCADO POLLEN

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Problems of pollination in the avocado implies the transfer of small, generally spherical bodies from the anthers to the stigma within the given flower, or the transfer of the pollen grain to the stigmas of other flowers, sometimes across great distances. The several factors which affect and possibly control pollen movement in the avocado are of interest, for they may enhance or detract from the development of satisfactory crops which result from successful pollination. The extensive review by Gad Ish-Am and Dan Eisikowitch[1] of the basic factors associated with pollination of the avocado have indicated the importance of insect transfer of pollen by the honeybee and the intricate biological implication of different stages of maturity of the male and female elements through the phenomenon of dichogamy within the flowers. Though not formally demonstrated, it is implied that electrostatic forces may be associated with the movement of the avocado pollen within a given flower and in subsequent transfer of pollen grains to other flowers by the honeybee. The present status of knowledge of the electric relationships between plants and their pollinators is described by Erickson and Buchmann[2]. The observations described in the present report have considered the possible effects of electrostatic forces in the movement of avocado pollen within the flower. The study was done with simple equipment, but the results can explain some aspects of the avocado pollination problem not described in previous investigations.

It is common knowledge that small particles of matter, both of inorganic and organic origin, will develop static electric charges particularly under conditions of low humidity and high temperatures. All small particles tend to develop a polarized condition. This implies the development of a positive electrical charge at one end and a negative charge at the other end of the particle. Thus, in warm dry weather a plastic comb which has been drawn through the hair will build up a substantial static electrical charge which can attract small physical objects such as bits of paper, dust, and particles of hair which adhere tenaciously to the charged comb. Among small natural particles are the pollen grains of avocado. These single cells are essentially spherical in form about 45 microns (0.045 mm.) in diameter. Apparently, these small spheres can develop a condition of polarity and exhibit an electrical charge. The static electrical force can suspend these small particles against the force of gravity, and can be effective in some cases in attracting such particulate matter across distances of several millimeters.

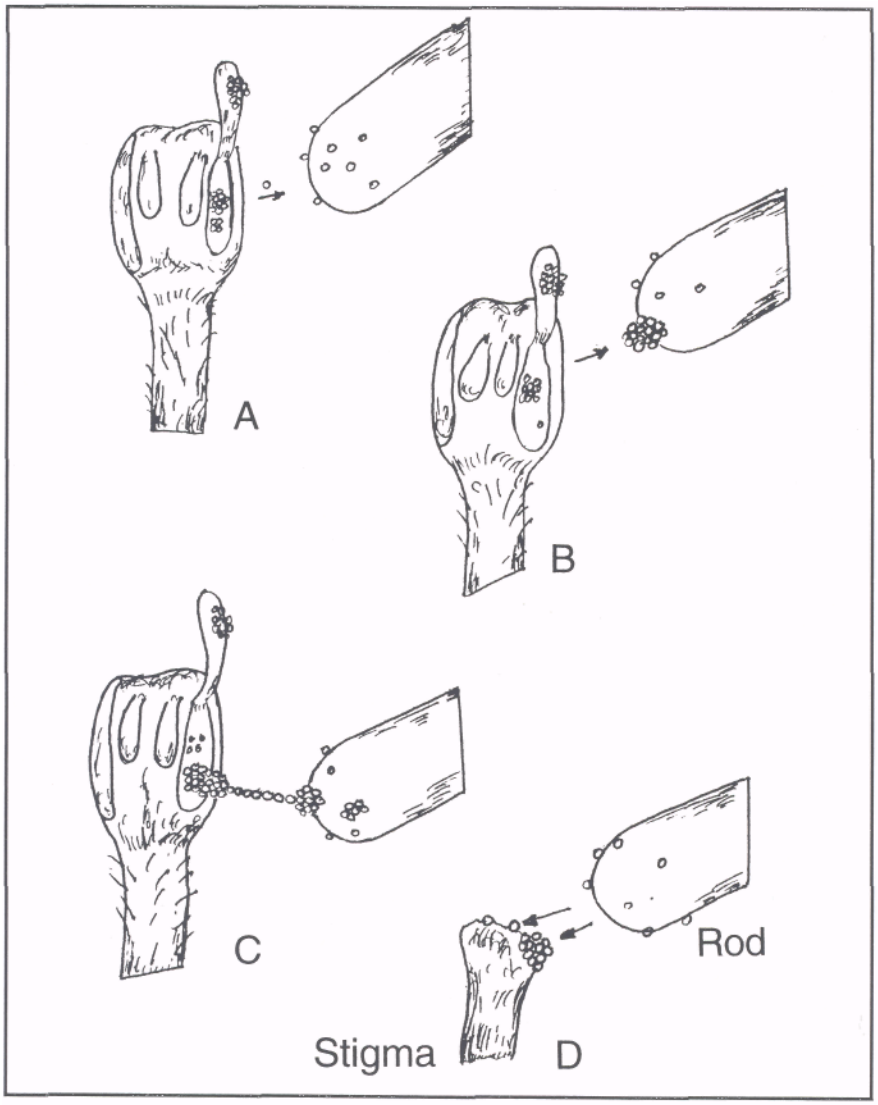
When a soft glass rod is rubbed briskly with a piece of silk cloth, an effective static electrical charge is built up in the rod. The glass rod used in the present observations was made from a piece of soft glass round rod five inches long and one-eighth inch in diameter. One end was drawn to a fine point approximately 1 mm. in diameter. The rod

was held at the large end and rubbed briskly with a silk cloth and quickly positioned in the vicinity of a freshly detached avocado flower under a dissecting microscope. The flowers which were in the second stage of opening had anther valves which were beginning to curl upward to expose the masses of pollen within the pollen chamber. Some clumps of pollen appeared to adhere to the reflected valve. The clumps of pollen consisted of 6 to 10 or more grains adhering together in an irregular shape. When a charged glass rod was brought into the vicinity of the anther at a distance of 5 to 10 mm., a rapid rearrangement of the configuration of the pollen mass resulted. Some of the pollen grains would "jump" to, and cling on, the tip of the rod. Single pollen grains as well as small clusters of grains would appear suddenly on the clean glass rod. Similarly, small clusters and single grains of pollen would suddenly jump from the rod to other floral parts nearby, or would instantaneously disappear out of the field of vision, which was 6 mm. in diameter. When the charged rod was placed near the opened pollen chamber, pollen masses would suddenly transfer to the charged glass surface. Movement of the rod in the vicinity of pollen clumps still adhering to the anther valve could sometimes induce a rearrangement of the pollen grains in the form of a "chain" of pollen grains one grain thick with adjacent grains adhering to each other in a continuous line much like a string of beads. This "chain" could extend over a distance of 0.5 mm. connecting the rod with the anther valve before collapsing. While there was no control which could be applied to direct the movement of the pollen under the conditions described, it is evident that indeed electrostatic forces were affecting the movement and physical arrangement of the pollen grains.

The casual observations on the behavior of avocado pollen described above strongly suggest that electrostatic forces probably perform an important role in the movement of pollen from one surface to another. The adherence of the avocado pollen to tools, to the surfaces of containers, and probably to the body parts of insect visitors as the result of electrostatic forces can explain in part some of the difficulties encountered in pollination investigations.

References

1. Ish-Am, Gad, and Dan Eisikowitch. 1993. The behaviour of honey bees (*Apis mellifera*) visiting avocado (*Persea americana*) flowers and their contribution to its pollination. Jour. Agricultural Res. 32(3/4):175-186.
2. Erickson, Eric H., and S. L. Buchmann. 1983. Electrostatics and pollination. In: Handbook of Experimental Pollination Biology, Eds. C. E. Jones and R. J. Little, pp. 173-184.



Legend to Figure

A - Avocado anther, showing pollen chambers with one open valve and pollen grain passing to charged glass rod.
B - Tip of stamen showing pollen chamber with charged glass rod in vicinity and with single pollen grains and a cluster of grains adhering to rod.
C - "String" of pollen grains bridging gap between pollen chamber and charged rod.
D - Diagrammatic transfer of pollen mass and a single pollen grain from charged rod to stigma of pistil.