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Floral Abnormality in the Avocado

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While observing flower behavior in the avocado, I have been impressed by the frequency of occurrence and variety of abnormalities in the flowers. Aside from the observation of double pistils by Robinson (1) and the report of naked ovules by Bambacioni-Mezzetti (2) there seems to be no mention of such abnormalities. It appears desirable, therefore, to record the results of a study of some 9000 flowers made during 1939-40. The flowers were collected in the University orchard at Los Angeles and in commercial orchards in Los Angeles, San Diego, and Ventura Counties. Included were flowers of commercial varieties of the Mexican and Guatemalan races, the Fuerte variety, and several Mexican seedlings.

Before discussing abnormal flowers a brief description of the normal flower is warranted. As shown in Figure 1, the normal flower has a single pistil and nine stamens. The pistil is free from the other floral parts and has a simple, bulbous, smooth ovary and a somewhat elongated style terminated by a slightly enlarged stigma. The stamens are inserted in two whorls. The inner whorl consists of three stamens with staminodes (sterile or abortive stamens) alternating between them. The outer whorl of six stamens is placed opposite the parts of the inner whorl so that for each outer stamen there is either an inner stamen or a staminode on the same radius. Each of the inner stamens has two small nectaries, one on each side of the filament at the base. The anthers shed their pollen by means of four valves which are hinged at the top. The inner stamens are extrorse (directed outward) while the outer stamens are introrse (directed inward).

The floral envelope consists of six parts which are so similar in appearance they are referred to generally as perianth parts. However, in some varieties there is sufficient differentiation to identify them as sepals and petals. All of the floral parts are pubescent (covered with hair) except on the stigmatic tissue, the nectaries, and tips of the staminodes.

Abnormal flowers such as were found in this study consisted primarily of deviations from the normal numbers of stamens, pistils, and perianth parts. In addition fusion of parts and naked ovules were observed. Of most frequent occurrence, however, was staminoidy—the conversion of other floral parts into stamens. While in the normal flower there are nine stamens, frequently flowers were found which had from four to fourteen. In an extreme case a single flower was found which consisted of sixty-two stamens, thirteen pistils, and thirty-six perianth parts. The arrangement of stamens around the pistil in abnormal flowers was usually regular, however.

It should be stated that extra stamens are produced by modification of perianth parts or staminodes or they may originate directly from the receptacle. Where perianth parts

were modified the resulting structures were often intermediate in form between perianth lobe and stamens. The number, shape, and position of the anther valves on these structures were variable. The viability of the pollen found in the pollen chambers was not ascertained, but the pollen grains appeared to be normal in structure.

Although there are normally six perianth parts, many flowers were found having from four to nine. When the perianth parts were fewer than six the stamen number often was increased because of staminoidy. Also when more than six perianth parts developed there were likewise more stamens which arose directly from the receptacle.

As illustrated in figure 2, G-I, in many flowers some or all of the staminodes developed into apparently normal or partially modified stamens thus accounting for the abnormality in stamen number. Nectaries sometimes were observed at the bases of these modified staminodes.

Pistilloidy—the conversion of other floral parts into pistils—was of less frequent occurrence than staminoidy. Occasionally one or more of the inner stamens or staminodes developed into structures which resembled pistils, but they were without ovules.

Several examples of double pistils were found, but this abnormality was not common.

A striking abnormality was the occurrence of naked ovules that is pistils with ovules borne on the outside of the ovary either wholly or partially exposed. As shown in figure 2, J-K, the naked ovule protrudes from the pistil at the base of the style. In the newly opened flower it resembles a glistening white bead or knob which might easily be mistaken for an insect egg by a casual observer. No ovules were found inside the ovaries of such flowers. In most cases flowers with naked ovules were normal in other respects, but sometimes extra perianth parts and stamens were found in these flowers,

Bambacioni-Mezzetti found naked ovules on fifty per cent of the flowers on a seedling tree (reported as Persea Gratissima) in Rome. This phenomenon seems to be of common occurrence; in the present study it was found in many cultivated varieties such as Benik, Carlsbad, Topa Topa, Queen, and Fuerte, as well as in several Mexican seedlings. Of the trees under study a maximum of eight per cent of the flowers collected had naked ovules.

A summary of the results indicates that within the limits of these observations, considerable irregularity occurs in the structure of avocado flowers irrespective of variety and location. A more extended investigation will be required before causal factors for such abnormalities can be assigned.

In view of the fact that avocado trees bear enormous numbers of blossoms and that irregularities in structure do not necessarily impair the function of the flowers it would seem that the abnormal flowers described would not appreciably reduce the amount of fruit production.

References

1. Robinson, T. R. 1930. Some aberrant forms of flower mechanism in the avocado. Calif. Avocado Assoc. Yearbook 1931:107.
2. Bambacioni-Mezzetti. V. 1937. Gimnovulia in **Persea Gratissima** Gaertn. e

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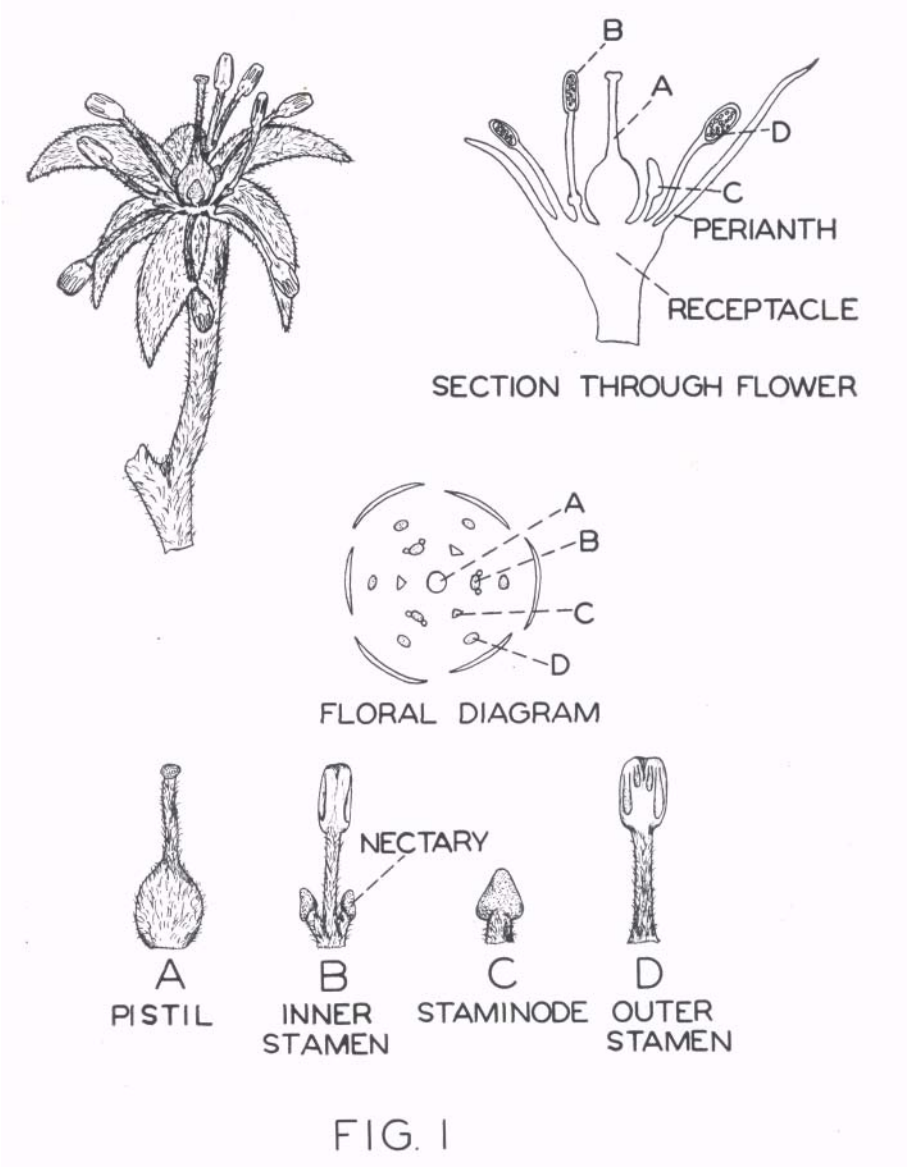
Figure 1. Normal Avocado flower and parts.



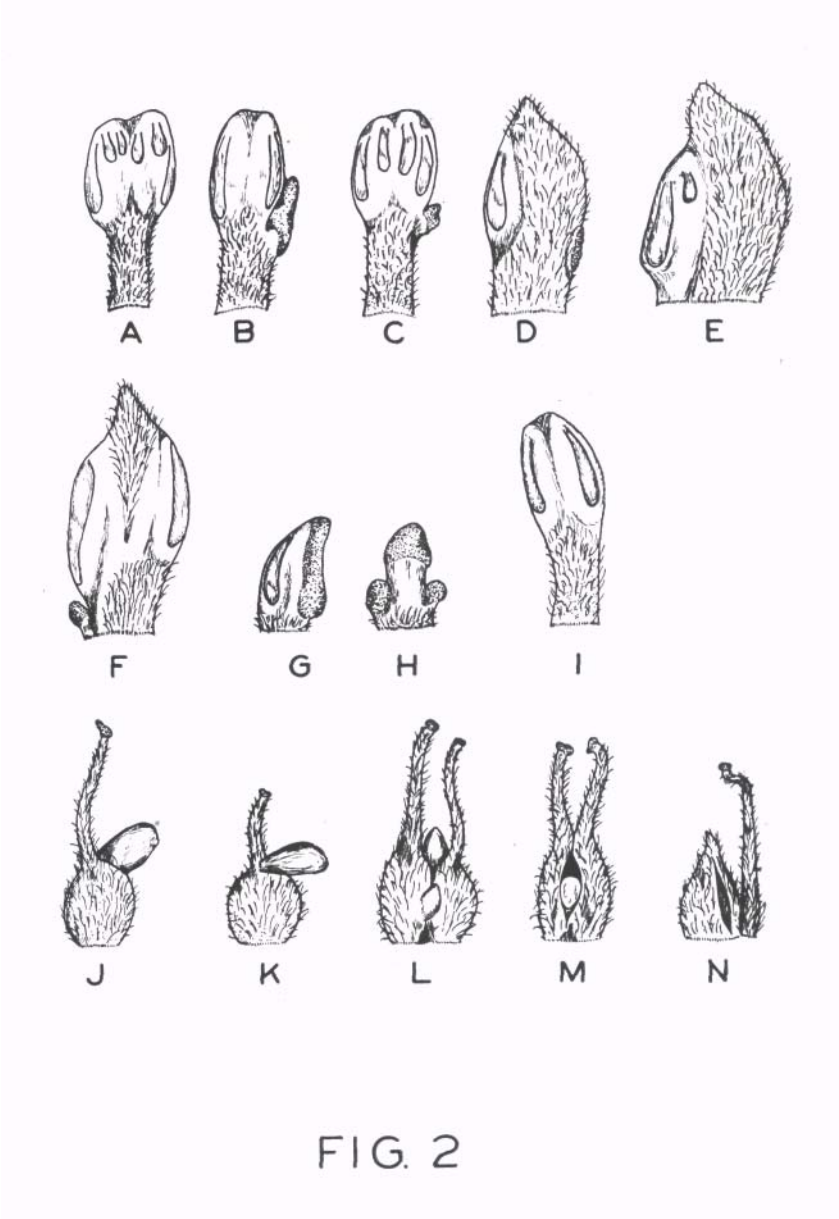


Figure 2. Abnormal flower parts of Avocado.

A—two stamens fused together
B—Stamen and staminode fused together
C—Stamen with irregular nectary
D, E, F—Perianth parts modified into partial stamens
G—Staminode partially developed into stamen
H—Staminode with nectaries at base
I—Staminode which has developed into apparently normal stamen
J, K—Pistils with naked ovules
L, M—Double pistils with naked ovules
N—Abnormal pistil with no stigma and .adjacent pistil which developed from a stamen