

PROLIFERATION OF AVOCADO FRUIT IN VINYL BAGS

C. A. Schroeder

Department of Botany, University of California, Los Angeles.

Studies on the growth and development of avocado fruit tissues has indicated that nearly all parts of this structure is capable of cellular proliferation from the time of bloom to maturity if the tissue is provided a proper environment. It is commonly observed that the lenticels on the fruit normally proliferate slightly as the fruit approaches maturity. The development of a slight corkiness caused by the breakdown of the lenticular structure frequently is considered a criterion to indicate approaching horticultural maturity. Excessive development of lenticular tissue under some climatic conditions produces a degree of corkiness and surface russetting which is distinctly detrimental to the favorable marketing appearance of the fruit. The development of this corky skin condition is variable from season to season and among avocado varieties. The varieties Zutano, Carlsbad, and Fuerte are among the prominent varieties which are subject to this condition though the trouble is not restricted entirely to these varieties. The tendency toward the excessive surface proliferation and corkiness is observed more frequently under the more extreme climatic conditions of the interior valleys where periodic arid, warm atmospheric conditions will result in a drying of the tender surface tissue giving rise to cork formation. Moist, coastal atmospheric conditions are less likely to provide the suitable environment for excessive cork development.

The response of avocado fruit to high humidity and temperature is vividly demonstrated by enclosing an attached fruit in an ordinary vinyl-film bag, the type designed for use in preparing frozen foods in the home. Such bags are normally moisture proof, but allow for an exchange of the gaseous atmosphere in both directions. If a nearly full size avocado is covered by a vinyl bag for a period of 6 to 8 weeks the entire fruit surface becomes nearly enveloped by a layer of white, proliferating tissue (Figure 1) approximately 2 to 5 millimeters in thickness. This surface growth results from the development of periderm just beneath the stomata and the surrounding lenticular tissue. Proliferation will continue indefinitely under these conditions as the fruit remains attached and enclosed by the bag. If the vinyl bag is removed following the initial proliferation, the newly formed cells, which are extremely delicate become desiccated and the entire surface will be converted into a dry mass of brown cork or scab.

The climatic environment within the bag provides an atmosphere of 100 per cent relative humidity as the vinyl is impervious to moisture. Active transpiration or water loss from the fruit continues as growth processes proceed, hence free water, sometimes of considerable volume, is found in the bag after it has been on the fruit for a short time.

The temperature within the bagged fruit is found to be above that of the uncovered fruit and considerably above that of surrounding air (Figure 2). In these particular observations both bagged and uncovered fruits were exposed directly to the sunlight.

The comparatively high temperature and high relative humidity are probably the major factors which are favorable to excessive surface cellular growth under these experimental conditions.

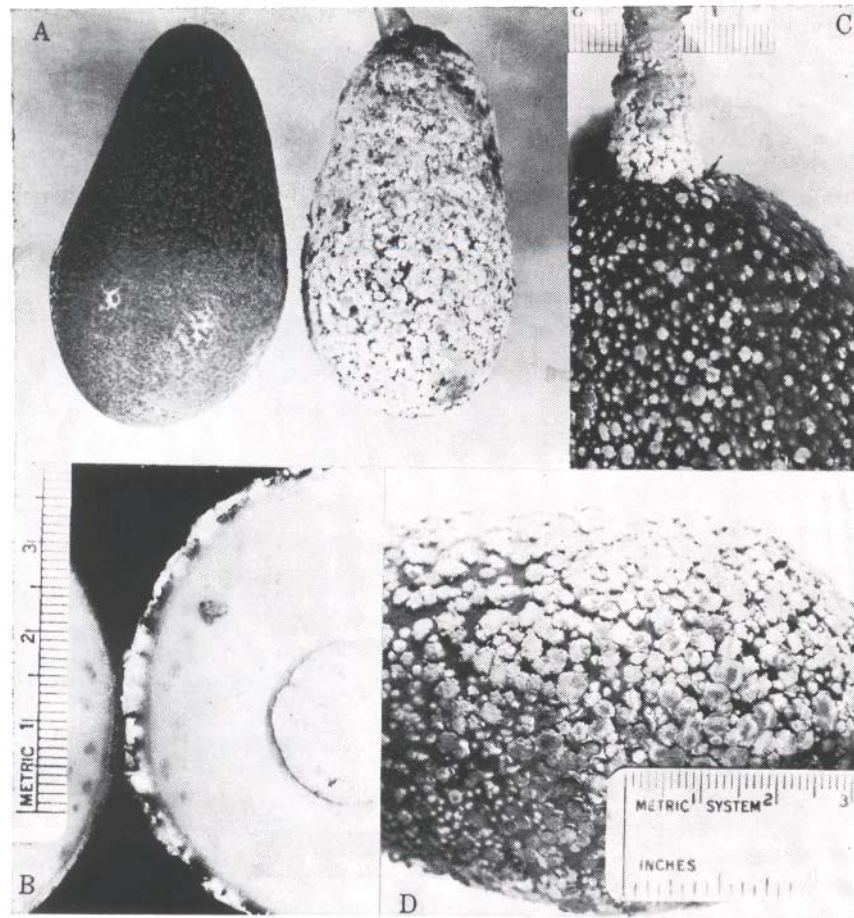


Figure 1. A. Carlsbad avocado fruits showing surface proliferation (right) after enclosure in vinyl-film bag for period of 6 weeks. Fruit on left was uncovered. B. Transverse section of uncovered (left) and vinyl covered fruit (right) showing comparative thickness of proliferated tissue in latter. C. Surface proliferation near stem and along pedicle of fruit covered with vinyl bag. D. Surface proliferation on pericarp of vinyl covered fruit.

The observations reported here suggest that fruit exposed to high humidity at some period during development followed by a condition of low aridity in the atmospheric environment may tend to develop excessive lenticular growth and a resulting corkiness. A similar situation has been demonstrated in the apple (5) where russetting has been shown to be prevalent under conditions of high humidity in some varieties. An apple fruit partially covered by a leaf will develop a pattern of russetting under that portion of fruit surface where a pocket of high atmospheric humidity is maintained by the leaf. Normally exposed fruits are less subject to the russetting condition. Modification of the microclimate on a fruit surface such as leaf cover probably is an important factor which determines fruit surface character on many kinds of fruit.

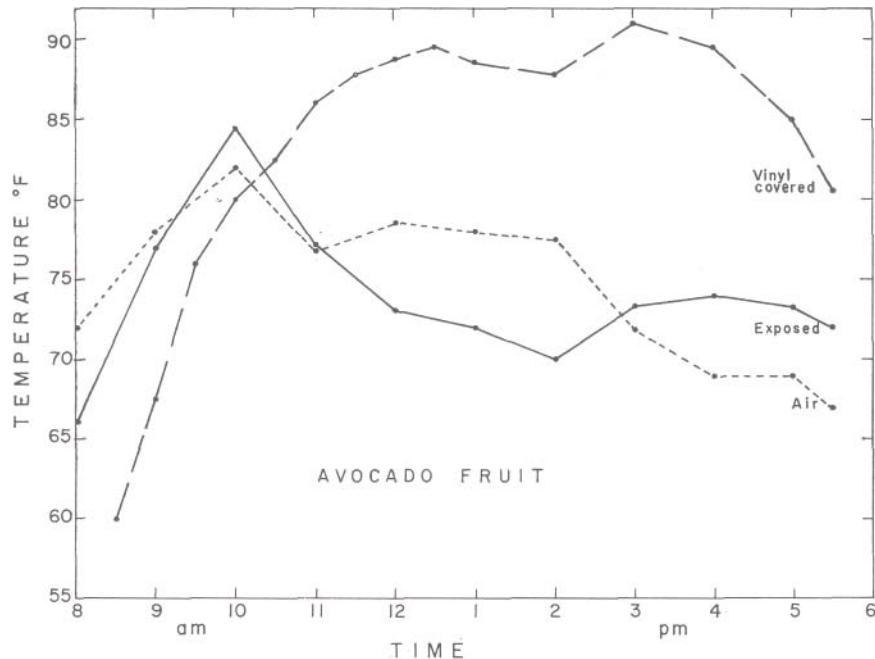


Figure 2. Fruit pericarp temperature of vinyl covered and exposed (uncovered) Haas fruit during day. Both fruits were in sun on south side of tree, Spring Valley, May 18, 1962.

The major climatic factors which probably affect the surface or rind character of avocado are temperature and atmospheric humidity. Previous studies (4) have indicated that the fruit can tolerate temperatures considerably above those normally experienced in such areas as the coastal climatic belt. Temperatures of 114° F can be tolerated for a period of 6 hours without apparent permanent injury or inhibition of the cell division activity. Low atmospheric humidity, however, presumably may desiccate the delicate, newly formed cells in the stomatal and lenticular cavities which are scattered over the fruit surface giving rise to numerous centers of cork formation. The thickness of this abnormal rind formation may be extensive. High temperature as such probably does not limit surface proliferation in avocado but sudden lowering of the atmospheric humidity which may accompany elevated temperature probably results in the desiccation and death of the tender surface tissue to produce cork.

LITERATURE CITED

1. Cummings, Katherine and C. A. Schroeder. 1943. Anatomy of the avocado fruit. Calif. Avocado Soc. Yearbook 1942: 56-64.
2. Schroeder, C. A. 1951 The structure of the skin or rind of the avocado. Calif. Avocado Soc. Yearbook 1950: 169-176.
3. Schroeder, C. A. 1957. Growth of avocado fruit tissue on artificial media. Calif. Avocado Soc. Yearbook 1956: 165-168.
4. Schroeder, C. A. and E. Kay. 1961. Temperature conditions and tolerance of avocado fruit tissue. Calif. Avocado Soc. Yearbook 45: 87-92.
5. Tukey, L. D. 1959. Observations on the russetting of apples growing in plastic bags. Amer. Soc. Hort. Sci. 74: 30-39.