Bud Mutation in the Vinifera Grape
II. Sultanina Gigas

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DURING the shipping season of the Sultanina (Thompson's Seedless) grape in California, field foremen are occasionally confronted by a picker who displays a thick-stemmed cluster with much larger and more rounded berries than the normal variety. Such off-type clusters are not often packed, since they are difficult to arrange without breakage and destroy the uniformity of the product. Seldom are whole vines found which bear this enlarged type of seedless grape. The origin of these large-berried clusters are usually traceable to a single mutated cane on an otherwise normal vine. Although this mutation occurs but rarely, it is known by several growers as "tomato grape", "bull grape", or "giant seedless".

The first mention of this form of Sultanina was made by Bioletti (1) as early as 1918, under the name Giant Sultanina. At that time its bud sport origin had not been proven. About 1920, however, Mr. L. F. Arnold of Merced found a single cane of the giant form growing from the trunk of a normal vine. Several years later another occurrence of the same type of mutation was reported by Mr. B. S. Anderson of Marysville. Both of these strains have been propagated in the experimental vineyard at Davis since the time of their discovery and have retained their original gigantic features. They appear to be identical, even though they arose independently. This particular type of mutation is recurrent and must have a similar origin, since all of the strains so far observed—five in all, from various regions in California—cannot be distinguished from one another.

Sultanina gigas is characterized by an enlargement of all the cells of the plant. This gigantism is most apparent in the size of the cluster stem and the fruit, although the canes are thicker and their internodes shortened. The clusters are seldom heavily shouldered, but are frequently much larger than the normal type (Fig. 1). Some exceptionally well-filled clusters harvested at Davis have weighed as much as 4.4 pounds with an average berry weight of 3.6 grams. Some of the largest berries may weigh as much as 5 grams, approximately double the weight of the largest berries of the normal variety grown under similar conditions. The berry approaches a spherical form and the flesh is less crisp than that of the normal variety. As in Sultanina, the seeds are rudimentary, but are proportionately increased in size. We have been unable to find seeds in the gigas mutant that have developed bony seed coats; they are soft enough to slip by unnoticed during mastication. Thus the very desirable "seedless" condition of the parental form is maintained.

Professor Bioletti has informed the writer that the Sultanina gigas was tried on a small scale planting in Fresno some years ago. The large seedless berry would probably be received favorably as a table grape by the consumer but from the grower's standpoint the variety has some serious defects. First is its inability to bear well-filled clusters con-

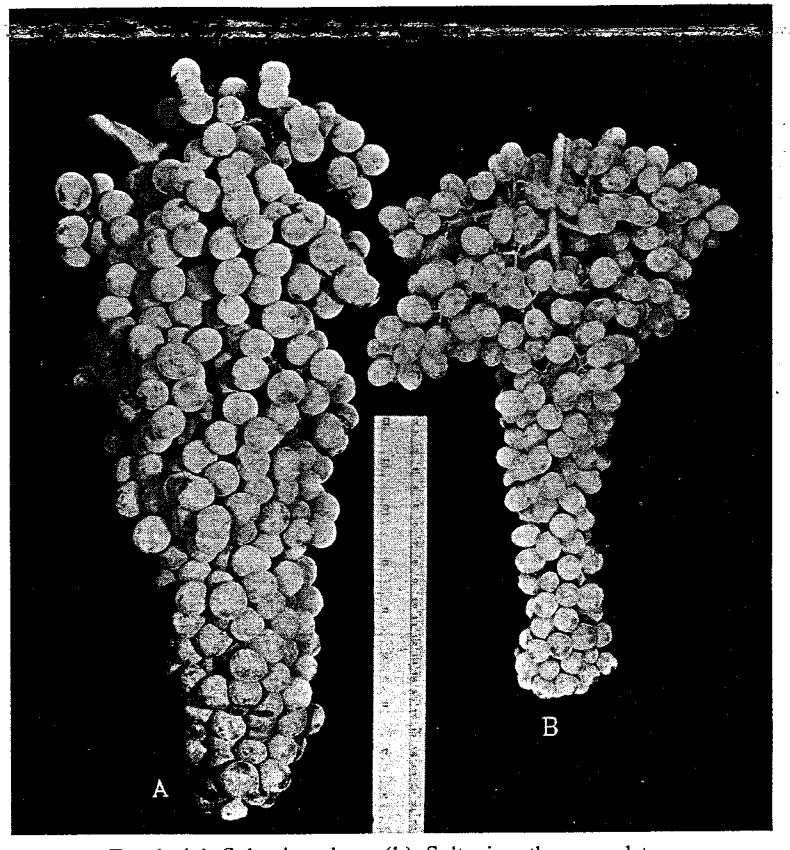

FIG. 1. (a) Sultanina gigas. (b) Sultanina, the normal type.

sistently. If all the flower clusters are left to develop, the usual result is a very poor berry set and consequently ragged clusters at harvest time. The set has been markedly improved on a few experimental vines at Davis by flower cluster thinning, but in this case many of the clusters become so compact that fracture of the berries occurs and bunch rot results. Flower cluster and berry thinning, as is practiced to a limited extent with some commercial varieties (Winkler, 4), might overcome such defects. Another demerit is the brittleness of the cluster stems and pedicels, necessitating extreme care in handling the fruit. It is questionable whether the fruit could satisfactorily be shipped any great distance.

The Sultanina gigas is an autotetraploid, arising by somatic mutation. Instead of two complete sets of 19 chromosomes in each somatic cell with a total diploid number of 38, four identical sets are present and the total chromosome number is 76 (Fig. 2). Nebel (3) first reported the gigas form of Sultanina to have double the normal somatic

number. At present, the most widely accepted view bases the origin of such autotetraploid forms on the failure of a cell division after the division of the chromosomes. Instead of the divided chromosomes passing to each pole of the spindle and maintaining the diploid number, they all form a single reconstituted nucleus. Since cell wall formation does not occur, a giant cell is the result. If such a cell happens to occupy an apical position in a growing point, it will continue to produce tetraploid cells like itself. Buds arising from tetraploid tissue would account for the gigas canes appearing spontaneously at rare intervals in vinifera grape varieties.

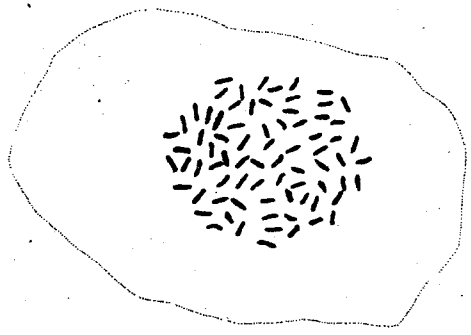

FIG. 2. Somatic chromosome plate from root tip preparation of Sultanina gigas, showing 76 chromosomes. ca x 4500.

The occurrence of gigas mutations is not limited to the variety described. Corresponding forms of the Muscat of Alexandria and Flame Tokay are growing at Davis. Bioletti (2) also mentions seeing a gigas form of the Zinfandel. During the last harvest season a single fruiting cane having gigas characteristics has been found at Davis on an otherwise normal vine of the Cornichon (Olivette noire). Thus the phenomenon is rather general, but occurs rarely in any given variety, since gigas mutations have so far only been discovered in varieties which are widely grown on a commercial scale in California.

The occurrence of fertile tetraploid forms in Vitis offers opportunities in breeding for varieties with higher chromosome number. Preliminary crosses indicate that little or no difficulty is experienced in crossing the autotetraploid with diploid varieties of vinifera, and vice versa.

LITERATURE CITED

1. BIOLETTI, F. T. The seedless raisin grapes. *Calif. Agr. Exp. Sta. Bul.* 298. 1918.
2. Ibid. (revised edition, May, 1921.)
3. NEBEL, B. Zur Cytologie von Malus und Vitis. *Gartenbauwiss.* 1: 549–592. 1928–29.
4. WINKLER, A. J. Pruning and thinning experiments with grapes. *Calif. Agr. Exp. Sta. Bul.* 519. 1931.