OCCURRENCE OF SPONTANEOUS MUTATIONS IN THE TOMATO VARIETY 'WALTER'

PAT CRILL AND D. S. BURGIS

IFAS Agricultural Research and Education Center
Bradenton

Abstract. **The occurrence of several distinctive mutations have been observed in commercial fields planted with the tomato variety 'Walter.' These included catface fruit, white fruit, hairy plant and striped corolla. None of the mutations are of economic significance except catface which resulted in no marketable fruit. Catface fruit, white fruit and striped corolla were found to be controlled by recessive genes. Dominance appeared complete and no extrachromosomal effects were found. White fruit and striped corolla were evidently pleiotropic or closely linked.**

Prior to being released as the variety 'Walter' in November 1969 (1), the University of Florida tomato breeding line CAStWd 1544-3-4-1-BK-BK-BK (STEP 535) was evaluated in several commercial fields. Such an evaluation is of value to the plant breeder because it provides an opportunity to observe the potential variety candidate under commercial conditions from planting through harvesting and marketing of the fruit. The line 1544-3-4-1-BK-BK was evaluated by two commercial tomato farms near Ruskin, Florida, during the 1969 spring growing season. Four distinct mutants were observed and further studied via crosses with normal 'Walter.' The results of these crosses are analyzed and a description of each mutant provided in this paper.

Materials and Methods

Seed of the University of Florida tomato breeding line 1544-3-4-1-BK-BK was supplied to two tomato growing firms, Council Farms and Elsberry Farms, Ruskin, Florida, for planting and evaluation during the 1969 spring season. Standard commercial tomato growing practices were used by both organizations. Each grew an experimental field of approximately five acres with a plant population of 1800-2000 plants per acre. Both fields were observed periodically for general performance, expression of various horticultural characters and overall uniformity of the breeding line.

Florida Agricultural Experiment Station Journal Series No. 4614.

Several off-type or mutant plants were observed in both fields. Characteristics of each plant were noted and seed were saved from each using standard acid extraction procedures. Each mutant was grown for at least four generations. Each was also crossed with normal 'Walter' and the segregating generation evaluated for an inheritance pattern. Reciprocal crosses and both parents were evaluated simultaneously.

Results

Four distinct mutants were observed in the two commercial fields of 1544-3-4-1-BK-BK during the 1969 spring season. The four characters were considered to be mutants rather than contamination because they were not present in any tomato lines previously utilized in the breeding program. Furthermore, the two fields were transplanted with plants produced under controlled conditions which eliminated the possibility of field contamination. The four mutants were designated as catface fruit, white fruit, striped corolla and hairy plant.

Description of White Fruit and Striped Corolla Mutant. Striped corolla was always associated with white fruit. From the limited populations studied it was not possible to determine if they were pleiotropic or linked. Plants appeared similar to normal 'Walter' except foliage was lighter green. Small immature fruit were a gray or dirty white rather than the usual pale green. As fruit enlarged they changed from gray to a white or creamy white. The normal green shoulder appeared brown or reddish brown on the white fruit. Ripening was initiated in mature fruit with the appearance of a pink blush on the blossom end. Fruit eventually became pink all over the surface and then became progressively darker until the typical red color of normal 'Walter' was expressed. A red ripe fruit from a white fruit mutant plant appeared identical to a normal red ripe 'Walter' fruit.

The striped corolla was expressed as a white stripe or stripes in the normal yellow petals of the corolla. Shape of the striped corolla is normal. The anther column was lighter yellow and the stigma and tip of the style often appeared a pale pink color when the anther column was removed.

Description of Catface Fruit Futant. Plants which produce catface fruit were usually taller than normal 'Walter' presumably because of the

small amount of fruit set, but otherwise appeared normal. Fruit was small, covered with corky tissue and often had one or more seed locules exposed. Fruit growth appeared to be at different rates in different areas of the fruit resulting in malformed and unmarketable fruit.

Description of the Hairy Plant Mutant. Hairiness was expressed on all parts of the plant including the fruit. The hairs were constant in density and length on various parts of the same plant but varied in density and length among plants.

Frequency of Mutation Rates. The catface mutant occurred in only one plant at the Council Farms field and has not been noted again in several thousands of further observations. Four white fruited plants were observed in the Council Farms field and 3 in the Elsberry Farms field. These 7 white fruited plants also exhibited the striped corolla character. The frequency of occurrence of the white fruit and striped corolla mutant was then approximately 3.5/10,000 plants Frequency of the hairy mutant was 125/10,000. Numerous white fruited as well as hairy mutant plants have been observed in commercial tomato fields planted with the variety 'Walter' during the past two years.

Inheritance of Mutant Characters. Progeny of the 'Walter' x 'hairy Walter' and 'hairy Walter' x 'Walter' crosses were evaluated in the F_2 generation. The expression of hairiness was quite variable for both density of hairs and length of hairs. No suitable classification method for hairiness was developed and it was not possible to determine the mode of inheritance. Results of inheritance studies with the catface fruit, striped corolla and white fruit mutants were more conclusive (Table 1). Data from the cross 'catface fruit' x 'Walter' indicated an acceptable fit to a 3:1 ratio. Data from the 'Walter' x 'catface fruit' and the combined data from both crosses were significant and the fit to a 3:1 ratio was not acceptable.

Data from the 'Walter' x 'white fruit' cross, the reciprocal cross and the combined data from both crosses indicated a good fit for a 3:1 ratio (Table 1). All plants with white fruit had flowers with a striped corolla and all with normal fruit had normal flowers.

Table 1. Chi-square and P values for 3:1 F_2 segregations of crosses involving 'Normal Walter' with white fruited and catface fruit mutants.

	Observed	Expected	Chi-square	P value
CLASS				
Catface Fruit x Normal Walter				
No. Normal Fruit	62	57.75	1.254	.30 - .20
No. Catface Fruit	15	19.25		
Normal Walter x Catface Fruit				
No. Normal Fruit	85	75.75	4.468	.05 - .02
No. Catface Fruit	16	25.25		
Combined Data				
No. Normal Fruit	147	133.5	5.470	.02 - .01
No. Catface Fruit	31	44.5		
CLASS				
White Fruit x Normal Walter				
No. Normal Fruit	73	71.25	0.172	.90 - .80
No. White Fruit	22	23.75		
Normal Walter x White Fruit				
No. Normal Fruit	72	69.0	0.523	.50 - .30
No. White Fruit	20	23.0		
Combined Data				
No. Normal Fruit	145	140.25	0.644	.50 - .30
No. White Fruit	42	46.75		

Discussion and Conclusions

The occurrence of white fruit, catface, striped corolla and hairy plant was not noted in the early generations of 'Walter' as it was being developed as a variety. These characters were evidently the result of spontaneous mutation. The frequency of mutation from normal to hairy plant was quite high (125/10,000 plants), from normal to white fruit (and normal to striped corolla) was less but also high (3.5/10,000 plants), and from normal to catface fruit was relatively low. The white fruit and striped corolla mutant characters were controlled by a recessive gene. The white fruit character was either linked or pleiotropic with the stroped corolla character since they never occurred independently. The catfact fruit mutant was probably due to a recessive gene also, but data were too limited to be certain. Both characters were recessive and dominance was complete (Table 1).

The occurrence of four mutant characters during such a short time may be significant with respect to the genetic stability of 'Walter.' Florida seedsmen, however, should consider the possibility that 'Walter' is more mutable than some other varieties and take special care in producing seed. Since the mutants are recessive, the character was not detected until at least one generation after the mutation occurred. For this reason seed production fields should be observed carefully every time they are grown and all off-type plants rogued as soon as they are detected.

Acknowledgments

The cooperation and assistance of the late Emmett H. (Bub) Council, Council Farms, Inc., Ruskin, Florida; Mr. Bruce Elsberry, Elsberry Farms, Inc., Ruskin, Florida; and Mr. Rosario Strano, Strano Farms, Inc., Homestead, Florida, is gratefully acknowledged.

Literature Cited

1. Strobel, J. W., N. C. Hayslip, D. S. Burgis and P. H. Everett. 1969. Walter—a determinate tomato resistant to races 1 and 2 of the Fusarium wilt pathogen. Univ. of Fla., IFAS Circ. S-202.

PRUNING TEST COMPARISON OF TOMATO VARIETIES FLORIDA MH-1 AND WALTER

D. S. Burgis and Pat Crill

IFAS Agricultural Research and Education Center
Bradenton

Abstract. **Pruning, restricted to the removal of 4-7 lateral branches up to, but not including the lateral shoot in the leaf axil below the first flower cluster resulted in earlier yield as well as an increased fruit size over a 5-week harvest period for both 'Florida MH-1' and 'Walter' tomato varieties.**

Pruning of both 'Florida MH-1' and 'Walter' resulted in the production of larger size grade which increased the value of the crop. The variety 'Walter' produced more marketable fruit as a result of pruning but no more than either pruned or unpruned 'Florida MH-1.'

Historically the tomato is thought to have originated in Peru although it was also cultivated by the Aztecs in Mexico. Evidence is that it had been cultivated in South and Central America since around 400 B.C. It was introduced into Europe in the 16th century. The size and color of fruit appears to have been well established at the time of its introduction into Europe where it was cultivated in Spain and Italy during the 17th century. Strangely enough it was considered poisonous in England, Northern Europe and America until about 1800. The tomato was first quoted on the New Orleans market in 1812 followed by the Boston Market in 1835 (11).

The Incas and Aztecs probably practiced pruning plants since they had been growing tomatoes for some 900 years before the arrival of Pizarro and Cortez. One of the oldest illustrations of tomato, drawn in 1581 (11), shows plants with lateral branches removed. In Buist's garden guide for 1885 (2) the statement is made that "most cultivators allow their tomato vines to grow wild and support themselves; they perhaps have never given it a thought that by training and properly pruning them they will not only increase their productiveness, but the fruit will ripen better and be of much finer quality." In 1918 Sherbakoff (10)

Florida Agricultural Experiment Station Journal Series No. 4676.