The Occurrence of Spur Type Trees in Seedling Apple Populations

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One of the interesting developments in the field of pomology in recent years has been the discovery of the occurrence of spur type tree mutations in some varieties of apple. These have attracted the attention of of commercial orchardists as well as professional horticulturists for a variety of reasons. The commercial orchardists have become interested in the spur type mutations of varieties they are already growing because of the economic advantage apparently offered by the smaller tree, earlier bearing habits and more open growth habit of the spur type tree. These advantages are still of controversial value, and it is not the intention of this paper to discuss that topic. The principal purpose of this discussion is to consider the origins of these mutations, their frequency of occurrence, possible reasons for their occurrence, and the possibility of other characters, both desirable and undesirable, that may be associated with the spur type growth habit.

Blodgett and Aichele (1) presented an excellent report on the spur type mutations in apple varieties discovered up to 1960. Their report indicated that mutations to the spur type growth habit had been observed in Delicious and its color sports, Winesap, Golden Delicious, and McIntosh. Of 87 sports of Delicious and its color sports that were listed, 20 were to the spur type. Of 33 Winesap sports listed, 3 were to the spur type. Three sports of Golden Delicious were listed, and all were of the spur type. Seven sports of McIntosh were listed, and one of these was considered as being a possible spur type. No spur types were listed among the 21 sports of Rome Beauty and 6 sports of Jonathan described.

The list of spur type mutations in apple varieties has been increased since the publication of the report by Blodgett and Aichele. Personal communications have indicated that a spur type mutation has been observed on Rome Beauty in West Virginia, and that 23 spur type Golden Delicious sports are under observation at the West Virginia University Experiment Station at Kerneysville. Stark (2) reported that spur type tree forms were available in Lodi, Jonathan, and Winesap, and fairly sure prospects were available in McIntosh and Spartan. Most of the early discoveries of spur type sports were reported in Washington, Oregon, and British Columbia. Recently a spur type sport of Richared discovered in Carroll County, Virginia, was introduced by an eastern nursery. Another spur type sport of Delicious discovered in West Virginia will be available from a midwestern nursery in 1965.

Mutations in tree fruits may occur as whole tree sports or as limb sports. The term "whole tree mutation" refers to a mutation affecting an entire tree. These result from a mutation that has occurred in a bud used in

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budding or grafting a young tree. In other words, in collecting buds for propagation, the propagator has unknowingly selected a bud or buds which have already undergone mutation to a different type. Since most commercially propagated trees develop from the insertion of a single bud, "whole tree sports" occur when buds are used that have been affected prior to or very shortly after the time of budding or grafting. In contrast, "limb sports" originate from a mutation which occurs in a bud on an already growing or established tree. The new growth coming from such a bud will show the mutation or sport effect. The size of the sported limb as compared to the remainder of the top growth of the tree is influenced by how early in the growth of the tree the mutation may have occurred, its relative position in the limb structure of the tree with reference to competition from the other portions of the tree, shading, pruning back by the orchardist, by the genetic changes resulting from the mutation, and also by other factors.

Most of the mutations to the spur type have occurred as whole tree mutations. According to Blodgett and Aichele (1), of the 20 spur type mutations of Delicious and its sports, 17 were whole tree mutations. The other three were limb mutations, but two were considered to be questionable spur types. Two of the three spur type sports of Winesap were limb sports. The spur type sport of McIntosh was listed as a whole tree sport. Two of the three spur type Golden Delicious sports were listed as whole tree sports and the other as a limb sport. The spur type sport of Richared found in Carroll County, Virginia, is a whole tree sport, as are the sports of Delicious and Rome found in Hampshire County, West Virginia. This preponderance of whole tree sports may be explained perhaps by the greater possibility of a whole tree sport being noticed by an orchardist or casual observer.

Comments have been made concerning the possibility of the spur type character being a result of a virus or viruses present in trees having the character. The fact that most of the variations to the spur type have been observed in whole tree variations does lend some support to this view.

The spur type growth habit appears to develop as a result of the development of fruit spurs from a very high proportion of the lateral buds on wood of the preceding season of growth. Very few of these lateral buds develop into typical vigorous long shoots. As a result there is sparse branching of the tree and the branches that do develop have a natural tendency toward erect growth (Figures 1 and 2). The heavy production of fruit spurs and resulting tendency toward early bearing may be one of the factors responsible for the shortened internodes and more restricted growth of spur type trees.

The spur type growth habit of apples has been of recent origin in so far as the attention of fruit growers and professional horticulturists is concerned. There is reason to believe, however, that this character may have been in existence for some time. In the variety testing orchard at Blacksburg, trees of Kendall, Grove, and V. P. I. 2 have been noted as having more or less of a spur type growth habit. The author recalls that the original seedling tree of Kendall on the grounds of the New York State Agricultural Experiment Station at Geneva, New York, was characterized by sparse branching, heavy production of spurs and "roping" of fruits. Several populations of apple seedlings grown at Blacksburg that had Kendall

Table 1. Distribution of spur type apple seedlings observed in seedling orchards at Blacksburg, Virginia, in 1963.

Parentage	No. of Seedlings	No. of spur type trees observed
Cortland x Cox Orange	95	2
Cortland x Idared	162	0
Cortland x Jerseyred	227	0
Purdue 832	79	0
Purdue 834	40	0
Purdue 843	76	2
Purdue 853	71	0
Purdue 856	66	5
Purdue 993	20	0
Purdue 998	19	0
Purdue 1042	33	0
Purdue 1050	25	2
Grove x (Winesap x Rome)	304	44
R. H. Planting (10 crosses)	897	0
D. I. Planting (4 crosses)	535	0

as one parent contained individuals that were characterized by sparse branching, heavy production of spurs and "roping" of the fruit. These seedlings lacked horticultural value and have been discarded, but field notes taken on the seedlings indicate that several were of this description.

In 1963 a population of 304 seedlings included a number of individuals that definitely had the spur type growth habit. This population was derived from a cross made in 1956 by using pollen of an unnamed V. P. I. seedling of Winesap by Red Rome Beauty parentage on the pistils of Grove. The latter variety was developed at the Missouri Fruit Experiment Station of Mountain Grove, Missouri, by crossing Ingram with Delicious. One hundred and thirteen of the seedlings bore fruit in 1963. Of these 44 were noted as having spur type growth. Forty-two of the spur type seedlings were listed for discarding because they had no horticultural value. The other two were listed as being of questionable value, but were held for further observation.

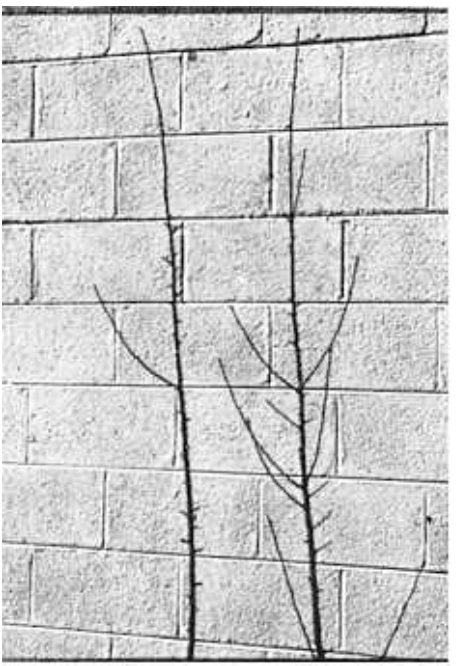

Fig. 1. Typical branches of Vance Delicious (right) and Waynespur Delicious (left) showing differences in proportion of longer shoots to fruit spurs in two and three year old wood.

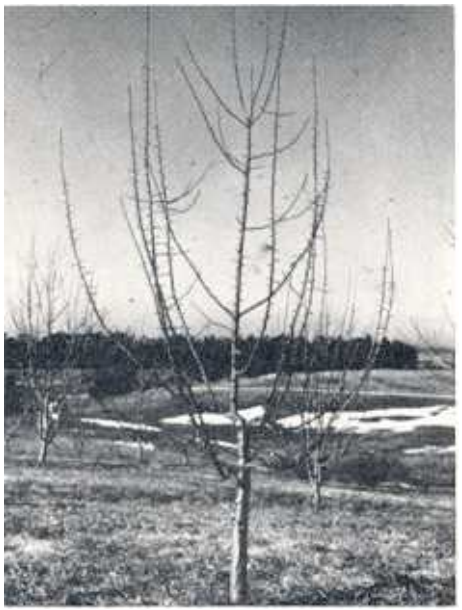

Fig. 2. A seedling apple tree of Grove x (Winesap x Rome Beauty) parentage showing typical spur type growth habit at Blacksburg, Va.

Five seedlings that bore no fruit in 1963 were described as possibly having the spur type growth habit. Several others had characteristics suggesting spur type growth, but this can best be verified after the trees bear a crop of fruit.

As mentioned previously, Grove, as it grows at Blacksburg, has spur type growth. The unnamed V. P. I. seedling selection used as the pollen parent for the cross has been discarded, and the seedling records of the tree make no mention of its tree characters.

Table 1 lists other crosses growing in the same seedling orchard and presents data on the occurrence of spur type seedlings observed in 1963 in this orchard and in two other seedling orchards.

The data in Table 1 suggest that the spur type growth habit may have a genetic basis. The data are too limited to permit genetic analysis, but it does appear that breeding for new varieties having the spur type habit of growth may be possible.

Literature Cited

1. Blodgett, E. C. and M. D. Aichele. 1960. Some notes on apple varieties. Washington State Department of Agriculture Bulletin No. 3, Olympia, Washington.
2. Stark, Paul, Jr. 1963. The spur-type tree . . . Will it replace the dwarf tree? American Fruit Grower. 83, No. 3-15, 44 and 45.

Apples in Israel

Your editor was fortunate to have been able to spend five weeks in Israel this Spring. At this time, I visited probably the largest apple orchard in the country of about 400 acres at Naot Mordechay, a kibbutz (collective farm) in northern Israel. Here I saw six-year old apple trees on East Malling and Chashabi (native) dwarfing rootstocks, planted 7 x 16 feet, producing about 1000 bu. per acre.

The variety Orleans, a Delicious type, performs well there. It is very productive, and colors better than the red sports of Delicious. Medina also does well for them.

Because of mild winters, the Israeli apple grower sprays his trees with oil during the dormant season in order to break their rest period. The spray also controls many insects.

Apple trees in Israel often suffer from iron induced chlorosis due to high soil pH, according to Bezalel Avni, manager of the orchard at Naot Mordechay. He finds that neutral zinc applied with the dormant oil sprays, or one pound of Sequestrone 138 applied to the soil in April reduce the chlorosis effectively.

They are also trying some light hedging and topping with mechanical pruners to reduce labor.