THE FACTOR FOR BITTERNESS IN THE SWEET ALMOND

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The blossoms of the almond tree are very susceptible to frost. As the almond blooms earlier than other orchard fruits it is often subjected to much more severe frosts than occur during the blooming period of the later fruits. As a result of this tenderness of the blossoms and the early period of blooming the crop secured is materially decreased. With the hope of improving our present varieties or securing new ones that would bloom late and yet be good in quality and productivity, a large number of nuts were secured from the crosses made in the first (1916) and fourth (1919) years of an almond pollination experiment being carried on by the CALIFORNIA EXPERIMENT STATION, and developed into seedlings. It was thought that if any of the important varieties, such as the Nonpareil, Ne Plus Ultra and I X L, could be made to come into blossom from five to eight days later than is normal for each variety, the hazards in almond growing would be materially decreased. If this failed, it was thought possible that some new variety could be developed. It so happens that the leading commercial varieties are the earliest bloomers and the less important varieties the latest bloomers.

The first year's planting consisted of 602 trees resulting from thirty-two crosses. Of these trees 243 came into bearing in 1922, comprising practically all the trees in twenty-one crosses. Out of the 243 trees there are 59 with bitter almonds and 208 with sweet almonds, distributed among the various crosses as shown in the table on the next page.

An examination of this table shows that there is no uniform outstanding proportion between trees possessing sweet almonds and those possessing bitter almonds in all the crosses. This would probably be expected owing to the small number of trees from each cross. However, when the totals are examined, it will be noticed that there is nearly a perfect 3 : 1 ratio, the actual ratio in terms of four being 3.028 : 0.972.

This close approximation to the theoretical Mendelian monohybrid ratio indicates that all the almond varieties represented in the above crosses are heterozygous for sweetness of the kernel. They must have the genetic constitution *Bb*, where *b* represents the factor for bitterness as the recessive character and B the factor for sweetness, as the dominant character.

As far as their genetic constitution for bitterness and sweetness is concerned, it seems likely that all varieties of sweet almonds are hybrids. Many horticulturists claim that the original almond was bitter. If this is true, it is possible that a mutation occurred in the bitter almond tree with the sweet almond as the result. This probably accounts for the two general types or races of almonds existing to-day, namely, the bitter and the sweet. Such a mutation is of more than ordinary interest because

	Cross	*Sweet trees*	*Bitter trees*
Lewelling	× I X L	2	1
California Paper Shell	× Nonpareil	8	1
Ne Plus Ultra	× Drake	1	0
Ne Plus Ultra	× I X L	32	7
Nonpareil	× Peerless	5	1
California Paper Shell	× I X L	3	1
Lewelling	× Ne Plus Ultra	5	2
California Paper Shell	× Ne Plus Ultra	2	1
Reams	× Ne Plus Ultra	5	1
Nonpareil	× California Paper Shell	20	6
Reams	× California Paper Shell	7	0
Nonpareil	× Texas	12	3
Nonpareil	× Ne Plus Ultra	5	2
Drake	× Jordan	3	0
Drake	× Ne Plus Ultra	25	13
Reams	× Nonpareil	4	3
Reams	× I X L	2	2
Languedoc	× Drake	12	4
Reams	× Texas	5	3
Ne Plus Ultra	× Lewelling	10	3
Drake	× I X L	16	5
		184	59

(1) the muta t character is dominant to the normal wild type, and (2) because this mutant character consists in the loss of the bitter principle present in the wild progenitor.

It is hoped that when all the trees in the experiment come into bearing, some light will be thrown on the segregation of such factors as blossoming period, hardness of shell, quality of nut, shape of tree and leaves, and productivity. A study of these characters will no doubt add a great deal to our much needed information on fruit and nut breeding.