

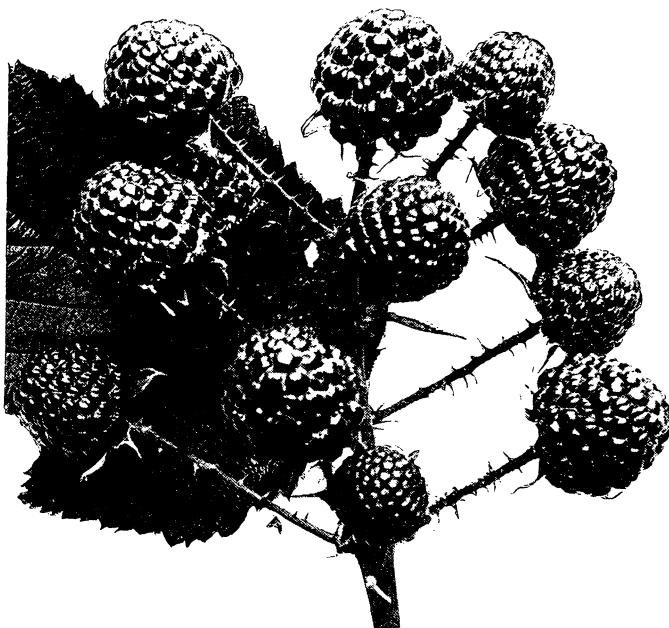
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A PROMISING BLACK-CAP SEEDLING FROM SMITH NO. 1.

BREEDING RASPBERRIES.

SUMMARIZED BY
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FROM BULLETIN BY
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BREEDING RASPBERRIES.

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Laws of heredity require much study.

With commercial plant breeders the origination of profitable new varieties is the first consideration. Unless such results follow, the work is counted a failure and is usually soon discontinued. At some experiment stations, however, and at other research institutions and breeding grounds, the discovery of the laws which govern the inheritance of characters and knowledge of the way those laws act in actual practice are of prime importance,—the immediate development of new varieties merely incidental. Were this not the case, the work at this Station with raspberries, continued now for more than twenty-five years, would seem of little consequence; for until within a very few years, from thousands of seedlings grown, less than half a dozen varieties of merit had arisen, and perhaps only two that are decided additions to the list.

But, building on principles and methods of application made clear by the earlier work, progress in originating valuable new varieties has been much greater in the past five years than ever before. It is believed that there is growing on the Station trial plats the foundation stock of many raspberry varieties better than any now grown.

Yet advance in knowledge of the heritable factors that make up the good raspberry,—black, red, or purple,—has been very slow; for these characters, though apparently simple to the casual observer, are themselves often made up from several factors, each of which exerts an influence and each of which may be inherited independently from those allied to it or, on the other hand, may be inseparable from some other factor with which, on the surface, it has no apparent connection.

Purple raspberries hybrids.

One result of the work in breeding purple raspberries has been to prove that this type of bramble does not constitute a true species, *Rubus neglectus*, but that such plants are true hybrids, or descendants of hybrids, between the black-cap and the red raspberry. Crosses were made between June, a Station red seedling, and two black-caps, Cumberland and Smith No. 1, giving more than 800 seedlings. Many of these seedlings, particularly those from Smith No. 1, were very promising, with bushes more vigorous than those of either parent, with large, firm fruit, a little later than that from the parents, and, on some plants, of a rich, glossy purple.

* This is a brief review of Bulletin No. 417 of this Station, on Some Notes on the Breeding of Raspberries, by R. D. Anthony.

All of the seedlings from June and Smith No. 1 were purple raspberries; and all but a few of the June-Cumberland cross were also purple-caps, the variants being yellow-fruited berries, due to a hidden factor, or factors, for that color in the black of Cumberland.

Yet Columbian, a purple raspberry whose history indicates that it came from direct crossing of a black and a red, did not, when self-fertilized, give one-fourth red seedlings and one-fourth black, as would be expected from Mendel's laws, but practically all were intermediate in character and almost none red raspberries either in color of fruit or in cane characters, and none showed any tendency to propagate by suckers as does the red raspberry.

Varieties as parents. In attempting to secure desirable purple raspberries, it seems best to make the red-black cross, rather than to use purples themselves as parents; and for this purpose, as well as for crossing within the colors and for "selfing" (i.e., breeding pure seedlings of any variety), the choice of parent varieties is very important. The varieties that do best in the commercial or home plantation do not always give the best progeny, and *vice versa*. For example, Cumberland would probably be ranked ahead of Smith No. 1 as a commercial berry; yet from crosses of these with the same red raspberry twice as many seedlings with Smith No. 1 as a parent were retained for testing as of those with Cumberland. It should be said that, crossed with June, even Cumberland gave many good seedlings.

As a parent Marlboro ranks high. Its seedlings tend to produce early fruit, of good size, often rather soft and frequently lacking in quality, bushes stocky rather than sprawling, rather poor as plant makers and often with a tendency toward few spines, especially when crossed with June, one of its own progeny.

Herbert seedlings lack vigor, produce low-growing plants and large, conical berries, which are sometimes too soft. Herbert should be crossed with a vigorous variety whose fruit needs larger size.

Cumberland ranks poor as a parent, though giving good results when combined with Smith No. 1. Of all Cumberland seedlings without Smith No. 1 influence, only 7 per ct. were retained.

Smith No. 1 is a useful parent. Of pure seedlings of this variety and of purple descendants nearly one-fourth were retained for a second test, and of seedlings with other black-caps 30 per ct. showed merit. The qualities transmitted by this variety appear to be productiveness, and large size, fine appearance, firmness and good quality of fruit. With only two possible exceptions, its progeny indicate that the black color in the fruit is a pure character.

Are fruit colors pure? Study of the inheritance of fruit color indicates that neither black nor red is pure in some cases, but that each may conceal a factor for yellow; and that each may also be made up of two or more factors which modify or limit the purity of the basal color. Smith No. 1 is

probably a pure black, but Cumberland, Hilborn and Palmer each have yellow descendants in small numbers; while Cuthbert, Marlboro, Herbert and June, among reds, also occasionally transmit yellow.

A pure black crossed with a red, even though the latter carry a yellow factor, will give only purples.

In the color-inheritance studies a rather interesting and possibly useful correlation of characters was observed, by which the undesirable yellow-fruited seedlings of any cross may be eliminated very early. In red crosses the distinction is very plain, but when blacks and reds are united, separation of the yellow from the purple seedlings is a little more difficult. The plants which produce yellow fruit lack the reddish tinge on the upper surface of the young leaves, which is a marked characteristic of the red-fruited varieties; and the gland-like tips of the leaf-serrations also are light yellowish green in color instead of being red or reddish. On the purple-fruited plants, the reddish markings are not so prominent, either on leaves or glands; but on the older leaves the gland-like tips of the serrations are always red, while the yellow-fruited kinds show no red. It is also believed that no red or purple shows on the dormant canes of the yellow-fruited plants.

**Inheritance
of cane
characters.**

Glaucousness, or bloom, on raspberry canes, a characteristic of many black-caps and some red raspberries, and the roughening of the bark due to shedding of the outer layer, seen on so many reds and a few blacks, both appear to be Mendelian dominant characters. That is, if the factor for rough bark and the factor for smoothness of bark are inherited by a plant, the rough-bark factor will prevail, as though the other were not present.

The tendency to reduction of spines, however, does not inherit in any simple Mendelian ratio, hence it is believed that two factors, possibly more, must be considered in the production of a spineless cane. Smith No. 1 transmits spines more strongly than does Cumberland.

**Using new
species.**

The wild thimble-berry or flowering raspberry, *Rubus odoratus*, was used in crossing with the red raspberry, blackberry and dewberry, but with most of the attempts very few seeds resulted. With the Herbert red raspberry, however, good vigorous seedlings were secured in considerable number. These show plainly that they are true hybrids, with the flowering raspberry habit of bush and character of flower but with leaves palmate like those of the red raspberry while large and rough like those of the thimble berry. These seedlings flowered abundantly in 1915 but set few fruits, probably owing to absence of cross pollination.

The success of such hybrids as the purple raspberry and the loganberry emphasize the desirability of work in hybridization; and it is a possibility that the flowering raspberry may become a "go-between" by means of which to unite the blood of several species.