THE GENES FOR DOUBLE FLOWERS IN THE COMMERCIAL VARIETIES OF THE PERPETUAL CARNATION

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By the staff of the Japan Carnation Society, many seedlings of the perpetual carnation, Dianthus Caryophyllus, were raised to improve the flowers. Through the courtesy of the Society, I undertook to investigate them from the genetic standpoint. In view of the complexity of the inheritance of the flower colour, a genic analysis is now under way. This short note, which concerns the genes responsible for the double flowers of the commercial varieties, is intended to follow my report on the sports that were observed on our benches (Imai 1936).

Fig. 1. From left to right, single, standard double, and bullhead flowers.

The commercial varieties of the perpetual carnation are regularly doubled, but, when inter-mated or out-mated between them, they give rise to mixed offspring, consisting of single, standard double, and bullhead double flowers (Fig. 1). According to Batchelor (1912) and Saunders (1917), the segregation is monogenic, or in other words, the three forms are produced in a 1:2:1 ratio, showing that the standard double is an intermediate expression of the heterozygote. In my experience, with the exclusion of Spectrum and its sport, Japanese Pink Spectrum, the preceding statement agreed well
with my data. In more than twenty crosses between Harvester, Morning Glow, Eldora, North Star, Patrician, Matchless, Betty Rou, and some Japanese varieties, the offspring bloomed into single, standard double, and bullhead flowers, as expected. The data, on totaling my records, amounted to 360 singles, 763 standard doubles, and 340 bullheads.

The single flower is small, having five humble ones. The so-called bullhead flower is deformed, having an astonishing large number of duplicated petals, which are said to be composed of some 100–350 ones. The flower generally contains some flower-buds (Fig. 2), which expand and disarrange it. Owing to the deformity of the flower, except for special purposes, the bullhead form is worthless from the commercial standpoint. Sometimes stamens are present, shedding pollen, but the pistil is deformed and abortive. Therefore, the hopeful clones are selected from the standard doubles, which are said each to have some 30–60 petals.

In inter-matings and out-matings of Spectrums, however, single flowers were scarcely produced, presenting entirely different results. These clonal varieties, when their flowers are inter-pollinated, gave offspring consisting of 61 ordinary doubles and 20 bullheads, without any singles. Their out-matings with Harvester, Lady Hindrip, Betty Rou, Eldora, North Star, and others gave 350 ordinary doubles and 138 bullheads. Thus the Spectrum-matings gave monogenic segregation of doubles and bullheads in a 3:1 ratio. In the double flowers, however, there occurred a marked gradation with respect to the degree of doubleness, comprising some inconspicuous doubles, which had a few extra petals. Though infrequent, nearly single flowers came to bloom as an extreme variation.

The results cited above will be understood by assuming two kinds of genes operating in the production of the doubleness, namely:

1. A dominant gene, Da (Double-a), that is responsible for the standard
double when heterozygous. Its homozygous form is the bullhead double; the double doses of the gene strengthens the degree of doubling. The recessive, normal allele, however, produces a single flower.

2. Another dominant gene, Db (Double-b), has to do with the doubling of a low degree, giving a dominant effect when heterozygous.

So far as the doubleness of the flower is concerned, the genic constitution of Spectrums is supposed to be Da/+ Db/Db, while the other commercial varieties are Da/+ +/+ . When inter-mated, Spectrums should give offspring in the ratio of 3 ordinary double (1 +/+ Db/Db and 2 Da/+ Db/Db) : 1 bullhead (1 Da/Db/Db). In their out-matings, the expectation of offspring is 3 ordinary doubles (1 +/+ Db/+ and 2 Da/+ Db/+ ) : 1 bullhead (1 Da/Db/+ ). Phenotypically, both these cases give the same segregation in flower forms, agreeing with my observations.

Thus, when Spectrum was used as one of the parents in cross-breeding, waste singles were hardly segregated, but there occurred some weak doubles, which are also useless for commercial purposes.

References

