Inheritance of Bright-pink Flower Color with Ornamental Value in Crimson Clover

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Crimson clover (*Trifolium incarnatum* L.) is an important cool-season annual legume species used as groundcover in road banks and right-of-ways and for winter grazing in the southeastern United States. Most cultivars and accessions held by the National Plant Germplasm System of the U.S. Dept. of Agriculture have crimson-red inflorescences, but a few have lavender or lavender-on-cream petals (Steiner et al., 1998). White petals are recessive to crimson (Sandal, 1955). Sullivan et al. (1972) reported that the flower colors crimson, deep pink, and medium pink were possibly controlled by three alleles dominant to white. Maroon and lavender were controlled by the interaction of two different genes also dominant to white. None of these genetic markers are currently available (G. Pederson, personal communication).

In 1996, a single plant in an experimental population being field tested at Tallahassee, Ala., produced bright-pink (BP) flowers (2.5R 7/8, Munsell Color Charts). Some of the resulting progeny had crimson flowers, whereas the other plants had BP petals like the mother plant. Progeny of the plants with crimson (2.5R 4/10) flowers segregated for crimson and BP flowers, whereas progeny from the BP flowers produced only plants with BP flowers. The agronomic industry is interested in development of clover cultivars with diverse flower colors. The objective of this study was to

determine the inheritance of BP flower color in crimson clover.

Seed of a single BP-flowered plant from a crimson clover field was collected in 1996 in Tallahassee, Ala. The plant was marked and the flowers were rolled between the fingers to increase the percentage of self-pollination. In 1996–97, seed was collected and planted in the greenhouse of the Auburn Univ. Plant Science Research Center, and the plants were kept isolated from insect pollinators. Progeny from the BP-flowered plant had either crimson or BP flowers. Flowers of both types of plants were rubbed to ensure self-pollination. In 1997, the progeny (families 3 and 8) from two of the crimson-flowered plants were planted in a growth chamber (18 °C, 18-h daylength provided by a mixture of fluorescent and incandescent lamps that produced a photosynthetic flux density of 380 $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$), and the plants were scored for flower color. A larger progeny from a third crimson-flowered plant (family 11) was grown in the greenhouse in 1998 (January through April) and scored for flower color. Environmental conditions in the greenhouse were set to 18 °C with natural daylength. G-statistics tests were used to determine the goodness of fit to the expected segregation ratio (Sokal and Rohlf, 1981).

Progeny from selfing the BP-flowered plants had BP flowers. Three populations derived from selfing three crimson-flowered plants segregated for crimson or BP flowers in a 3:1 ratio. Segregation ratios for each F_2 family fit a one-gene model (Table 1). A χ^2 homogeneity test indicated that the populations were homogeneous ($P = 0.75\text{--}0.90$) and that the data could be pooled. Thus, results from the three F_2 families were combined. The G-test also indicated a good fit to the one-gene model. These results indicate that BP color is a simply inherited character controlled by a recessive allele at a single locus. The designation of *bp*, for BP mutant, is proposed for this allele.

The BP flower color is easily identifiable and, because it is simply inherited, may be valuable as a genetic marker in linkage studies of flower color in crimson clover. Furthermore, the BP flowers are quite attractive; thus, an ornamental “crimson clover” with a different flower color can be developed for use as a groundcover. Such a population may offer new uses in agronomic and horticultural industries. Current efforts are under way to evaluate progeny performance of BP-flowered plants selected from the populations included in this study in central Alabama.

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Table 1. F_2 family segregation for crimson and bright-pink flower color in crimson clover.

F_2 family	No. of plants		Expected ratio	G-statistic	<i>P</i>
	Crimson flower	Bright-pink flower			
3	41	14	3:1	0.01	0.90–0.95
8	39	15	3:1	0.22	0.50–0.75
11	97	44	3:1	2.76	0.05–0.10
All combined	177	73	3:1	2.27	0.10–0.25

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