A Note on Testcrosses Between Tan or Pink Testa Color and Recessive Red Peanut Genotypes[1]

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ABSTRACT

Phenotypically distinguishing between tan and pink peanut (*Arachis hypogaea* L.) testa color can be difficult. Genetic separation was attempted by testcrosses with homozygously recessive red testa genotypes ($\underline{r}_2\underline{r}_2$, $\underline{r}_3\underline{r}_3$). The recessive red testa color was found to differ from all of the following pink and tan cultivars: Sunbelt Runner, Southern Runner, Starr, Toalson, and the tan colored Krinkle-leaf genotype ($\underline{F}_1\underline{F}_2\underline{D}_1\underline{D}_2\underline{r}_1$) by only one of the two recessive red loci. Even though these results show that testcrossing to recessive red genotypes is not a viable approach for discerning tan versus pink testa color, it does suggest that several peanut cultivars already carry one recessive red gene.

Key Words: *Arachis hypogaea* L., groundnut, seedcoat color inheritance, cultivars.

Within peanut (*Arachis hypogaea* L.) germplasm, pink versus tan testa color has been somewhat difficult to discern and just as difficult to genetically explain. Likewise, both colors may not be equally desirable within present-day, peanut breeding programs because of seed appearance, blending, and acceptances by manufacturers.

Pink peanut testa color differs from tan in having more of a pinkish-tinge appearance, but intensity does seem to vary somewhat even within these testa color genotypes. Distinguishing the two testa colors can be complicated because of environmental factors such as leaching or fading from moisture or disease and insect damage during seed development. Age and maturity also can cause some problems in separating the different testa colors.

The ambiguous classification of tan and pink peanut seed has resulted in grouping of these two colors together on numerous occasions. So, the need to find a reliable genetic means to separate tan versus pink became apparent.

Unfortunately, the differential inheritance of tan versus pink peanut testa color is still not understood. However, two sets of duplicate genes ($\underline{F}_1\underline{F}_2$ and $\underline{D}_1\underline{D}_2$) are known to interact in the development of basic testa color, and it takes at least one dominant $\underline{F}$ and $\underline{D}$ for color to be expressed. Otherwise, when either or both sets of these two genes are homozygously recessive only white testa color results.

Hammons (5) suggested that the flesh or tan testa color of T-900 or Krinkle-leaf genotype ($\underline{F}_1\underline{F}_2\underline{D}_1\underline{D}_2\underline{r}_1$) was typical of other spanish U.S. market types (*A. hypogaea* L. subsp. *fastigiata* var. *vulgaris*). Conversely, pink testa color has been frequently associated with the runner and virginia market types (*A. hypogaea* L. subsp. *hypogaea* var. *hypogaea*).

Recently, recessive red peanut testa color has been shown to be controlled by two complementary genes (3, 7). Branch and Holbrook (2) also found that the Makulu Red cultivar did not differ from two other homozygously recessive red genotypes ($\underline{r}_2\underline{r}_2$, $\underline{r}_3\underline{r}_3$) which were derived upon crossing different pink testa colored, parental lines.

Previously, Branch and Hammons (1) had reported monogenic differences between Makulu Red and sister lines of Florunner and Florigiant. These new findings would suggest that certain pink testa color peanut cultivars are already recessive for one of the two red genes. Thus, the objective of this study was to determine a) if one recessive red gene is a common occurrence among other peanut cultivars and b) if just one recessive red locus could be responsible for the contrasting pink *vs* tan testa color expression.

Materials and Methods

Testcross combinations were made in the greenhouse between bulked F_3-derived red testa color gentoypes ($\underline{r}_2\underline{r}_2$, $\underline{r}_3\underline{r}_3$) obtained from Southern Runner x Sunbelt Runner cross combination (7) and four tan or pink testa color cultivars plus Krinkle-leaf. The four cultivars included the two recurrent runner parents of these recessive red testa genotypes, Southern Runner and Sunbelt Runner, and two spanish-type cultivars, Starr and Toalson.

The testa of Starr is reported to be tan-colored (9). However, Starr and Toalson have visually similar, yet slightly pink looking testa color. Toalson has Starr as one parent (10). Seed of Sunbelt Runner are distinctly pink in color (8), whereas Southern Runner seed have a much lighter tan color (4).

The F_1 and F_2 populations were each space-planted in nursery plots at the agronomy field research farm near Tifton, Georgia during 1987 and 1988, respectively. Recommended production practices of fertilization, irrigation, and pest control were applied throughout the growing seasons. Phenotypic classification of individual plant testa color was based upon fully mature sound seed. Segregation data were analyzed by the CHISQA computer program of Hanna *et al* (6).

Results and Discussion

The F_1 testa colors from the recessive red testcrosses to Sunbelt Runner, Southern Runner, Starr, Toalson, and Krinkle-leaf were all pink. As expected, this again showed the recessive nature of the red testa color among these peanut cross combinations.

If the hypothesis that pink testa color genotypes ($\underline{R}_2\underline{r}_3$ or $\underline{r}_2\underline{R}_3$) differ from tan ($\underline{R}_2\underline{R}_3$) by one of these two recessive red loci was true, then F_2 segregation involving the homozygously recessive red parent ($\underline{r}_2\underline{r}_2$, $\underline{r}_3\underline{r}_3$) should yield a 15:1 ratio for

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tan and 3:1 for pink testa color parents. Unfortunately, this was not the case.

Segregation of the F_2 populations from each of the five peanut testcrosses showed a good fit to a 3 pink or tan: 1 red ratio (Table 1). Likewise, total, pooled, and homogeneity chi-square values all fit a simple monogenic model. Since in an earlier study by Holbrook and Branch (7) the same F_3-derived genotypic lines from red testa F_2 plants bred true-to-type and two of these five testcrosses were also backcrosses to both original parents, F_3 data was not deemed necessary.

Thus, only one gene was found to be different between the recessive red genotype and each of these diverse parental lines. These results also agree with the previous report of one gene difference found between Makulu Red and the two popular U.S. pink-testa cultivars, Florunner and Florigiant (1).

So far, we have been assuming that both tan and pink testa colors had the same basic developmental genotype, $\underline{F}_1\underline{F}_2\underline{D}_1\underline{D}_2$. However, possibly only one of either of these two duplicate loci could be the contributing genetic factors for tan versus pink. Then for example, $\underline{F}_1\underline{f}_2\underline{D}_1\underline{D}_2$ or $\underline{F}_1\underline{F}_2\underline{D}_1\underline{d}_2$ might be the pink genotype and $\underline{F}_1\underline{F}_2\underline{D}_1\underline{D}_2$ the tan. It does appear from other cross combinations that pink may be recessive to tan by only a single gene (unpublished data). Such possibilities should be considered in future testa color inheritance studies.

Table 1. F_2 testa color segregation from five peanut testcrosses involving recessive red genotypes as the female parent.

Rec. Red Testcross	No. Families	F_2 Testa Color		χ^2 (3:1)
		Pink or Tan	Red	
X Sunbelt Runner	4	377	122	0.081
X Southern Runner	3	621	196	0.444
X Starr	2	933	312	0.002
X Toalson	2	895	297	0.004
X Krinkle-leaf	2	912	327	1.281
Total				1.812
Pooled		3738	1254	0.038
Homogeneity				1.774

In conclusion, the recessive red testcross approach did not discriminate tan versus pink testa color genotypes. However, it does show that several peanut cultivars already carry one recessive red gene and that these genotypes can still express either tan or pink testa color.

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