This pigment-enhancing "side-effect" of stippled tends, of course, to vitiate the present test for a cytoplasmic component in the R paramutation system. If a cytoplasmic element that depresses R aleurone pigmentation is present in the R' segregates from RSt R, its effect is exceeded by the oppositely directed inter-kernel action of stippled.

R. A. Brink

2. Relative paramutagenic capacities of the paramutant forms of R\superscript{G} mutants derived from the standard R\superscript{F} allele.

It has been found that the standard R\superscript{F} allele and its R\superscript{G} mutant derivatives not only become heritably reduced in pigmenting action when passed through a heterozygote with the stippled (R\superscript{G\*}) allele but that they also acquire the capacity to promote a similar, though smaller, reduction in pigmenting action when combined with other paramutable genes (Brown and Brink, Genetics 45:1313-1316, 1960). The data reported here indicate that ten R\superscript{G} alleles independently derived by mutation from standard R\superscript{F} are indistinguishable from one another with regard to the level of paramutagenic activity acquired in heterozygotes with RSt.

Pollen from each of twelve R\superscript{F}R\superscript{F} plants was applied to silks of R\superscript{G}R\superscript{G}\superscript{St} plants representing the ten R\superscript{G} alleles. Progeny from a total of 111 successful pollinations of this type were grown in the following season, and two randomly selected R\superscript{F}R\superscript{G}\superscript{1} plants from each family were testcrossed to R\superscript{G}\superscript{G\*}\superscript{St} pistillate parents. In this way, R\superscript{G} genes derived from nine to twelve R\superscript{G}R\superscript{G}\superscript{St} plants in the case of each R\superscript{G} allele were combined with standard R\superscript{F} genes from a common source. Differences in paramutagenic competence among the paramutant forms of the various R\superscript{G} alleles should be reflected in this test as differences in the level of pigmenting action of R\superscript{F} genes in the corresponding groups of R\superscript{F}R\superscript{G}\superscript{1} plants.

Forty-two R\superscript{F}R\superscript{G}\superscript{G\*} kernels from each R\superscript{G}\superscript{G\*} \times R\superscript{F}R\superscript{G}\superscript{1} test mating were scored against a standard set of kernels defining seven pigmentation classes. The mean R\superscript{F}R\superscript{G}\superscript{G\*} scores from testcrosses of two R\superscript{F}R\superscript{G}\superscript{1} plants from each of the 111 R\superscript{G}R\superscript{G}\superscript{St} \times R\superscript{F}R\superscript{G} matings are shown in Table 1.

An analysis of variance performed on the data in Table 1 revealed no differences among the mean scores attributable to the R\superscript{G} alleles involved in the respective pedigrees (F = 0.751, P > .1). The overall mean R\superscript{F}R\superscript{G}\superscript{G\*} scores from testcrosses of R\superscript{F}R\superscript{G}\superscript{1} plants involving individual R\superscript{G} alleles are all within the range 5.21 to 5.31. These results show that the ten R\superscript{G} mutants from standard R\superscript{F} are indistinguishable from one another with regard to the level of paramutagenic action acquired in heterozygotes with RSt.
Table 1

Mean scores for $R^{r}R^{r}$ kernels from testcrosses to $R^{g}R^{g}$ pistillate parents of $R^{r}R^{g}$ offspring of $R^{r}R^{r} \times R^{g}R^{g}$ matings. Each entry represents the pooled tests of two $R^{r}R^{g}$ plants.

<table>
<thead>
<tr>
<th>$R^{r}R^{r}$ parent no.</th>
<th>$R^{g}$ allele number</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>5.10</td>
<td>5.26</td>
<td>5.29</td>
<td>5.18</td>
<td>5.38</td>
<td>5.50</td>
<td>5.57</td>
<td>-----</td>
<td>5.28</td>
<td>5.01</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>4.73</td>
<td>5.26</td>
<td>5.32</td>
<td>5.32</td>
<td>5.01</td>
<td>5.32</td>
<td>5.27</td>
<td>5.32</td>
<td>5.07</td>
<td>5.18</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>5.43</td>
<td>5.32</td>
<td>5.11</td>
<td>5.30</td>
<td>4.98</td>
<td>5.25</td>
<td>5.18</td>
<td>5.41</td>
<td>5.18</td>
<td>5.19</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>5.35</td>
<td>5.28</td>
<td>5.12</td>
<td>5.29</td>
<td>5.41</td>
<td>5.00</td>
<td>5.27</td>
<td>5.20</td>
<td>5.53</td>
<td>5.43</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>5.34</td>
<td>5.17</td>
<td>5.43</td>
<td>5.16</td>
<td>5.16</td>
<td>5.37</td>
<td>5.11</td>
<td>5.02</td>
<td>5.22</td>
<td>5.43</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>5.31</td>
<td>5.12</td>
<td>5.43</td>
<td>-----</td>
<td>5.49</td>
<td>5.22</td>
<td>5.13</td>
<td>5.11</td>
<td>5.84</td>
<td>4.99</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>5.28</td>
<td>5.41</td>
<td>5.31</td>
<td>5.40</td>
<td>5.41</td>
<td>5.32</td>
<td>5.29</td>
<td>5.36</td>
<td>5.08</td>
<td>5.08</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>5.42</td>
<td>5.31</td>
<td>5.40</td>
<td>-----</td>
<td>-----</td>
<td>5.29</td>
<td>5.20</td>
<td>5.31</td>
<td>5.03</td>
<td>4.81</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>5.20</td>
<td>5.46</td>
<td>5.26</td>
<td>5.10</td>
<td>5.19</td>
<td>5.48</td>
<td>-----</td>
<td>5.30</td>
<td>5.27</td>
<td>5.68</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>5.55</td>
<td>5.63</td>
<td>5.03</td>
<td>5.17</td>
<td>5.28</td>
<td>5.29</td>
<td>5.14</td>
<td>5.19</td>
<td>5.45</td>
<td>5.08</td>
</tr>
<tr>
<td>11</td>
<td></td>
<td>5.29</td>
<td>-----</td>
<td>4.92</td>
<td>5.43</td>
<td>-----</td>
<td>5.38</td>
<td>-----</td>
<td>5.51</td>
<td>5.10</td>
<td>5.40</td>
</tr>
<tr>
<td>12</td>
<td></td>
<td>5.24</td>
<td>5.28</td>
<td>5.42</td>
<td>5.06</td>
<td>4.97</td>
<td>-----</td>
<td>-----</td>
<td>5.10</td>
<td>5.43</td>
<td>-----</td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td>5.27</td>
<td>5.31</td>
<td>5.21</td>
<td>5.30</td>
<td>5.23</td>
<td>5.31</td>
<td>5.34</td>
<td>5.26</td>
<td>5.29</td>
<td>5.21</td>
</tr>
</tbody>
</table>
Previous studies (Brink, Brown, Kemnicke and Weyers; Genetics 45:1297-1312, 1960) established that the pigmenting capacities of $R^p$ and eight of its $R^g$ mutant derivatives are reduced to a similar extent in heterozygotes with $R^s$. Testcrosses to $R^g R^s$ pistillate parents of $R^s R^g$ and $R^g R^g$ sib progeny from $R^s R^s$ x $R^g R^s$ matings have confirmed that the $R^g$ and $R^s$ alleles are equally sensitive to the paramutagenic stimulus of $R^s$ when measured in terms of aleurone pigmentation. The present test does not provide for an assessment of the relative paramutagenic potencies of paramutant $R^p$ and paramutant $R^g$. The observation that ten $R^g$ mutants of independent origin do not differ in level of paramutagenic action acquired in heterozygotes with $R^s$, however, agrees with the conclusion, implied by the results of tests of $R^s R^g$ and $R^g R^g$ plants, that the mutational events underlying the origin of the $R^g$ alleles involved in these studies have not altered the chromosomal elements concerned with paramutation.

Douglas F. Brown


The reduction in the pigmenting action of paramutable $R$ alleles which is induced by paramutant $R^p$ genes is slight when compared with that induced by $R^s$ (Brown and Brink, Genetics 45:1313-1316). Tests of $R^g R^g$ and $R^p R^g$ plants in $F_1$, $F_2$, and backcross 1 generations, which are described here, reveal that the extent of impairment in the pigmentation action of $R^g$ or $R^p$ is cumulative when the paramutant allele acts in two successive sporophytic generations.

$R^g R^g$ staminate testcross parents were produced according to the following mating plan:

$$
\begin{array}{c}
\text{Table 1} \\
R^s R^s \times R^p R^p \\
\downarrow \\
R^g R^g \\
\downarrow \\
R^g R^g \\
\downarrow \\
R^g R^g
\end{array}
$$

Four lines, each containing a different $R^g$ allele, were established from single $R^s R^s \times R^p R^p$ pollinations. A single $R^g R^g$ offspring from each $R^s R^s \times R^p R^p$ mating was sibbed to produce $R^g R^g$ $F_2$ plants, and another was crossed to $R^s R^s$ to produce $R^g R^g$ backcross 1 ($BC_1$) plants. The two $R^s R^s$ plants in each pedigree were sibs grown from the same parental ear.