Tester stocks for A-B translocations — To use A-B translocations (TB's) efficiently for locating genes, it is necessary to know that crosses have been made with plants carrying the translocation. One sure way to do this is to use a homozygous translocation line. I am not aware, however, of many homozygous A-B translocation stocks; most lines have been propagated by outcrossing. It is best to use the TB parents as females, thereby producing heterozygous TB plants of A $A^B$ $B^A$ constitution. If the TB plants are used as males, most of the heterozygotes will be hyperploid (i.e., A $A^B$ $B^A$ $B^A$). The euploid heterozygotes have slightly higher pollen sterility than the hyperploid and are thus easier to classify. The compound TB's are exceptions to the general use of female propagation; it is better to propagate these as males. Because the pairing relationships in the hyperploid plants are more likely to be $AA^B$ and $B^AB^A$, there is less likelihood of a crossover occurring that would disrupt the compound TB than in euploid heterozygotes where the $B^A$ element is more likely to pair with the homologous A chromosomes.

Pollen sterility is one way of picking out plants carrying TB's, but it is not a foolproof method since sterility is frequently low and will overlap the range observed in normal siblings. For euploid heterozygotes 15-25% defective pollen can be expected, while hyperploid heterozygotes will exhibit 10-20%. Hyperploid compound TB's have pollen sterility that ranges from 15% to nearly 50%, although the most commonly observed value is about 25%. Because these stocks carry a reciprocal A translocation some plants with high sterility (e.g., up to 50%) may not carry the TB. Therefore, all compound TB's must be confirmed by crossing to a marker gene (see below). If the TB parent (simple or compound) is crossed as a male, some deficient plants will be produced which show approximately 50% sterility; these are of no use in locating genes or in propagating the TB.

A more reliable way to pick plants which are known to carry a given TB is to use endosperm marker genes. If the TB is propagated in the absence of the marker gene, subsequent crosses to the marked stock will generate seeds segregating for the marker. Such seeds will have a deficient (hypoploid) endosperm and a hyperploid embryo and thus carry the desired TB. Table 1 lists the TB's I have worked with and the marker stocks that can be used to generate known heterozygotes. This list is made up of those TB's originally produced by Roman (Agron. J. 43:450-454, 1951), some of those more recently developed by Beckett (MGNL 45:144-146, 1971) and compound TB's developed by Rakha and Robertson (Genetics 65:223-240, 1970).

Table 1. Suggested marker genes for producing known TB heterozygotes.

| TB | Source | Chromosome arm(s) | Endosperm tester gene | Hypoploid endosperm phenotype | Comments |
|---|---|---|---|---|---|
| 1a | Roman | 1L | lw | Pale yellow &/or white | Crosses will segregate large and small seeds. Small seeds will have hyperploid embryos. |
| 1b | Roman | 1S | vp5 | Pale yellow &/or white | Crosses will segregate large and small seeds. Small seeds will have hyperploid embryos. |
| 1c | Beckett | 1L | lw | Pale yellow &/or white | |
| 2S,3L (6270) | Rakha & Robertson | 2S & 3L | al | Pale yellow &/or white | Compound TB |
| 2L,1Sc | Rakha & Robertson | 2L & 1S | w3 | Pale yellow &/or white | Compound TB |
| 2L,1S (4464) | Rakha & Robertson | 2L & 1S | w3 | Pale yellow &/or white | Compound TB. I have a homozygous stock of this translocation. |
| 2L,3L (7285) | Rakha & Robertson | 2L & 3L | w3 | Pale yellow &/or white | Compound TB |
| 3a | Roman | 3L | a or sh2 | Non-purple or Shrunken | |
| 3b | Beckett | 3S | c1 | Pale yellow &/or white | |
| 4a | Roman | 4S | su | Sugary | |
| 4L,9S (6222) | Rakha & Robertson | 4L & 9S | c2 | Non-purple | Compound TB |
| 4L,9S (6504) | Rakha & Robertson | 4L & 9S | c2 | Non-purple | Compound TB |
| 4L,1L (4692) | Rakha & Robertson | 4L & 1L | c2 | Non-purple | Compound TB |

Table 1. (continued)

| TB | Source | Chromosome arm(s) | Endosperm tester gene | Hypoploid endosperm phenotype | Comments |
|---|---|---|---|---|---|
| 4L,7L (4698) | Rakha & Robertson | 4L & 7L | c2 | Non-purple | Compound TB |
| 5S,1L (8041) | Robertson | 5S & 1L | a | Non-purple | Compound TB |
| 5a | Beckett | 5L | lw2 or pr | Pale yellow &/or white; red seeds | |
| 6b | Beckett | 6L | none | | Crosses with w14 ($w_{8657}$) can be used to confirm the presence of the TB but they cannot be used to select TB plants. Use pollen sterility. |
| 7b | Roman | 7L | o5 | Opaque-shrunken | |
| 8a | Roman | 8L | none | | Crosses with v21 can be used to confirm the presence of the TB but cannot be used to select TB plants. Use pollen sterility |
| 9a | Roman | 9L | none | | Crosses with Bf can be used to confirm the presence of the TB but cannot be used to select TB plants. Use pollen sterility. |
| 9b | Roman | 9S | c or sh | Non-purple or Shrunken | |
| 9c | Beckett | 9L | none | | Crosses with Bf can be used to confirm the presence of the TB but cannot be used to select TB plants. Use pollen sterility. |

Table 1. (continued)

| TB | Source | Chromosome arm(s) | Endosperm tester gene | Hypoploid endosperm phenotype | Comments |
|---|---|---|---|---|---|
| 10a | Roman | 10L | r | Non-purple (purple scutellum, see comments) | I have a homozygous TB stock, homozygous for purple aleurone and the R-scm2 allele that colors the scutellum. |
| 10b | Beckett | 10L | r | Non-purple | |
| 10c | Beckett | 10S | y9 | Pale yellow | |

Tester genes lw, vp5, w3, lw2 and cl are all white-albino mutants and cannot be made homozygous. Thus, segregating populations must be used, and it is best to cross each putative TB plant with several plants suspected of carrying the marker gene. The al, y9 and o5 marker genes produce weak homozygotes, and it would be more efficient if a tester line were established by crossing homozygotes of these markers (as males) to a standard line to develop stocks of known heterozygotes.

Donald S. Robertson

Additional studies on the differential recovery of crossover products from male and female in plants hypoploid for TB-10a — In 1970, I reported that more crossover products were recovered through the pollen than through the eggs of TB-10a hypoploid (deficient) plants (MGCNL 44:84-91, 1970). In these tests plants hypoploid for TB-10a and heterozygous for y9 were reciprocally crossed with homozygous y9 plants. The hypoploid plants carried y9 on the normal chromosome and the + allele on the deficient $10^{B}$ chromosome; most of the functional gametes from such plants will be expected to carry y9, but a few + gametes will be produced as a result of crossing over between the breakpoint and y9. The frequency of + (yellow endosperm) seeds in crosses involving hypoploid plants will therefore be a measure of the crossing over.

The crosses in the 1970 report (1969 crosses) were not exact reciprocals. In 1970 and 1971 paired reciprocal crosses were made so that in each set of crosses the two plants involved functioned as both male and female parents with respect to each other. The results of these tests (Table 1) are in agreement with those reported in 1970.