Locating Recessive Genes to Chromosome Arm with B-A Translocations

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The B-A translocations of maize permit recessive genes to be located to the correct chromosome arm in the F₁. RFLPs, codominants, and dominant genes with extreme phenotypes when homozygous or hemizygous can also be located to the appropriate chromosome arms by this system. See previous chapter by Carlson for a description of B-A translocation behavior.

B-A translocations are reciprocal translocations between the basic, or A, set of chromosomes and the supernumerary B chromosome (Figure 43.1). At the second pollen division, the B chromosome nondisjoins (i.e., both products of mitosis remain together), so that one sperm cell of a pollen grain has two B chromosomes and the other has none. If part of an A chromosome arm has been translocated onto the centromere-bearing portion of the B chromosome, then nondisjunction of this B-A chromosome results in one sperm with two copies of the A arm and the other sperm with none (Figure 43.2). (Note that a complete B-A translocation consists of two parts, the B-A chromosome, bearing the B centromere, and the A-B chromosome with the A centromere. The distal portion of the B chromosome carries a factor for nondisjunction, so the A-B chromosome must be present before the B-A chromosome can nondisjoin.) If the deficient sperm fertilizes the egg, the resulting embryo (and subsequently the resulting plant) will be hemizygous (hypoploid) for part of the A chromosome arm. On the other hand, if the deficient sperm unites with the polar nuclei, the resulting endosperm will lack the B-A chromosome. If a dominant gene for color resides on the translocated A arm, and the female parent carries the recessive allele, then noncorrespondence between the genotypes of the embryo and the endosperm can be demonstrated (Figure 43.3). More complete discussions of B-A translocations (Beckett 1978, 1991; Birchler 1983) and factors affecting nondisjunction (Carlson 1978, 1986) are available.

This chapter is concerned primarily with providing a list of the B-A translocations.
and discussing their use in locating genes to chromosome arm. Please consult the reviews by Beckett, Birchler, and Carlson (see preceding paragraph) for references to original publications. Other papers are cited only if their contents are not covered in the reviews. Table 48.1 lists the B-A translocations available. The compound B-A translocations listed in the table were developed by crossing regular reciprocal translocations with existing