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Using Fluorescence in situ hybridization to study maize lines genetically predicted to have chromosomal abnormalities

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Since the 1960s, genetic evidence has indicated chromosome damage and nondisjunction in lines of maize containing knob heterochromatin-bearing chromosomes and at least two B chromosomes. However, at that time researchers lacked the technology to visualize these occurrences. Now, using Fluorescence in situ Hybridization to "paint" and photograph the chromosomes, it is possible to accurately karyotype and identify broken, missing, or extra chromosomes. A line with a very large number of heterochromatic knobs had been crossed with another line containing supernumerary B chromosomes. This F1 hybrid that had been self pollinated (B73+B/K10) was chosen for study by the FISH method because it contains both knobs and B chromosomes, as well as exhibiting abnormalities such as irregular rows, ovule abortion, and defective kernels. This material combined a high knob number with B chromosomes and exhibited properties suggestive of chromosome breakage or nondisjunction. Metaphase spreads from the root tips were prepared and hybridized to fluorescent probes. Spreads were observed using fluorescence microscopy. The majority of the plants studied possessed the normal content of 20 A chromosomes plus varying numbers of B chromosomes. One individual was found with 21 chromosomes that might have resulted from nondisjunction. No chromosomal breakage was evident in this background. FISH proved to be a powerful cytogenetic tool in observing these plants; however, further research on this topic is needed to provide insight into the cause of the genetic abnormalities.