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Mitochondrial DNA insertions into the nuclear chromosomes of the maize Mo17 inbred line

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Mitochondria contain their own DNA separate from the nucleus; however, most of their genes have been transferred to the nucleus over evolutionary time. The lateral transfer of DNA from the mitochondria to the nucleus appears to be a continuing process and is more frequent in plants than in animals. Our laboratory has documented extensive variation in the nuclear-mitochondrial sequences (NUMTs) among maize inbred lines using total mitochondrial DNA (mtDNA) as probes onto mitotic metaphase chromosomes, a technique known as fluorescence in situ hybridization (FISH). The mitochondrial genome has been cloned into 20 cosmids, which were used to examine the insertions of individual segments. The focus of the current study was to use FISH with the 20 individual mtDNA-containing cosmids to locate mtDNA within the nuclear chromosomes of the Mo17 inbred line of maize and to compare these locations with those of the B73 line. We studied Mo17 because this line and its derivatives are used in crosses with B73-derived lines to create the most commonly used corn hybrids. Fifteen NUMTs had been detected on the Mo17 chromosomes using a mixture of 19 mtDNA-containing cosmids. However, only nine of the 15 NUMTs were seen when applying individual mtDNA-containing cosmids, suggesting that the portions of nuclear DNA corresponding to the individual mtDNA-containing cosmids were too small to be detected until many cosmids were combined. A large NUMT was previously detected on the long arm of chromosome 9 by 14 of the 20 individually tested cosmids in the B73 inbred line. However, a NUMT present at the same site in Mo17 was detected by only 2 of the 20 cosmids (5 and 20). This suggests that the major insertion in B73 is recent and that it may have inserted by homologous recombination.