SUMMARY

Interspecific hybrids between *P. glaucum* and *P. mezianum*, and *P. glaucum* and *P. orientale* obtained earlier were analyzed for their nuclear and cytoplasmic components by Southern blot hybridization of restricted genomic DNA with homologous and heterologous probes. The morphology and habit of all the hybrids more towards their pollen parent implied the dominant nature of the tertiary gene pool genome(s) over *glaucum*. Reciprocal crosses were made but no interspecific hybrid progeny could be obtained, in spite of repeated attempts (this study). Since the cross was unilateral, attempts for synthesis of somatic hybrids met with limited success (data not presented).

The homologous clones developed in our lab showed fixed variation or differential modulation among five *Pennisetum* species examined. Sequencing revealed the clones that showed modulation were distinctly nuclear, while the clones that showed fixed variation mapped to the Chloroplast genome. The copy numbers of the nuclear clones were high in *P. glaucum*, while being far less in the other tertiary gene pool members. Sequence in clone PGB 625 belonged to the major class of satellite DNA cloned earlier and was highly polymorphic as seen from Southern hybridizations. PGB 625 related sequences were amplified to very high levels in 'A' or 'A'-like genome(s) and is not a genus-specific sequence. Sequences in clone PGB 662 and PGB 107 were new and highly polymorphic in *P. glaucum*. The Chloroplast clones mapped to different regions on the cpDNA except clones PGP 005 and PGB 727 that had a 2 kbp overlap. Four clones viz., PGP 005, PGB 727, PGB 058 and PGB 074 were highly conserved across taxa and code for ribosomal RNA and Photosystem I-related peptides. Clone PGB 788 contained sequences homologous to IRF 170 that showed conservation across *Pennisetum* species. Clone PGB 582 contained sequences homologous to ribosomal protein genes and initiation factor A and showed variation between *Pennisetum* species. Clone PGE 015 contained sequences homologous to transfer RNAs and ATPases and showed variation between *Pennisetum* species. Clone PGE 123 contained sequences homologous to tRNA gene cluster and covered the region considered one of the hot spots in Chloroplast DNA hence showed maximum variation between *Pennisetum* species.

The nuclear genome(s) in the interspecific hybrids were analyzed using rDNA, repetitive DNA and unique-copy sequences as probes in Southern hybridization. All the GxO hybrids had the complete set of *glaucum* and *orientale* complement. In four GxM
hybrids, *glaucum* complement was eliminated completely. In one hybrid, elimination of *glaucum* complement was incomplete and in the other eight hybrids, no elimination of the *glaucum* complement was seen. Deviations from the ideal hybrid pattern *viz.*, loss of parental fragments and appearance of novel fragments was observed for rDNA in GxO and GxM hybrids. The observed deviations were not due to methylation. A localized recombination between rDNA loci could be the likely cause, indicative of intergenomic rearrangements between the parental sets akin to homoeologous recombination. Repetitive DNA and unique copy sequences showed no specific tendency. Since, the parental species had differentiated nuclear complement, rapid elimination of sequences to discriminate homoeologous chromosomes, may not be operating in the interspecific hybrids analyzed.

The Chloroplast clones, when used as probes in Southern hybridizations, revealed four of the GxM hybrids had paternal plastids, eight GxM hybrids had maternal plastids and one GxM hybrid had a skewed heteroplasmy. Among the GxO hybrids, eleven had maternal plastids and one had paternal plastids. To our knowledge this is the first report of high frequency paternal plastid transmission in Gramineae in an interspecific cross.

The mitochondrial clones, when used as probes in Southern hybridizations, revealed only the female pattern consistent with maternal inheritance of mitochondria in angiosperms. Few hybrids showed additional non-parental fragments that could be due to the nature of the mitochondrial genome *per se* or due to nucleo-cytoplasmic interaction after hybridization.

Four of the GxM hybrids that showed complete elimination of *glaucum* nuclear complement, had paternally-derived plastids and maternally-derived mitochondria. The fertility of the four GxM hybrids implied nuclear restorer(s) from the *mezianum* genome were able to restore fertility to the male sterile cytoplasm of *glaucum*. One GxM hybrid that showed incomplete elimination of the *glaucum* nuclear complement, had skewed heteroplastidic setup and maternally-derived mitochondria, was completely male & female sterile. The other eight GxM hybrids that had complete sets of *glaucum* and *mezianum* nuclear complement with maternal plastids and mitochondria are yet to flower. All the GxO hybrids flowered but were sterile. From two GxO hybrids, plantlet-like structures developed from the spikes that did not grow beyond 4 cm in length. This could be reminiscent of the apomictic mode of reproduction seen in *orientale*. 