

# Validation of PCR-based Markers to differentiate Petaloid CMS Systems and Male Fertility in Carrot (*Daucus carota* L.)

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**Abstract**—Cytoplasmic male sterility (CMS) is an important genetic mechanism for facilitating hybrid development and low cost hybrid seed production. The most widely used type of CMS system in carrot is petaloidy, in which the stamens are replaced by petals or bract-like structure and this is due to interaction of sterile cytoplasm and homozygous nuclear genes. In the present investigation a number of mitochondria-specific PCR markers were tested to distinguish petaloid sterility (Sp) and male-fertility (N). The markers targeted *atp1*, *atp6*, *atp9* and *cob* loci from the mitochondrial genomes of carrot. Twelve genotypes of carrot were used in the study viz. IPC-55A, IPC-55B, IPC-11 Red A, IPC-11 Red B, IPC-124 A, IPC-124B, IPC-11 Orange A, IPC-11 Orange B, IPC-7A, IPC-7B, IPC-126 A and IPC-126B. Out of these six were male fertile and remaining had petaloid cytoplasmic male sterility. The A lines represented the CMS line whereas B lines represented the corresponding maintainer male fertile line. A total of 10 primer were used on these twelve genotypes to test their potential in discriminating CMS and male fertile lines. Two primers based on *cob* and *atp6* genes were able to distinguish male fertile and CMS lines but gave a dominant pattern where the band was present only in CMS lines, whereas four primers designed from *atp9* genes gave alternate alleles in CMS and Male fertile lines. The markers reported in this study are useful tools to identify the type of cytoplasm in cultivated carrot and to evaluate variation in the mitochondrial genomes within the genus *Daucus*