

ABSTRACT

Characterization and *In Vitro* Investigation of the Puffy Stem Phenomenon in *Capsicum annuum Pfi* mutant plants

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Mutant traits are crucial genetic resources in *Capsicum annuum* breeding because they introduce new alleles and phenotypic variation that can improve plant structure, fruit quality and stress resistance. As stem mutations were once considered harmful, breeders now use these traits to improve yield and develop new cultivation methods. Traits related to the hypocotyl and stem growth are particularly important, as seen in mutants like *pcx* (*procumbent plant*) and *titi* (*tortuosa internodi*), which show irregular growth or longer stems and changes in response to gravity.

This study focused on the *pfi* mutant, which has a strong laying-down growth pattern and puffy stems, to find out if its unusual phenotype is due to various environmental stimuli or weak stem structure. Experiments showed that *pfi* seedlings sense light and gravity normally, with root statoliths present and normal antigravitropic responses. Over time, the hypocotyls bent more slowly but still adjusted to gravity. Biochemical tests, including measuring lignin and starch, found much less lignin in all stem areas, especially in the lower parts that support the plant. Starch-filled amyloplasts (statoliths) were present in root tips, ruling out problems with starch-based perception as the reason for the altered response to gravity.

These results show that the *pfi* laying-down growth is due to less lignin and weaker stem structure, not problems with how the plant senses light or gravity. This study shows why it is important to combine structural and physiological analysis in mutant research and provides a way to use stem traits to improve plant structure in pepper breeding.