Microscopy for Phytohormone-Induced Alterations in Wheat Callus Cells

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Plant callus cells are undifferentiated, disorganized, proliferating cells that can form on plant tissues in response to wounding in vivo or phytohormone-induced stimuli in vitro, and are used in plant biotechnology for micropropagation and genetic manipulation. The role of cytokinins in organogenesis from callus cells is well described, yet the effects of cytokinins on callus initiation and proliferation, and on microscopic changes in callus cell culture, are not yet well understood. Wheat embryos were cultured in culture media under different phytohormone treatments, including auxin treatment, cytokinin treatment, and combined auxin-cytokinin treatment. Callus cell induction and fresh weight were analyzed and visualized, and callus masses were examined using light microscopy and transmission electron microscopy (TEM). Callus cells were induced in auxin and auxin-cytokinin treatments, while cytokinin treatment alone did not produce callus induction and proliferation, leading to germination in 100% of samples. However, in the presence of auxin, cytokinin did not significantly reduce the induction percentage or fresh weight. Ultrastructural analysis revealed cytokinin-induced alterations, including significant changes in nuclear morphology, cell wall thickness, enlargement of vacuoles, and reduction of organelles. The observed changes in ultrastructure suggest that phytohormones may act as stressors in callus cell culture, and that cytokinin may be used as a model for research on stress in micropropagation, suggesting optimization of certain protocols.

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