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Genotypically determined actin-adjustable water permeability of two transport channels of plasmodesmata in roots of the winter wheat seedlings

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Abstract

In roots of 5 - 6-day old seedlings of three cultivars of the winter wheat, varying in drought-resistance: Bezostaya 1 (low resistant), Mironovskaya 808 (resistant), and Albidum 114 (highly resistant) water permeability of two transport chanels of plasmodesmata was studied at the action of cytochalasin B, which is known to inhibit polymerization of cytoskeleton actin filaments, by a pulse method of NMR, on the background of increasing water loss in the seedlings. It has been found that the registered coefficient of water selfdiffusion, two of which (D2 and D3) depend on the water permeability of different transport channels of plasmodesta, differ in opposite directions. This may suggest that in roots drought-resistant plants, after a moderate water loss, a diffusive water flow through the cytoplasmic symplast increases (demonstrated by an increases of D2), while that through vacuolar symplast decreases (seen by an increase of D3). After a high water loss in seedlings, we noticed an even greater increase in water permeability of the cytoplasmic symplast, and a decrease in water permeability of the vacuolar symplast, however, in the roots of low resistant cultivars these changes were poorly expressed, if at all. Under stress-less conditions cytochalasin B would result in an increased water transport through cytoplasmic channel of plasmodesmata due apparently to a destruction of their actin-myosin sphincters. Both weak and average degrees of water loss would strengthen the cytochalasin B exerted influence on plasmodesmal water conductance, that may testify to a synergetic action of these two factors. After a significant water loss this action was kept only partially, because the inhibitor, on blocking the cytoplasmic channel, did increase at the same time the effect of water stress, limiting water flows through the vacuolar symplast and, simultaneously, raising the water inflow to the apoplast.