A PHYSIOLOGICAL STUDY OF DIPLOID AND RELATED TETRAPLOID PLANTS[1]

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Knowledge of the physiological consequences of naturally occurring or experimentally induced polyploidy is relatively limited, although its cytological and morphological effects on a number of species have been studied. The postulation by former workers of an increased hardiness resulting from polyploidy in plants makes the need of such information apparent. This work is a comparison of the water relations of two species, *Vinca rosea* and *Petunia violacea*, with their respective colchicine-induced tetraploids (Schnell 1940, 1941).

Comparisons were made on the basis of stomata per unit area of leaf surface, osmotic pressure of stomatal guard cells at incipient plasmolysis, diffusion pressure deficit of leaves determined by the method of Ursprung and Blum (1916), absorption lag behind transpiration measured by a modified potometric method, wilting coefficient, ratio of surface to volume of tissue, and periodic variations of transpiration obtained by interval weighings (Taylor 1941). Stomata of tetraploids are about fifty percent longer and wider than those of the parent diploids, but their number per unit area is reduced approximately thirty percent. The osmotic pressure is considerably reduced in tetraploid *Vinca*, but little changed in *Petunia*. Diffiusion pressure deficit of *Vinca* leaves is lower in the tetraploid, except during mid-day when transpiration is highest. Lag in absorption as transpiration increases during the day is more marked in the tetraploid *Vinca*, and its wilting coefficient is slightly higher. Ratio of surface to volume is decreased and the transpiration rate per unit area of leaf surface is usually lowered in tetraploids (Taylor 1941). Though stomatal changes are not such that they materially affect the rate of transpiration, it is possible that a lower osmotic pressure may result in a faster loss of water. However, the change in surface volume ratio, resulting in less exposed surface per unit volume of leaf tissue in the tetraploids, and the absorption lag, developing a low diffusion pressure deficit, seem to reduce the total transpiration of the tetraploids as compared with the diploids. It need not be assumed that this transpirational change materially affects the vigor or hardiness of the tetraploids, though it is conceivable that a lower osmotic pressure would be correlated with less cold resistance. Nevertheless, the changes noted are not sufficient to explain an apparent increased vigor and hardiness in these tetraploid races.

LITERATURE CITED

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[1]This work was done in the Department of Botany and Bacteriology, University of Oklahoma, under the direction of Dr. O. J. Eigsti. Contribution from that Department, n.s. No. 72.

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