Technical Papers

Anomalous Structure in the Hypocotyl of Soybean Following Treatment with 2,4-Dichlorophenoxyacetic Acid

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The effects of 2,4-dichlorophenoxyacetic acid (2,4-D) on the histological responses of certain plants have been described by various investigators. However, little response has been found in the pith cells of the hypocotyl region (*1*). This paper deals with the effects of 2,4-D in producing anomalous structures in the pith of the hypocotyl region of soybean seedlings (Monroe variety).

The seeds, after having been soaked for 24 hr in tap water, were transferred to moist blotting paper in Petri dishes for another 24-hr period. The seedlings were then immersed for 10 min in an aqueous solution of 2,4-D (500 mg/lit), after which they were cultured on moist blotting paper in Petri dishes and washed daily. The chloroplasts disappeared in the cortical parenchyma cells of the treated hypocotyl. The latter became yellowish and stunted but considerably enlarged in diameter. The four-winged broad shoulders developed throughout the entire region, owing primarily to the proliferation of the pericycle.

The pith cells of the hypocotyl region showed a very interesting response to 2,4-D. After 5 days of treatment, they started meristematic activity, the activity being greatest at the upper end of the hypocotyl. Only a few cells next to the primary xylem at the lower end of the hypocotyl divided at this stage. After 10 days of treatment, almost all the cells in the pith at any level within the hypocotyl had become meristematic. The pith cells proliferated and differentiated most rapidly directly beneath the cotyledons.

At the periphery, the active cell division resulted in the formation of a continuous, circular cambium layer from which vascular elements differentiated. A few derivatives centripetal to this cambium layer differentiated into tracheids and other vascular elements (Fig. 1, left). At a lower level, the cambium layer was irregular and curved along a random path so that it did not present a circular pattern in cross section. At the root end of the hypocotyl, dividing cells were observed in the pith, but no cambium layer was formed (Fig. 1, right). Pitted tracheids were present among the primary xylem elements and also in the vascular strands of the pith.

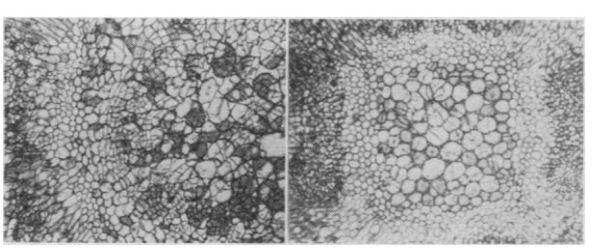

Fig. 1. Transverse sections of the hypocotyl region of soybean seedling after 10 days of treatment with 2,4-D. (Left) Transverse section at the upper end of the hypocotyl showing cambium and vascular strands in the pith. (Right) Transverse section at the root end of the hypocotyl showing the dividing cells in the pith. (×46)

It is obvious that one of the striking responses of the soybean hypocotyl to 2,4-D is the tendency of cells to become highly meristematic; another response is the development of vascular strands in the pith. These responses show that differentiated cells retain their totipotential capacities following treatment. The 2,4-D apparently disrupts the orderly metabolic and physiological processes and, thus, leads to nonpolarized cell division and abnormal growth patterns.

References and Notes

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21 January 1955.

Genetic and Nongenetic Effects of Radiations in *Neurospora*

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The mechanism of radiation damage in biological systems eludes detailed description. It is concluded that, on the one hand, the lethal effects of x-rays are mediated entirely through the nuclei in *Neurospora* conidia (*1*), whereas, on the other hand, in barley (*2*) and *Habrobracon* (*3*), genetic (nuclear) damage alone cannot account for all the lethal effects of x-rays (*4*).

This paper (*5*) describes genetic and nongenetic effects of radiations in *N. crassa*, strain 74A-3b. The criterions used to detect radiation effects included genetic mutation, inactivation, and a "stimulatory" effect. The last criterion was measured as an increase in the number of conidia that germinated and as an accelerated growth rate following irradiation.

The mutation rate of one glutamic acid locus has been studied (*6*). The mutants were recovered according to the filtration and selective-plating technique (*7*). The observed mutation rate, expressed as mutants per 10,000 conidia, increased with x-ray dosage as follows: no dose, 0.85; 250 r, 0.93; 1000 r, 1.12; 2000 r, 1.03; 3000 r, 1.50; 7000 r, 3.05; and 10,000 r, 3.72 (Fig. 1).

Inactivation and the increase in the number of conidia that germinated following irradiation were measured concomitantly. Survival values of marcroconidial populations were determined following expo-