Inhibition of Water Uptake by High Concentrations of Auxin-like Substances

V. KOZINKA

Department of Plant Physiology, Botanic Institute of Slovak Academy of Sciences, Bratislava*

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Abstract. The intensity of water uptake by halves of splitroot cuttings from Coleus blumei Benth was measured by potometrical method. Inhibition of the water uptake induced by application of high concentrations of sodium salts of α-naftylacetic acid (NAA) and 2-methyl-4-chlorophenoxyacetic acid (MCPA) in the treated half of the root induced an increase of water uptake by the other half. The compensation is not complete. If only one half of the root treated by synthetic auxin was allowed to take up water, MCPA appeared to induce a smaller degree of reversibility than NAA.

It was discovered some time ago that the application of auxin-like substances in high concentrations induces closing of stomata (BROWN 1946, FERRI and LEX 1948, FERRI and RACHID 1949, BRANDBURY and ENNIS 1949, 1952, PLAYER 1950). These authors consider the closing of stomata to be a direct consequence of physiological changes induced by high concentrations of auxins in leaf tissues. They do not suppose that closing of stomata is in any connection with the disturbance of water uptake. Such a connection has recently been postulated (TAKAOKI 1962, ALLERUP 1964). In previous papers (KOZINKA 1966, 1967, 1968) we demonstrated changes in the intensity of water uptake, induced immediately after application of high concentrations of synthetic auxins to roots.

The purpose of our study was to find out whether the inhibition of the water uptake by high concentrations of synthetic auxins in roots is reversible or irreversible.

Material and Methods

Experimental Material

Well-established root cuttings, cultivated by the split-root technique, were used as the experimental material. Coleus is a very suitable plant for the application of split-root technique. Localization of vascular bundles in

* Address: Dúbravská 26, Bratislava, Czechoslovakia.
the corners of quadrigenial axes does not complicate the splitting of roots to halves. Only one clone of *Coleus blumei* was used throughout all the experiments. The axes were cut tangentially to approximately 8 cm long cuttings and these were placed in moistened sand. After rooting, only adventive roots were maintained and cultivated in water cultures in Knop's solution which was changed at 4—5 day intervals. Water cultures were placed in the greenhouse.

Fig. 1. Scheme of equipment for the measurement of the intensity of the water uptake by halves of split roots *Coleus blumei* Benth. 1) Potometric vessel; 2) rubber stopper with three orifices; 3) trifurcated air tube with one-way rubber pipe; 5) brass stick with razor for cutting off the roots without removing the plant from the potometer; 6) measuring capillary; 7) needle of the syringe for application of synthetic auxin to the potometric vessel 8) the plant with split root — a) the point of cutting off half of the split root in the air, b) the point of cutting off half of the split root inside the potometer.

**Potometer**

Both halves of the split root were placed separately into two potometers and the solution of synthetic auxin was applied into only one of the potometers. The changes in water uptake were observed in both halves of split-roots independently. The change in water uptake after cutting off one half of the split root was followed in the same way.

The means of stoppering by potometric stoppers, application of solutions of synthetic auxins and cutting halves of split-roots without removing them from the potometer have been described (KOZINKA 1966, 1967) and the main points are illustrated in Fig. 1.

**Measuring of Water Uptake**

The intensity of the water uptake was determined every 5 minutes from readings on the horizontally placed measuring capillaries of the potometers. The capillaries were marked at 0.005 ml intervals and were fixed to the bottom by silicone oil. During experiments the potometric vessels with the plants were placed in a water bath at 25 ± 1°; the feeding solution in the

*Abbreviations used:* NAA — α-naphylacetic acid, MCPA — 2-methyl-4-chlorophenoxyacetic acid.