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IAA DISTRIBUTION AND AUXIN SENSITIVITY IN CCC-TREATED BEAN HYPOCOTYLS

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Abstract

Studies were performed on the distribution of IAA content in the hypocotyls of CCC-treated bean plants, as well as on the sensitivity of the tissues against exogenous IAA. The treatment induces changes in respect to the IAA distribution between the apical and basal parts of the hypocotyls; on the effect of CCC a large part of the IAA content becomes accumulated at the basal part. The elongation growth reaction to exogenous IAA of the hypocotyls of the treated plants does not show any correlation with the endogenous IAA concentration.
Key words: hypocotyl, CCC, IAA-distribution, IAA-sensitivity

Introduction

The growth inhibition occurring as a response to chlorocholine chloride (CCC) treatment is the result of a complex effect, which besides the inhibition of the gibberellin (GA) biosynthesis, also involves the effect exerted on IAA metabolism. In a previous work it was concluded that the amount of diffusible IAA extractable from bean plants shows an increase on the effect of CCC treatment. This indicates ability of the treatment to influence hormone motion within the tissues (NAGY and TABI, 1983), and thus presumedly also the distribution within the organ.

The present paper reports on our studies concerning the IAA distribution and in connection with this, the auxin sensitivity in the hypocotyls of CCC-treated bean plants.

Material and Method

Phaseolus vulgaris L. cv. *Juliska* plants were used for our studies. The seeds were swollen in 500 mg/l concentration of CCC aqueous solution (Merck-Schuchardt) in 25 °C thermostat, then planted in garden mould. The plants were grown under controlled conditions (CONVIRON Cabinet model EF7, equipped with 4x50 W Sylvania incandescent lamps, at 25/20°C day/night temperature, 16 h illumination with 21 Wm^{-2} and 65% relative humidity), and processed at 6 days of age. Measurement of IAA content: the IAA content of 100 hypocotyls was determined after extraction with 80% cold methanol. The extract was evaporated to dryness at lower pressure, then 0,5 M K_2HPO_4 solution was added (pH 9,5). The purifica-

tion and fractionation were carried out according to KAMISAKA and LARSEN (1977). The amount of IAA present in the final acidic ether fraction was measured by the indole-α-pyrone fluorescence method (KNEGT and BRUINSMA, 1973; HEMBERG and TILLBERG, 1980) with Perkin-Elmer spectrofluorometer. All the experiments were carried out in quadruplicates and two parallels. The figures show the mean values of 8 measurements.

IAA solution in 0,001 — 100 mg/l concentration interval was used for measuring the auxin sensitivity of the hypocotyl tissues. The isolated hypocotyls or hypocotyl parts were incubated in light for 24 hours in Petri dishes at 25 °C, under half-sterile conditions.

Results and discussion

EFFECT OF CCC TREATMENT ON THE GROWTH OF THE HYPOCOTYLS

CCC has selective effect on the function of the apical and subapical meristem; thus without affecting the initiative function of the apical meristem leaf and flower, it exerts a strongly inhibiting effect on the subapical meristem function determining the height of the plant (SACHS, 1965; DEEVA, 1980). Since our studies were performed with seedlings, the CCC was introduced into the seed during the course of swelling so as to have it present at the continuation of ontogeny. The applied concentration did not influence the germination of the seeds. The sensitivity of the seedlings against CCC is demonstrated in Fig. 1.

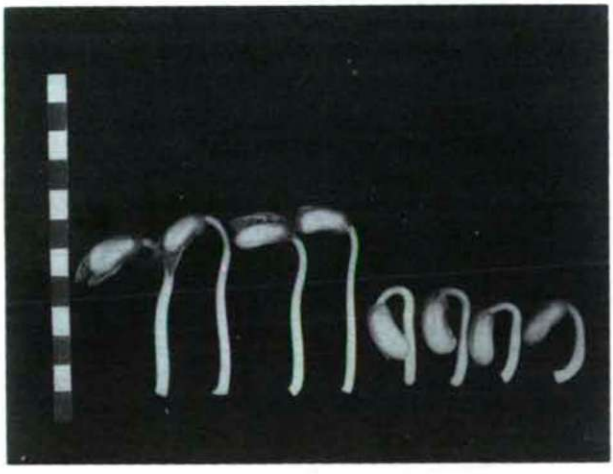

Fig. 1. Effect of CCC in 500 mg/l concentration on the growth of the hypocotyls of *Phaseolus vulgaris* cv. *Juliska* seedlings. Left: control, right: treated.

EFFECT OF CCC TREATMENT ON THE IAA CONTENT AND THE DISTRIBUTION OF THE HYPOCOTYLS

Fig. 2 shows the effect of the treatment on the IAA content of the hypocotyls. The figure also indicates the IAA amount per unit fresh mass, i.e. the IAA concentration.

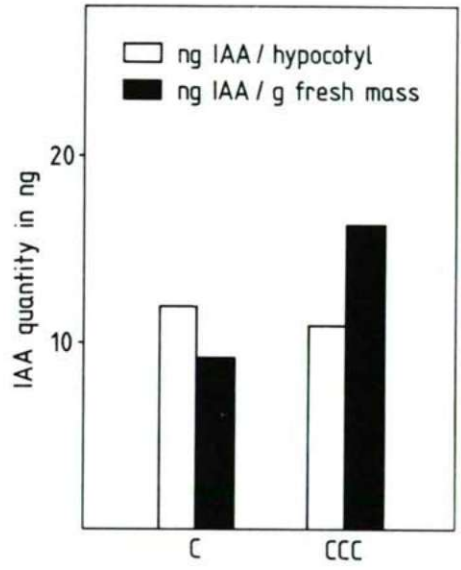

Fig. 2. Effect of CCC on the IAA content extractable by organic solvent.

The IAA content in the hypocotyls of the CCC-treated plants is lower as compared to that of the control. This corresponds to the fact that the total-IAA content in the intact plant decreases on the effect of the treatment compared to the control (NAGY and TABI, 1983), which has also been concluded in case of other plants (KURAISHI and MUIR, 1963; NORRIS, 1966; VOLYNETZ and PALCHENKO, 1977). At the same time, the IAA amount referring to g fresh mass, i.e. the IAA concentration, is higher in the hypocotyl of the treated plant.

Since the IAA distribution within the organ plays important role in the determination of the growth reactions, measurements were also performed in respect to the IAA content in the apical (A) and basal (B) parts of the hypocotyls.

On the effect of the treatment, there is a change in the IAA distribution between the apical and basal parts of the hypocotyls; in the treated plants a large part of the IAA is found accumulated in the basal part of the hypocotyl (Fig. 3). The percental distribution of the total-IAA content concerning the various hypocotyl parts is as follows: *A* in control: 41,46; *B:* 58,54; *A* in treated plants: 21,21; *B:* 78,71%. The higher diffusible amount of IAA extractable from the treated plants (NAGY and TABI, 1983) may be in connection with the higher amount of hormone accumulating in the basal part of the shoot.

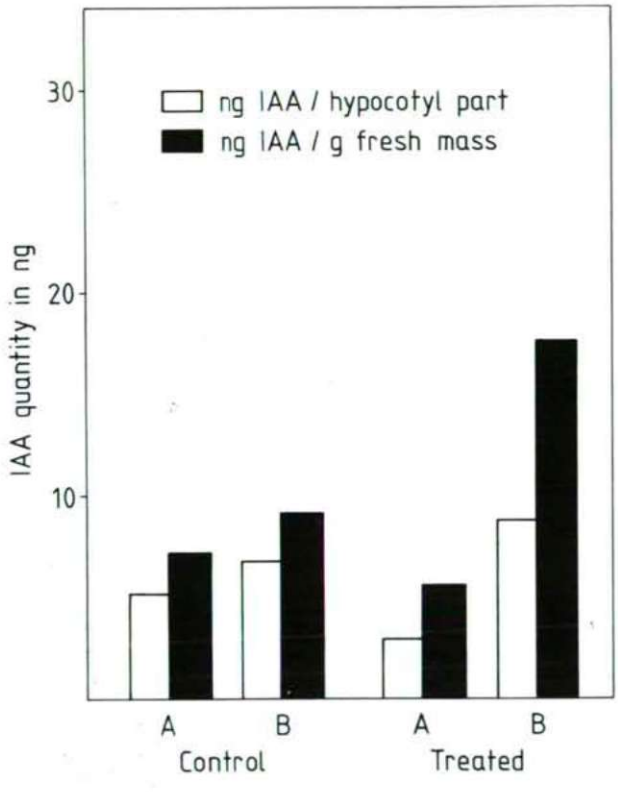

Fig. 3. Effect of CCC treatment on the distribution of the IAA content of the hypocotyls between the apical (A) and basal (B) parts.

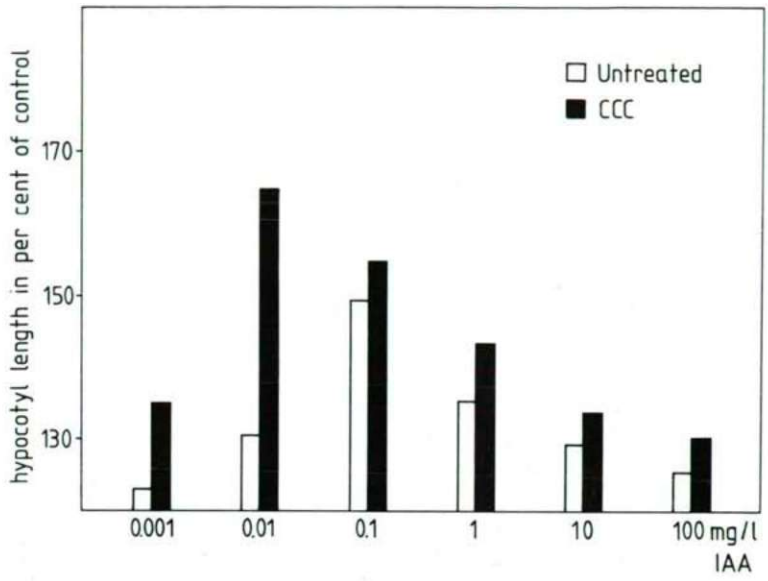

Fig. 4. Effect of CCC treatment on the IAA sensitivity of the hypocotyls.

EFFECT OF CCC TREATMENT ON THE AUXIN SENSITIVITY OF THE HYPOCOTYLS

Studies on the IAA sensitivity of the hypocotyls were performed by means of an indirect method, using exogenous IAA. The growth reactions of the hypocotyls are demonstrated in Figs. 4 and 5. As shown by the results, the hypocotyls of the treated plants react to a lower concentration of IAA than the control, with maximal elongation (Fig. 4). This reaction is as a matter of fact the reaction of the apical (A) part containing the elongation zone (Fig. 5).

As the IAA concentration in the apical part of the hypocotyls of the treated plants is lower than that of the control, assuming receptor molecules of identical number and activity, the saturating dose would be expectable in the higher concentration interval.

The circumstance that in the hypocotyls excised from the treated plants the maximum of the elongation reaction — i.e. the saturating does - is at a lower exogenous IAA concentration, indicates the fact that the elongation reaction is not determined by the absolute degree of the given IAA concentration, but rather by the relationship, ratios of the amount of endogenous growth factors regulating the elongation (in the present case the endogenous IAA and gibberellin). Since CCC

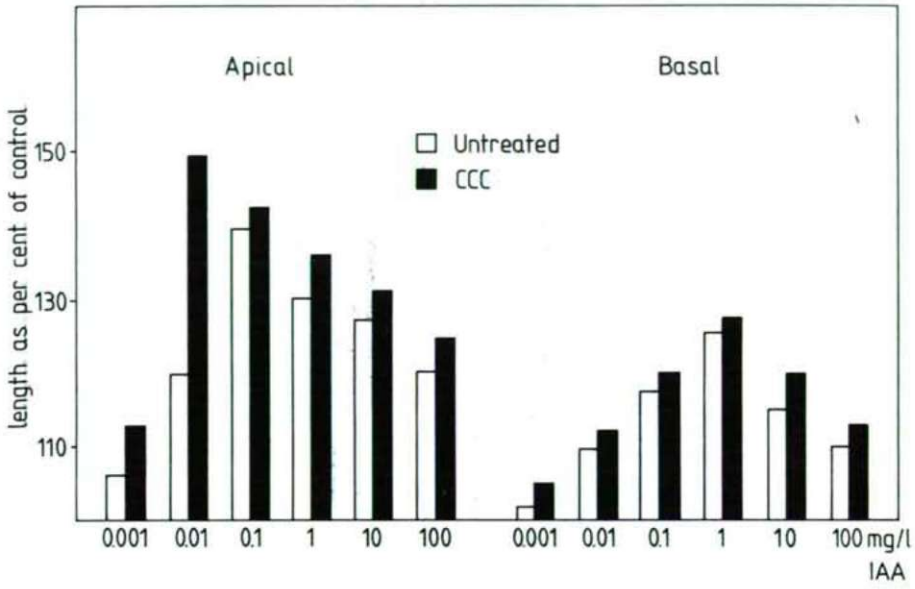

Fig. 5. Effect of CCC treatment on the IAA sensitivity of the apical (A) and basal (B) part of the hypocotyls.

treatment causes significant changes not only in the IAA-. but also in the gibberellin-content and distribution (NAGY, 1986), the developing new hormonal ratios have strong influence on the degree of the elongation reaction of the tissues to the exogenous IAA.

Our results demonstrate that the elongation growth reaction of the hypocotyls of the CCC-treated plants to exogenous IAA does not show any correlation with the endogenous IAA concentration.

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