Acta Biologica Szeged. *22* (1—4), pp. 79—81 (1976)

EFFECT OF THE SODIUM SALT OF 2.4-DICHLORO-OXYPHENYLACETIC ACID ON CUCURBITACEAE SEEDLINGS

HORVÁTH, M. MÁRIA and TRAN VAN LE

Department of Biophysics, Phylogenetical Laboratory, Attila József University, Szeged

(Received September 10, 1975)

Abstract

The peroxidase enzyme activity of the Cucurbitaceae seedlings was increased by 2.4-D parallel with the degree of damage. The enzymes participating in hydroxylation are bound by neutralizing the chemical agent and, therefore, the amount of indolehydroxy-derivatives decreased.

It is proved by several publications and the production itself that the genetically balanced plant stand can be deteriorated by plant-protecting agents applied in a not satisfactory concentration. Besides the mutagenous effect, degenerated successor generations that are different from the stand of the species are produced. In connection with that, we have investigated in our work the effect of herbicides upon Cucurbitaceae seedlings under experimental conditions.

Materials and Methods

The seeds of gourd were caused to germinate at 25 °C in a thermostat. Germination took place on a filter-paper moistened with a solution of 2.4—D. At controls tap water was applied. These were examined as preemergent treatments. At the other part of the experiments, the seedlings — when their radicle was about 2 cm long — were placed into a 2.4—D solution and the controls were put in a water culture under half-conditioned conditions and grown under about 7000 lux illumination. In this case, a postemergent treatment was used and investigated as a function of time, as well. The 0.25‰ and 0.50‰ — lower resp. higher — concentrations of the sodium salt fo 2.4—D were used. The effect of the chemical agent was followed with attention by measuring the peroxidase enzyme (SOLYMOSY—FARKAS, 1963) and the indole-hydroxylating capacity of seedlings (HORVÁTH *et al.*, 1975).

Evaluation of the experimental results

The formation of the activity of perioxidase enzyme is shown in the following figure.

It is shown by the figure that — as compared to the enzyme activity measured on the shoot of a 13-day old control gourd — the 2.4—D of lower concentration, applied postemergently, increased the enzyme activity threefold, and that of higher concentration more than fourfold. In the roots of seedlings the enzyme acted differently. The enzyme activity measured from the roots of control plants is about fivefold of the activity measured from shoots. The 2.4—D applied in both kinds of concentra-

tion exerted an exactly similar effect on the roots, the enzyme activity has remained at the same level.

The roots were in contact with the solutions and the controls with tap water. In this way, both 2.4—D and tap water had damaging effects as the plant was not accustomed to water culture.

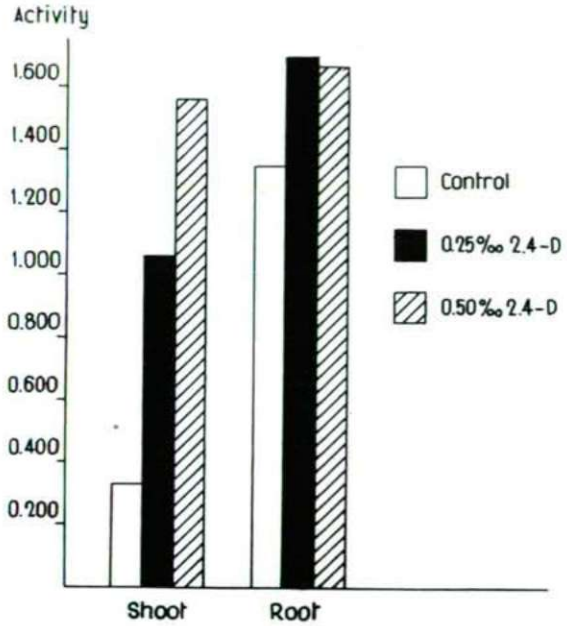

Fig. 1. Effect of a 9-day 2.4—D treatment on the peroxidase enzyme activity of Cucurbitaceae seedlings

The behaviour of the plants treated with 2.4—D of lower and higher concentrations, as well as that of controls, were investigated at the indole-hydroxylation, the pre- and postemergent treatment. The compounds containing the hydroxy-group are produced in normal metabolic processes. The products of hydroxylation are often substrates in further processes but they may leave the organism, as well. The removal of indole structured compounds, as well, if considerably accumulated, takes place in enzymatic way.

At our experiments, the effect of 2.4—D proved to be harmful in both concentrations for the Cucurbitaceae seedlings. In the considerably damaged plants the metabolic indices did change, as well. The quantity of indolehydroxy-derivatives decreased as a result of the 2.4—D of higher concentration as the enzymes were engaged in an indirect way to neutralize the superfluous 2.4—D.

In Table 1, the values obtained at the preemergent treatment are demonstrated.

It is obvious that a derivative was produced at carbon-atom 5 of the indole-structure, and the quantity of the derivative was increased by the preemergently applied 2.4—D of lower concentration.

The effect of the chemical agent exerted in the course of the postemergent treatment on shoots is shown in Table 2, and that on roots in Table 3.

Table 1. Development of an indole-hydroxy derivative of a 4-day old Cucurbitacea seedling, after a preemergent treatment. Calculated to γ/g fresh weight

Derivative	Control	2.4—D of low concentration	2.4—D of high concentration
5—OH	168	172	158

Table 2. Development of the amount of indole-hydroxy derivatives produced in the shoots of 4-day old Cucurbitaceae seedlings, after a postemergent treatment. Calculated to γ/g fresch weight

Days of treatment	2-.4—D of low concentration				2.4—D of high concentration				Control			
	4—OH	5—OH	6—OH	7—OH	4—OH	5—OH	6—OH	7—OH	4—OH	5—OH	6—OH	7—OH
7	4.90	3.95	3.85	—	1.30	2.90	1.90	1.60	3.90	3.60	3.85	—

Table 3. Development of the amount of indole-hydroxy derivatives produced in the roots of 4-day old Cucurbitaceae seedlings, after a postemergent treatment. Calculated to γ/g fresh weight

Days of treatment	2.4—D of low concentration				2.4—D of high concentration				Control			
	4—OH	5—OH	6—OH	7—OH	4—OH	5—OH	6—OH	7—OH	4—OH	5—OH	6—OH	7—OH
7	18.50	4.10	—	—	4.60	3.30	—	0.70	48.90	3.70	—	—

It is visible that the derivatives appeared at carbon-atoms 4 and 5, and in case of shoots at carbon-atom 6, of the indole-structure. At carbon-atom 7 there was obtained no measurable derivative, and in case of roots at site 6, there was similarly none of them. A considerable amount of derivatives was produced in the root at 2.4—D of low concentration, and in the control at carbon-atom 4. As a result of all these, there are necessitated further investigations concerning Cucurbitaceae seedlings: partly the isolation of the enzymes taking part in hydroxylation, partly the necessity of the isolability of the endogenous indole.

References

HORVÁTH, M. MÁRIA—GUBA, F.—HANUSZ, B.—KIRÁLY, L. (1975): Indol hidroxilálás különböző növényfajoknál (Indole-hydroxalytion at various plant species). Acta Phytopathologica, Budapest. (In the press.)

SOLYMOSSY, F.—FARKAS, G. L. (1963): Metabolic characteristics at the enzymatic level of tobacco tissues exhibiting localized acquired resistence to viral infection. — Virology *21*, 210—221.

Address of the authors:
DR. HORVÁTH, M. MÁRIA
TAN VAN LE
Department of Biophysics,
Phylogenetical Laboratory,
A. J. University,
H—6701 Szeged, P. O. Box 428,
Hungary