A POSSIBLE MECHANISM FOR THE INCREASED RESISTANCE AGAINST FUNGAL ATTACK AS A CONSEQUENCE OF ROOT INJURY

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SUMMARY

Root injury increases the indoleacetic acid oxidase activity of cucumber hypocotyl extracts. Both root injury and changes in IAA-oxidase activity have been connected with resistance against fungal attack. A mechanism correlating the increased resistance following chemical or mechanical injury with IAA-oxidase activity is proposed.

1. INTRODUCTION

In her experiments on the mode of action of L-threo-β-phenylserine VAN ANDEL (1966) demonstrated that the susceptibility of cucumber seedlings to *Cladosporium cucumerinum* was correlated with the indoleacetic acid oxidase activity. A higher IAA-oxidase activity resulted in enhanced resistance. It has been known for a long time that chemical or mechanical root injury is often followed by increased resistance against fungal attack (KEYWORTH & DIMOND 1952). SOEKARJO & JANSSEN (1969) found that treatment of *Coleus* internodes with potassium hydroxide or sulphuric acid resulted in the liberation of IAA-oxidase inhibitors. The effect of injurious conditions on *Coleus* internodes tempted me to compare the IAA-oxidase activities of cucumber plants treated with phenylserine, with other chemicals, and with hot water.

2. MATERIAL AND METHOD

Ten-day old cucumber seedlings (*Cucumis sativus* L. cv. "Lange gele tros") were placed with their roots in a solution of the compound in question or in water. In the "hot water treatment" the roots were first immersed for 30 sec. in water of varying temperatures. After 1 to 2 days the hypocotyls were ground in buffer and centrifuged. The supernatant was tested for its IAA-oxidase activity in a reaction mixture containing 0.2 ml cucumber extract, 0.2 ml indoleacetic acid 10^{-3} g/ml and 4.6 ml phosphate-citrate buffer pH 4.3. The residual amount o indoleactic acid was measured colorimetrically with Salkowski reagent (TANG & BONNER 1947).

3. RESULTS AND DISCUSSION

The activity of the hypocotyl extracts of plants treated with phenylserine (PS) and with potassium hydroxyde can be seen in *fig. 1*. VAN ANDEL (1962) empha-

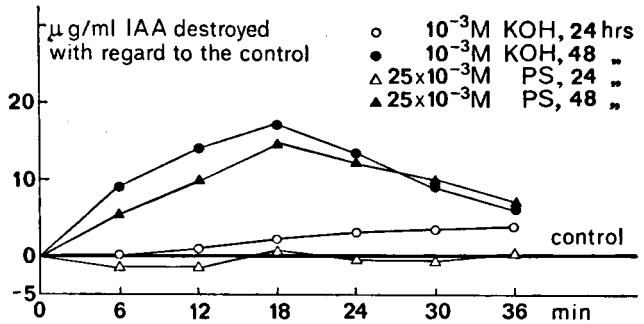

Fig. 1. Difference in IAA-oxidase activity between extracts of cucumber hypocotyls of plants treated with KOH or PS for one or two days and those of control plants.

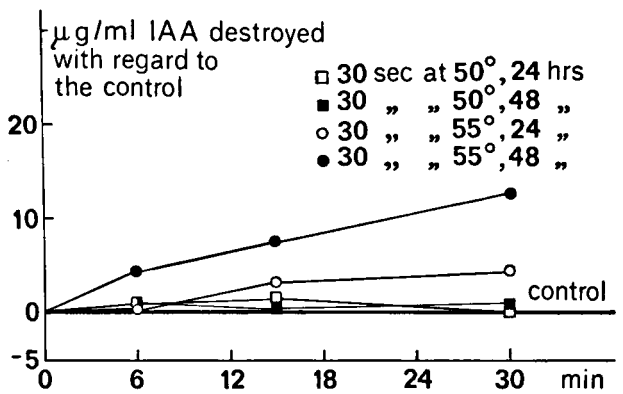

Fig. 2. Difference in IAA-oxidase activity between extracts of cucumber hypocotyls of plants treated for 30 sec. with water of 50 °C and of 55 °C and those of control plants.

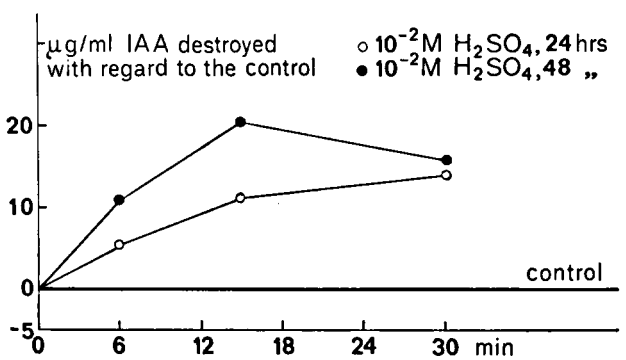

Fig. 3. Difference in IAA-oxidase activity between extracts of cucumber hypocotyls of plants treated with sulphuric acid for one or two days and those of control plants.

sized the indirect and delayed effect of phenylserine. As far as IAA-oxidase activity is concerned both PS and KOH give a similar picture. After one day no effect can be seen. Only after two days in both cases a significant increase in the IAA-oxidase activity occurs. *Figs. 2* and *3* give the hypocotyl IAA-oxidase activity after treatment with sulphuric acid and after 30 sec. at 55 °C. With hot water the same effect as with PS and KOH was obtained. With sulphuric acid the activity was already enhanced after the first 24 hours, a further increase in the second 24 hours was found. When the plants remained in the solution for a longer time generally visible root injury occurred.

The results give rise to the suggestion that a more general mechanism triggering the IAA-oxidase activity is involved in all cases. Root injury also causes an increase in the carbohydrate content of the aerial parts of the plant (KEYWORTH & DIMOND 1952). Changes in the carbohydrate levels in plants have been correlated with increased resistance (KEYWORTH & DIMOND 1952, EATON & RIGLER 1946). Thus, Keyworth & Dimond suggested that this change in metabolism caused by root injury may be correlated with the increased resistance. Changes in IAA-oxidase activity, however, will also effect susceptibility (VAN ANDEL 1966). Even a direct relation between IAA concentration and susceptibility has been found (VAN ANDEL 1966). Thus, the effect of chemical or mechanical injury on plant diseases might also be explained by the increased IAA-oxidase activity.

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