

ACTION OF RESORCYLIC ACIDS ON THE AUXIN-OXIDASE ACTIVITY

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Abstract—Resorcylic acids activated the IAA-oxidase system from pea roots. A relation between chemical structure and enzymic activity is apparent. The activity diminished in the order: β -, γ - and α -resorcylic acids.

INTRODUCTION

MANY phenolic substances affect the destruction of β -indolylacetic (IAA).¹⁻⁴ Monophenols are generally accepted as co-factors of the IAA-oxidase system and polyphenols as inhibitors.⁵ Furthermore, it has been shown that the introduction of various substituents in the phenolic molecule can modify the effect of such compounds on auxin catabolism.⁶ The concentration of the phenol used⁷ and the pH value for both extraction and incubation⁸ also modify IAA-oxidase activity.

In spite of the fact that resorcinol is well known to act as a co-factor of the IAA oxidation,⁹⁻¹² the action of its monocarboxylic derivatives has not been systematically studied. In the present paper, α -, β - and γ -resorcylic (3,5-, 2,4-, 2,6-dihydroxybenzoic) acids have been examined in order to see whether the action of the *m*-diphenol on IAA catabolism is modified by the introduction of a carboxylic group.

RESULTS AND DISCUSSION

In agreement with the results of Lee and Skoog⁶ for tobacco callus extracts, the activity of IAA-oxidase from pea roots was increased by β -resorcylic acid, the activity being directly correlated with the concentration (Fig. 1) and the time of incubation. Similarly, α - and γ -resorcylic acids stimulated the IAA destruction, but only at high concentrations ($5 \cdot 10^{-5}$ M) (Fig. 1). Although γ -resorcylic was always more effective than α -resorcylic acid in the tested range of concentrations, the differences were not significant. The optimal pH of extraction and incubation (6.2) was the same for each of the resorcylic acids.

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⁴ G. W. SCHAEFFER, J. G. BUTA and F. SHARPE, *Physiol. Plantarum* **20**, 342 (1967).

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¹¹ TH. GASPAR, *Les Phytohormones et l'Organogenèse*. C. U. LIÈGE **38**, 41 (1966).

¹² P. E. PILET and M. C. MATO, *Ann. Physiol. vég.* **9**, 369 (1967).

The evidence here summarized shows that the position of the carboxylic group imparts a different rate of activity of the three resorcylic acids in the enzymatic inactivation of IAA. Resorcinol itself is a strong promoter of IAA oxidation¹⁰ and its effectiveness is scarcely modified by attaching a carboxylic substituent to position 4. The introduction of the same group to positions 2 or 5 markedly decreases the activation, which is then only apparent at rather high concentrations (Fig. 1).

β -Resorcylic acid is more susceptible to oxidation than the corresponding α - and γ -isomers. In addition, the low rate of oxidation shown with α -resorcylic acid might well result from steric hinderance. The present results might be explained, therefore, by assuming that the first step in the promotion of the IAA-oxidase reaction is the oxidation of the phenolic co-factors¹³ in such a way that the formation of a peroxidase intermediate¹⁴ is favored. The action is paralleled by the release of phenolic radicals which not only oxidize IAA^{15, 16} but also produce Mn^{3+} and Mn^{4+} which,¹⁷ in turn, could be involved in the auxin oxidation.

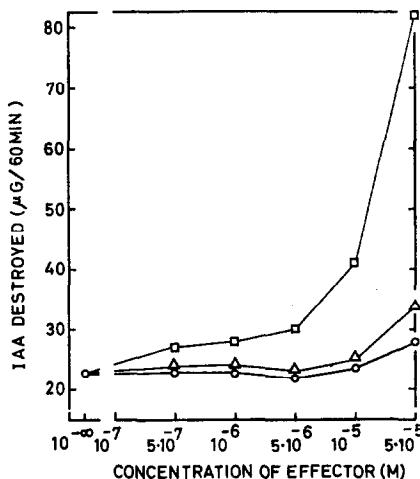


FIG. 1. EFFECT OF RESORCYLIC ACIDS ON THE IAA OXIDATION BY PEA ROOTS EXTRACT.
 ○—○ α -resorcylic; □—□ β -resorcylic; △—△ γ -resorcylic acids.

EXPERIMENTAL

Plant Material

Seeds of *Pisum sativum* L. were soaked in distilled water for 6 hr, washed and placed on moist filter paper in petri dishes in the dark at 25°. After 3 days, roots 35–40 mm long were selected and ground in a chilled mortar with phosphate buffer (pH 6.2) and quartz sand. The crude extract was centrifuged (10,000 g, 20 min 0°) and the supernatant used as a source of enzyme. (About 2.0 g roots gave 20 ml of enzyme solution.)

Determination of Enzyme Activity

The mixture reaction contained 2 ml of enzyme solution and 4 ml phosphate buffer in 10 ml. The final concentration of IAA was 10^{-4} M and those of the co-factors tested are shown in Fig. 1. The mixtures were

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¹⁶ I. YAMAZAKI and L. H. PIETTE, *Biochem. Biophys. Acta* **77**, 47 (1963).

¹⁷ P. E. PILET and TH. GASPAR, *Le Catabolisme auxinique*, p. 25, Masson, Paris (1968).

incubated at 27° in the dark. Successive 1 ml aliquots were removed after 0, 30 and 60 min incubation and added to tubes containing 3 ml modified Salkowski reagent.¹⁸ The initial and residual IAA were estimated colorimetrically at 535 nm.

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