Reduction of Parathion induced by Light

WHILE investigating the decomposition of parathion (O,O-diethyl-O-*p*-nitrophenylphosphorothionate) I was able to confirm the findings of Ketelaar[1] on the specific action of Cu^{2+}-ions in catalysing the hydrolysis leading to *p*-nitrophenol. Other metal ions are ineffective, and the catalytic action of copper can be suppressed by various chelating agents[2]. The experiments were carried out at room temperature in a barbiturate milieu at *p*H 8·0 and lasted for more than four weeks. Change in concentration of parathion with a modified polarographic method was followed, and this permitted the estimation of parathion and simultaneously of the *p*-nitrophenol formed. In certain instances however, in solutions not containing the catalyst, a significant decrease of the polarographic wave of parathion was observed though the corresponding appearance of *p*-nitrophenol was not detected. Although in publications dealing with the degradation of parathion[4] there is no allusion to the possibility of a spontaneous reduction, I have shown it to be induced by light.

A 2×10^{-3} *M* solution of parathion (prepared from 20 per cent parathion 'Paridol', Chemisch-Technische Werke A.G. Muttenz-Basel—a material not containing appreciable amounts of degradation products) in 5×10^{-2} *M* *p*H 8·0 barbiturate buffer was divided into several portions and some of them were exposed to direct sunlight. The irradiation was carried out in thin-walled Jena test-tubes. The temperature was controlled continuously and the portions kept in the dark were thermostated according to the temperature of the irradiated specimens. At intervals, samples were taken and analysed by: (*a*) polarography, which gives the amount of non-degraded parathion and any *p*-nitrophenol present; (*b*) the method of Averell–Norris[5], which gives estimates of the intact and reduced parathion; (*c*) the method of Averell–Norris, which was modified for this purpose, omitting the reduction step, thus giving values of the reduced parathion only.

Table 1. DEGRADATION OF PARATHION SOLUTIONS KEPT IN THE DARK AND EXPOSED TO SUNLIGHT

Solution tested	Age of solution	Polarographically		Averell–Norris	
		Parathion	*p*-Nitrophenol	Reduced parathion	Parathion + reduced parathion
		Molarity × 10^4			
'Paridol' alone	2½ hr.				
Dark		20	traces	nil	19
Light		16	traces	5	21
Dark	5½ hr.	20	traces	nil	20
Light		14	traces	7	20
'Paridol' + copper	2½ hr.				
Dark		13·5	6	nil	14
Light		11	7	1·5	14
Dark	5½ hr.	6·5	12·5	nil	7·5
Light		3	13·5	1·9	6
'Paridol' + copper + EDTA	2½ hr.				
Dark		20	traces	nil	23
Light		16	traces	5	21
Dark	5½ hr.	20	traces	nil	24
Light		14	traces	8	22

The solutions contained 0·002 *M* parathion in a 0·05 *M*, *p*H 8·0 barbiturate buffer. Copper ions were applied at a 10^{-4} mol. and ethylenediamine tetraacetate at a 10^{-3} mol. concentration. The results are representative ones, and were obtained on a hot July day in 1957 in Budapest, the temperature of the solutions being 35–45° C.

In parallel experiments I investigated the effect of Cu^{2+}-ions alone and in presence of ethylenediamine tetraacetate. The copper ions, as expected, catalysed the hydrolytic degradation of parathion to *p*-nitrophenol, competing with the light-induced reduction. The chelating agent inhibited the catalytic action.

The results, of which a representative series is given in Table 1, clearly show the photochemical reduction of parathion, presumably to the corresponding *p*-amino-compound. Similar results were obtained by irradiation with a mercury discharge lamp. It is planned to conduct further experiments in order to investigate the effect of *p*H, various other metals and chelating agents, and the behaviour of spray residues under field conditions.

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Gibberellin and the Growth of Plant Tissue Cultures

Two recent publications report the effects of gibberellic acid on the growth of excised plant tissues. Netien[1], working with isolates from the tuber parenchyma of *Helianthus tuberosus*, found a slight increase in growth at 1 p.p.m. in the absence of indolylacetic acid and a decrease at higher levels. In the presence of the auxin all levels of gibberellic acid were quite inhibitory. Schroeder and Spector[2] used explants from the mesocarp of mature citron (*Citrus medica*). They found gibberellic acid, in the absence of indolylacetic acid, caused an increase in weight at 5 p.p.m. In the presence of indolylacetic acid all levels tested resulted in increases in weight.

This report is concerned with the effect of gibberellins on the growth of plant tissues *in vitro* using well-established, actively proliferating clones. The present results are part of a larger report now being prepared. The tissues discussed here were selected to show that an increase in growth, no effect, or a decrease in growth can be obtained under the same conditions by changing the test material.

All the tissues listed in Table 1 have been in culture in this laboratory for the past seven years. The basal synthetic medium used for all tissues consists simply of mineral salts, sucrose, three vitamins, trace elements, and agar[3]. Gibberellin stock solutions were made up at ten times the desired concentration, sterile-filtered through sintered glass, and added to give the desired level to previously autoclaved basal medium just prior to solidification. Experimental transfers of equal size were made to the solid medium and initial weights recorded. After four and eight weeks growth in an air-conditioned culture room at 22·5° C., the tissues were weighed. The results are expressed in Table 1 as 'growth value', which is a number obtained by dividing the final wet weight by the original wet weight. All values are the average of two experiments with five replicates in each experiment.