B—Lower half up to the hypothallus bright yellow and transparent.

3. After dehiscence hypothallus is honey-comb-like and transparent.
4. Capillitium scanty of free elaters, constricted and echinulate.
5. Spores faint and bright yellow, spinulose, 12–13·8 μm in dia.

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ROLE OF IAA, IAA-OXIDASE, O-DIHYDROXY PHENOLS, POLYPHENOL OXIDASE AND PEROXIDASE IN STEM GALL DISEASE OF *CORIANDRUM SATIVUM* L.

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Healthy plant is a completely balanced complex of interrelated reactions which are in a state of dynamic equilibrium. Any change in this system tends to disturb the equilibrium and causes various deformities which are symptomatically displayed in one way or the other. The morphological and histological deformities caused by *Protomyces macrosporus* Unger in *Coriandrum sativum* L. have been studied but the exploration of underlying biochemical changes in this plant is still in the infant state. It was, therefore, intended to analyse the diseased and healthy plant, for IAA-oxidase, polyphenol oxidase (PPO), peroxidase (PO), IAA- and O-dihydroxyphenols and to discuss their possible implication in disease development and the resistance.

Freshly collected healthy and diseased plant pieces (30 g each) were finely crushed and subjected to IAA preparation and estimation with Salkowski reagent[1]. The enzyme preparation was done at 4° C temperature. *Plant material (10 g each)* was crushed and homogenized in prechilled acetate buffer (pH 5·2) for IAA oxidase and in phosphate buffer (pH 6·5) for PPO and PO. The homogenates were filtered and centrifuged at 4000 rpm for 10 min. The supernatants were subjected to ammonium sulphate precipitation between 20 and 80% saturation. The precipitates were collected by centrifugation at 16,000 r.p.m. for 15 min and suspended in 10 ml of respective buffers for each sample. The resultant solutions were assayed for IAA-oxidase[3], PPO[3] and PO[4] activities. The protein was determined by Lowry's method[5] using BSA as standard. O-dihydroxy phenols were extracted by crushing plant material (15 g each) in 80% ethanol and measured with Arnow's reagent[1].

High O-dihydroxy phenols, increased PO and decreased PPO activities were recorded in diseased plants of Coriander (Table I). The quantity of IAA was, however, considerably low with a simultaneously high activity of IAA-oxidase measured per unit fresh weight tissue (Fig. 1 A). But when the enzyme activity was determined per unit protein, it was found low in diseased plant than in healthy ones (Fig. 1 B). It indicates that enzyme protein has not correspondingly increased with increase in total protein contents. The high concentration of O-dihydroxyphenols was thought to have inhibited IAA-oxidase[8].

TABLE I

Quantitative analysis of healthy and diseased tissues of C. sativum *infected with* P. macrosporus

(Values are mean ± S.E. of 5 observations)

Analysed substances	μg/g fresh weight tissue	
	Healthy	Diseased
O-dihydroxyphenols	425 ± 4·4	580 ± 2·3
IAA	19·7 ± 0·15	5·0 ± 0·23
Polyphenol oxidase*	140 ± 3·9	80 ± 1·6
Peroxidase*	45 ± 2·4	75 ± 2·2

Values are significant at 0·05 level.
*Change in absorbance/min/ml enzyme solution.

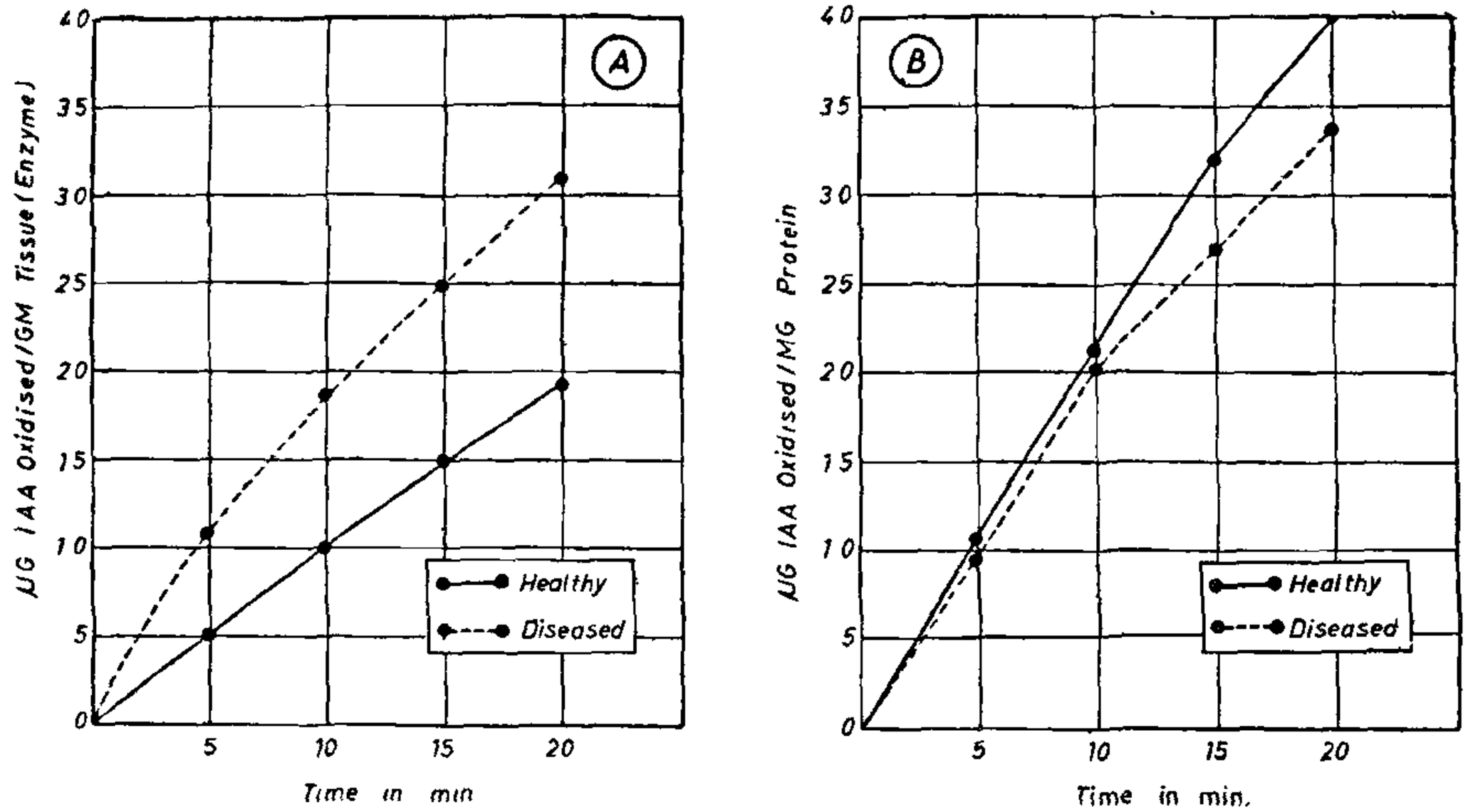

FIG. 1. IAA-oxidase activity in healthy and diseased plant of *Coriandrum sativum* L.

The observations of this investigation, therefore, stand contradictory to this concept. The inhibition of IAA-oxidase by diphenols *in vivo* in diseased plants may not be true as the process might be governed by other factors also. This can be clarified if the infection to the plant results in injury accompanied with other deformities and scarcities causing an increase in the enzyme activity. It, therefore, stands to reason that high IAA-oxidase activity here, in diseased plants, is a consequence of injury following the infection and is thus a secondary effect partly independent of O-dihydroxyphenols as also shown by Niemann[7] and Darbyshire[8]. The increased O-dihydroxy phenols reported here might be involved in the inhibition of the activity of phenyl oxidase. These phenolics also act as substrates of some enzymes such as peroxidase[8]. Phenol oxidising enzyme system, PPO–PO complex, is found deeply involved in the defence reactions of the plant against pathogens. These enzymes are also involved in reactions leading to the darkening of the plant tissues after injury and in the formation of physical barriers against the pathogen.[10] More highly oxidised and polymerised products of phenolics are directly toxic to pathogens[11]. In addition to IAA-oxidase, PPO and PO may also cause low level of IAA in diseased plants[12]. The results demonstrate the complex defensive biochemical mechanism operating in plant against the pathogen.

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