Latin diagnosis.—Efformat colonias brunneas in substrato. Sub lente singulæ coloniæ constant et conidiophoris pluribue quæ sunt compacte aggregata et sterillia supra ; submicroscopic pars inferior conidiophorum evadit compacta et inter se parallela. Stipes erectus non furcatus, parietibus crassis, ad quinquies septatus, 194·5–243·0 μ longus, 4·0–5·0 μ latus cum apice sterili subhyalino. Pars sterilis apicis supra regionem sporiferam 75·0–93·5 μ longa. Cellulæ sprogenæ lateraliter productæ e cellulis basalibus et mediis stiptitis immediate suo ipsis septis, pallide vel fusce brunneæ, vulgo globose, leves 4·5–5·0 μ diam. Conidia producta basifuga in catensis simplicibus, fusce brunnea, globosa, parietibus crassis pulchre verrucosis et 4·0–5·5 μ diam.

Lectus ad Varanasi in inflorescentia *Ureriæ pictæ*, leg, S. D. Bharadwaj, et positus in Herb. Botany Deptt., B.H.U., Varanasi.

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ROOT-ROT OF *ARACHIS HYPOGAEA* SEEDLINGS CAUSED BY *PYTHIUM DEBARYANUM*

During January-February 1965, seedlings of *Arachis hypogæa* L. (groundnut) were found affected by root-rot caused by a species of *Pythium*. Serious incidence of the disease was observed in the same season of the subsequent years. A brief account of the disease is given below.

The disease manifested itself as water-soaked light-brown to brown lesions on the root near the hypocotyl region and later spread to the entire root system. The affected roots turned brown to dark-brown and subsequently the seedlings wilted. The causal organism was isolated in pure culture and maintained on oat-meal agar slants.

Hyphæ branched, 1·6–4 μ ; sporangia spherical to elliptical, rarely with delicate beaks, terminal or intercalary, borne singly or in monochasial branches, 10–22 μ when spherical, 16–28 $\mu \times$ 12–20 μ when elliptical, germinate either by germ-tubes or zoospores ; zoospore reniform with two lateral flagella, 7–11 $\times$ 5–7 μ ; encysted zoospores measure 6–8 μ.

Oogenia spherical, smooth, mostly terminal. rarely intercalary, 12–22 μ ; antheridia usually 1–5 per oogonium, monoclinous and diclinous, clavate, terminal, making apical contact with oogonium ; oospores smooth, spherical, aplerotic, 12–20 μ, with a single reserve globule and a refringent body. The fungus is identified as *Pythium debaryanum* Hesse.[2]

Pathogenicity of the organism was established on its natural host and it also infected *Brassica juncea* Coss., *B. oleracea* vari *botrytis* L., *Crotalaria juncea* L., *Cyamopsis tetragonoloba* (L.) Taub., *Phaseolus mungo* L.

Root-rot of *Arachis hypogæa* due to *Pythium ultimum* Trow has been reported from different countries.[3,4] Frezzi[1] reported that apart from *P. ultimum*, *P. irregulare* Buisman and *P. debaryanum* were also responsible for groundnut pod-rot in Argentina. In India *P. debaryanum* has not been reported on groundnut and this is the first report.

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ANTAGONISTIC ACTION OF BORON ON COPPER IN GROUNDNUT PLANT

Deficiency of boron alters a number of enzymatic reactions,[1] although it was not a constituent of any enzyme nor was indispensable for their action. The present study was made to find out the biochemical nature of B-toxicity on copper and copper-protein enzymes in the leaves of groundnut, *Arachis hypogæa* L. var. TMV-2.

The sand culture technique for growing the plants, other experimental procedures and 10 p.p.m. boron treatment were the same as used by Gopal.[2] After boron treatment was

started, the mature leaves from middle of the stem from individual plants of both the control (0·5 p.p.m. boron in nutrient solution) and treated sets were sampled once every two days and continued upto 12 days (including an initial sampling before excess B-treatment). At each time of sampling, the leaves were analysed for their boron[3] and copper[4] spectrophotometrically. The activities of ascorbic acid oxidase and polyphenol oxidase were assayed titrimetrically.[5] The results are presented in Table I.

TABLE I

Effect of boron on copper and activities of copper-protein enzymes in the middle leaves of Arachis hypogæa (*Mean of three replications*)

Days after 10 p.p.m. boron treatment	Control (0·5 p.p m. boron)[A]				Treated (10 p p.m. boron)[A]			
	Boron*	Copper*	Ascorbic acid oxidase†	Polyphenol oxidase†	Boron*	Copper*	Ascorbic acid oxidase†	Polyphenol oxidase†
0‡	110±4	20±1	3·4±0·2	23·0±0·4	106± 6	21±1	3·5±0·2	23·1±0·4
2	121±3	21±1	4·4±0·3	31·0±0·6	1230±40	19±1	1·7±0·4	30·2±0·6
4	124±4	20±2	3·6±0·2	28·1±0·6	2022±44	19±1	1·9±0·3	14·9±0·6
6	106±5	20±1	3·6±0·2	24·5±0·4	2394±30	18±2	1·8±0·1	14·6±0·8
8	100±6	21±1	5·1±0·2	30·0±0·6	2860±64	18±2	1·8±0·3	22·4±0·4
10	108±4	21±2	5·6±0·2	31·4±0·6	3220±36	17±1	2·3±0·4	21·2±0·8
12	110±6	21±1	6·1±0·4	30·2±0·5	3910±86	17±1	2·0±0·2	20·6±0·6

[A] Both the control and treated plants were supplied with 0·02 p.p.m. copper as copper sulphate in nutrient s lution. * Values expressed in μg/g. or p.p.m. on oven dry weight. † Ascorbic acid oxidase and polyphenol oxidase activities expressed in mg. ascorbic acid oxidize /g. fresh weight in 30 min. ‡ Analysis made before 10 p.p m. boron treatment.

With increase in the accumulation of boron in leaves, the B-toxicity symptoms such as chlorosis (yellowing) gradually intensified and later (10 days after treatment) necrosis manifested. There was not much variation in the B-content of the leaves in control plants in the experimental period. In treated plants, the boron content quickly increased in the leaves and it was 3,910 p.p.m., 12 days after treatment. The copper content of the leaves of control plants ranged from 20 to 21 p.p.m., and it was lowered by 19%, 12 days after B-treatment against respective control.

The activities of ascorbic acid oxidase and polyphenol oxidase in the leaves of control plants showed some fluctuation ; however, they were either equal to the initial values or increased slightly by the end of 12 days. Ascorbic acid oxidase activity was relatively lower than the polyphenol oxidase. With B-treatment, the activity of ascorbic acid oxidase was much lowered than polyphenol oxidase ; by 12 days after treatment, it was only 33%, whereas the activity of polyphenol oxidase decreased to 68% over respective controls.

A definite decrease in the activities of the two copper-protein enzymes was observed in the leaves of plants supplied with toxic boron level. The inhibition of the enzyme activities may be an indirect effect associated with a decrease in the copper content or due to the overall adverse effect leading to the disintegration or impaired activity of cytoplasmic proteins associated with an accumulation of abnormally high concentrations of boron in the chlorotic leaves. The experimental evidence and theoretical concepts on the nature of antagonism between B and Cu in plants were discussed by MacVicar and Burris[6] and Ramamoorthy.[7] The present results on the effect of B-toxicity on the enzyme systems of copper indicates the mode of antagonism between boron and copper in plant cells.

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