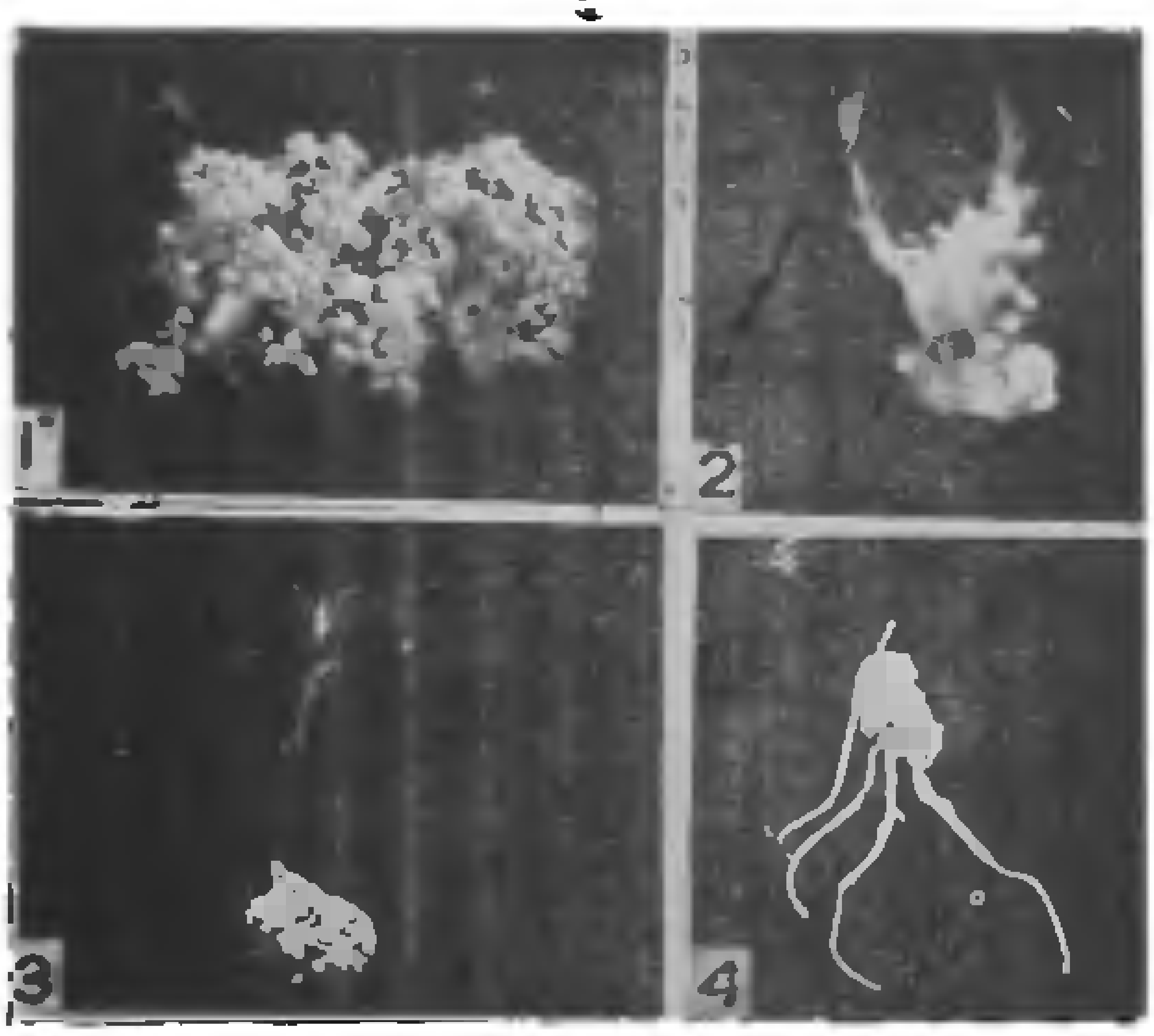
formed in the bunches on the surface of the callus tissues. The differentiated shoots possess well developed leaves but shoot length was short. The number of shoots was very low (1–2) in the root callus but the length of shoots were about 4–6 cm (Fig. 3).

No shoot bud initiation was observed when direct root segments placed on the differentiation medium. Among the other cytokinins, kinetin and adenine sulphate were ineffective to induce shoot bud formation. The development of shoot bud was greatly enhanced when medium was added with ME (500 ppm). The effect of the 2,4-D on organogenesis was inhibitory. The roots were formed in stem and root callus on medium containing NAA or indole acetic acid (IAA) (1·0 ppm) and kinetin (0·1 ppm) (Fig. 4).



Figs. 1–4. Formation of compact, globular and glandular callus of *C. aurantifolia* on modified MS medium with 1·0 ppm Kn. Fig. 2. Shoot formation stem callus after 6 weeks growth on MS medium supplemented with 0·5 ppm BAP and 0·1 ppm auxin. Fig. 3. Elongated shoot formed from root callus after 8 weeks growth. Fig. 4. Callus showing rooting in 3 weeks growth on MS medium with 1·0 ppm auxin.

It is, therefore, concluded that light, cytokinin and auxin affect markedly the growth and organogenesis in callus tissues *Citrus aurantifolia*.

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Jodhpur, *March* 9, 1978.

1. Mitra, G. C. and Chaturvedi, H. C., *Bull. Torrey Bot. Club*, 1972, **99**, 184.
2. Rangan, T. S., Murashige, T. and Bitters, W. P., *Proc. First Int. Citrus Symp.*, 1961, **1**, 225.
3. Chaturvedi, H. C. and Mitra, G. C., *Hort. Science*, 1974, **9**, 118.
4. Grinblat, W. J., *Amer. Soc. Hort. Sci.*, 1972, **97**, 599.
5. Norton, J. P. and Boll, W. G., *Science*, New York, 1954, pp. 119, 220.
6. Zenktler, M. A., *Acta Soc. Bot. Pol.*, 1971, **60**, 305.
7. Peterson, R. L., Cited in *The Development and Function of Roots*, Ed. J. G. Torrey and D. T. Clarkson, Academic Press, New York, 1975, p. 125.
8. Raj Bhansali and Arya, H. C., *Indian J. Exp. Biol.*, 1978, **16**, 409.

EFFECT OF POTASH ON PROTEIN AND VARIOUS AMINOACID CONTENTS IN CHILLI LEAVES INFECTED WITH *XANTHOMONAS VESICATORIA* (DOIDGE) DOWSON

Increased supply of potassium has been reported to reduce the intensity of bacterial leaf spot disease caused by *Xanthomonas vesicatoria* in chilli crop[3]. In the present study, the role of nitrogen compounds in the chilli leaves supplied with high levels of potash has been studied.

Materials and Methods

Chilli (variety K–1) was transplanted in pots with five levels of potassium, *viz.*, 0 K, 30 K, 60 K, 90 K, 120 K kg/ha. Inoculation was done with the bacterial suspension (*ca* 10^7 cells/ml) of *X. vesicatoria*, when the plants were 35 days old. Inoculated pots were kept under humid condition for the disease development. Each treatment was replicated four times and suitable controls were also maintained. After 10 days, when the plants developed good leaf spot symptoms, the protein and free aminoacids in the leaves were estimated. Protein was estimated by microkjeldhal method and expressed in gm %. Aminoacids were estimated by dimensional chromatography and the results are expressed μg/g.

Results and Discussion

Table I reveals that under low potash levels, there is a fall in protein content. When the potash level is increased, an increase in protein content is observed. Amberger[1] reported that main consequences of potash deficiency is the accumulation of free aminoacids and a block in protein synthesis.

Due to *X. vesicatoria* infection, the protein content decreases at almost all levels of potash. A breakdown of proteins in the chilli leaves due to bacterial infection is a possibility. The bacterium may perhaps utilise the host proteins for its own multiplication.

Under potassium deficient conditions, the free aminoacids accumulate in leaves which may be due to inten-

TABLE I

Effect of potash on protein and aminoacids of chilli leaves infected with Xanthomonas vesicatoria

Aminoacids (μg/g leaf)	Potash levels in g/pot									
	Control		0·30 K		0·60 K		0·90 K		1·20 K	
	H	I	H	I	H	I	H	I	H	I
Protein (g%)	15	12	17	15	24	20	24	19	18	20
Asp	3515	tr	tr	tr	1343	782	104	221	292	937
Alanine	5910	1137	2237	1546	2072	3692	2210	2453	1705	1845
Asparagine	..	..	..	152	1040	1210	..	..	..	..
Cystine } Cysteine	1040	1040	tr	tr	tr	260	242	875	260	1457
Glutamic acid	2380	1040	1785	810	1190	647	986	757	297	715
Glycine	3015	197	1790	1452	tr	892	292	1040	495	1270
Glutamine	815	1460	1955	2006	602	740	408	675	307	710
Leucine	445	tr	..	..	..	250	425	102	320	..
Methionine	1652	tr	925	212	1065	847	2376	2312	1735	1715
Threonine	781	781	1040	1652	562	tr	..	756	..	832
Serine	525	tr	320	405	462	540	..	632	..	512
Valine	832	..	tr	..	tr	7207	1040	..	1042	..
Proline	..	..	..	..	110	..	tr	20460	..	40000
Phenyl alanine	..	tr	tr	..	..	..	..	953	..	1022
Tyrosine	..	..	..	..	..	..	..	47	..	108
TOTAL ..	20925	5667	10069	8250	8470	17087	8107	31292	6471	51143

H : Healthy. I: Infected. tr: Trace.

sive hydrolysis of protein or decreased synthesis of the same. Aminoacids are important in the plant disease resistance mechanism[2]. Potassium deficient plants usually accumulate more soluble nitrogen compounds (in particular aminoacids) and a fall in proteins[4]. Here, aminoacids like, alanine, glutamic acid, glycine, leucine and serine are found to accumulate under potash deficient conditions, and the opposite is true when the potash level is increased.

Bacterial inocu ation in general has resulted in the accumulation of free aminoacids (Table I). Padmanabhan *et al.*[5] have reported that, *Xanthomonas citri* infection resulted in the accumulation of aminoacids. Increased aromatic aminoacids like tyrosine *and tryptophan may be due to the blockage in the synthesis of total phenolics. Increased levels of potash* application have decreased the total phenolics in chilli leaves due to *X. vesicatoria* infection[3].

Some aminoacids like alanine, glycine and glutamic acid may support the good growth of the bacterium *X. vesicatoria*. When the potash level is increased, the level of these aminoacids decreases which may not be adequate for the bacterial consumption. Alanine, glycine and glutamic acid supported good *growth of X. malvacearum, X. sesami and X. ricinella* while serine gave very little or no growth[6]. It is seen under high potash levels, a huge accumulation of serine, cystine and cysteine takes place due to bacterial infection (Table I). Presence of serine is found to give resistance to cotton plants against *X. malvacearum*[7].

Hence, low levels of alanine, glycine, glutamic acid and accumulation of tyrosine, phenyl alanine (Aromatic aminoacids), proline, cystine, cysteine and serine at higher potash levels enhance the resistance of chilli leaves to *Xanthomonas vesicatoria*.

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1. Amberger, A., *Fertilizer Use and Protein Synthesis*, 'Der Bund' Press, Switzerland, 1975, p. 75.
2. Gassner, C. and Hassebrauk, K., *Phytopath. Z.*, 1933, 5, 323.
3. Mohan, R., Mohamed Mustaq Ahmed, N., Sabitha Doraiswamy and Thenammai, V., *Curr. Sci.*, 1977, 46, 616.
4. Morard, P., *Potash Review*, 1974, 10, 1.
5. Padmanabhan, D., Vidyasekaran, P. and Soumini Rajagopalan, C. K., *Indian Phytopath.*, 1974, 27, 404.
6. Singh, R. P. and Verma, J. P., *Science and Culture*, 1973, 39, 502.
7. Verma, J. P. and Singh, R. P., *Acta Phytopathologiea Academical Scientiarum*, 1974, 9, 55.

PHOMOPSIS ROT DISEASE OF GRAPE

DURING the visit of grape garden of a cultivator at Hyderabad (A.P.), the authors came across the pycnidial fungus growing on grape berries. The incidence of the disease in the garden was significantly high particularly on Anab-e-shahi cultivar and fruit drop was enormous. The characteristic ymptoms of the disease (Fig. 1) is the formation of water soaked lesions on

FIG. 1. Grape berries covered with pycnidia of *Phomopsis viticola* Sacc.

the berries which bear a large number of black dot-like pycnidia. Pycnidia initially immersed, becoming erumpent, dark globose to irregular up to 200–350 μm diameter, with protruding ostioles; pycnidial wall multicellular, conidiophores (phialides) hyaline, filiform, arising from innermost layer of cells lining the cavity. A-conidia hyaline, unicellular, fusoid to ellipsoidal, 2-guttulate, rarely 3, measuring 8–10 $\times$ 2·5–3 μm. B-conidia very few, hyaline, elongated, filiform, curved, blunt at the base, aseptate, eguttulate, measuring 20–30 $\times$ 1–1·5 μm. Both types of spores are exuded from the pycnidium in a thick, water-soluble matrix. The host epidermis surrounding the erumpent black pycnidia becomes darkened.

In culture, the fungus forms a whitish mat of creeping hyphae on the agar surface with little or no aerial mycelium and later turns as smoky-gray. Pycnidia are formed on tenth day; they are sometimes scattered singly over the surface but more generally coalesced to form large, black multiostiolate bodies.

Pathogenicity tests were conducted with the pure cultures of the fungus by applying the culture on healthy grape berries with or without wounds. The infection started early in the wounded tissue though ultimately there was no difference in wounded or unwounded ones. Typical lesions of the disease were observed on the seventh day which gradually increased in size. Reisolations from the diseased tissues yielded the same fungus.

The fungus has been identified as *Phomopsis viticola* Sacc. Hewitt[1] reported in California (U.S.A.) that the fungus responsible for *Phomopsis* rot and dead-arm of grape is the same and the fungus grows from the stems into the grape and causes rotting. However, *Phomopsis* rot disease has not been reported on grape so far from India.

The culture and the specimen have been deposited in the P.K.V. Plant Pathology Herbarium by PKV PP 103 number.

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1. Hewitt, W. B., *California Agril. Exptl. Stn. Bull.*, 1974, p. 868.

RARE AXILLARY BRANCHING IN *PHOENIX SYLVESTRIS* (L.)

THE genus *Phoenix* consists of a few unbranched species, and others with sucker formation (Tomlinson[3]). The present contribution deals with a wild date-palm, *Phoenix sylvestris* (L.) Roxb., with its abnormal axillary branching with bulbils, and the sucker shoots.

The particular wild date-palm, *Phoenix sylvestris*, was located by the authors during their field study.