length. The virus was present in high concentrations. These virus particles resembled particles of TMV. The presence of rod-shaped particles similar to TMV in banana mosaic is being reported for the first time from India or elsewhere.

Recently Lockhart[5] reported a bacilliform virus measuring 49 × 12 nm associated with banana streak disease from Morocco. The virus under study is entirely different in particle morphology.

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1. Capoor, S. P., *Proc. Seminar Dis. Hort. Plants*, ICAR, New Delhi, 1959, p. 163.
2. Capoor, S. P. and Varma, P. M., *Indian Phytopathol.*, 1970, **23**, 62.
3. Joshi, D. M. and Joshi, H. U., *GAU Res. J.*, 1978, **1**, 105.
4. Mali, V. R. and Deshpande, G. D., *Indian J. Mycol. Plant Pathol.*, 1976, **6**, 23.
5. Lockhart, B. E. L., *Phytopathology*, 1986, **76**, 995.

ALTERED NITROGEN AND PROTEIN CONTENTS IN BITTER GOURD (*MOMORDICA CHARANTIA* L.) DUE TO CUCUMIS VIRUS 3 INFECTION

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A severe mosaic disease of bitter gourd (*Momordica charantia* L.) caused by cucumis virus 3 (CV_3) occurred at Gorakhpur and the adjacent areas[1]. The present communication records the effect of the virus on nitrogen and protein contents of the host.

Experiments were carried out in an insect-free glass house. Two lots each of 25 plants were taken. One lot was mechanically inoculated with CV_3 on the 7th day after germination and the other lot kept as control. Symptoms developed nine days after inoculation. Leaf, stem and root, from five healthy and five infected plants were collected on 10, 20, 30, 40 and 50 days after inoculation and dried in an electric oven at 65°C till a constant weight was obtained. Nitrogen[2] and protein contents[3] were estimated by the methods described earlier. For the measurement of nitrogen content 50 mg and for protein content 1 g of the dried samples (healthy and infected) at each intervals were taken and the optical density was measured at 440 nm in a colorimeter. The values were calculated from a standard curve drawn from ammonium sulphate and expressed as percentage dry weight of the samples. All the experiments were repeated thrice.

Tables 1 and 2 show a general increase in nitrogen and protein contents with age in all the infected and healthy samples of leaf, stem and root. Infected samples had more nitrogen and protein contents than their comparable healthy counterparts. Leaf samples of both healthy and diseased plants contained higher nitrogen and protein contents than stem and root samples. All the values are significant at 5% level when analysed statistically.

The present results agree with those reported[4-6] earlier in different virus-infected plants. The increase in the total nitrogen may be due to the accumulation of protein[7] (table 2). The increase in the amino acid content due to virus infection is responsible for increase in nitrogen and protein contents[7-8].

The increase in cytoplasmic protein due to utilization of chloroplastic protein for virus protein synthesis may be the other reason for the increase in the protein content[9].

Table 1 *Effects of CV, infection on nitrogen content (per cent dry weight) of healthy and diseased bitter gourd leaf, stem and root at different days after inoculation*

Days after inoculation	Leaf		Stem		Root	
	Healthy	Diseased	Healthy	Diseased	Healthy	Diseased
10	2.50	3.12	1.87	2.19	2.12	3.15
20	2.81	3.75	2.19	2.50	2.44	3.66
30	3.75	4.89	2.81	3.44	3.37	4.00
40	4.37	5.31	3.12	3.70	4.00	4.62
50	4.69	5.62	3.64	4.06	4.31	5.25
CD value	0.83		0.18		0.32	

Table 2 *Effect of CV. infection on protein content (per cent dry weight) of healthy and diseased bitter gourd leaf, stem and root at different days after inoculation*

Days after inoculation	Leaf		Stem		Root	
	Healthy	Diseased	Healthy	Diseased	Healthy	Diseased
10	9 07	10.20	6 67	7.18	6 25	9 04
20	9 81	12 07	7 84	7 90	6.66	9 51
30	12.90	15.30	9.72	10 98	9 60	10 36
40	14 33	16.30	11.51	12.91	10 44	11.87
50	14.63	18.21	13 06	14 61	10 90	13.65
CD value	1 91		1 24		1 99	

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1. Bhargava, B. and Bhargava, K. S., *Indian J. Agric. Sci.*, 1947, **47**, 1.
2. Doneen, L. D., *Plant Physiol.*, 1932, **7**, 717.
3. Snell, F. D. and Snell, C. T., *Colorimetric methods of analysis*, D. Van Nostrand Co., Inc., New York, 1949, Vol. 2, p. 813.
4. Joshi, R. D. and Dubey, L. N., *Phytopathol. Med.*, 1974, **13**, 51.
5. Singh, H. C., Singh, B. R. and Gangulee, R., *Acta Bot. Indica*, 1978, **6**, 204.
6. Shukla, K., Gupta, A. K. and Joshi, R. D., *Indian J. Plant Pathol.*, 1984, **2**, 161.
7. Singh A. B., Pandey, P. K. and Nimbalkar, M. R., *Curr. Sci.*, 1976, **45**, 297.
8. Thankappan, M. and Chacko, C. I., *Indian J. Plant Physiol.*, 1970, **13**, 99.
9. Chinnadurai, G. and Nair, M. C., *Curr. Sci.*, 1971, **40**, 18.

INTRODUCTION AND ESTABLISHMENT OF *CHILOCORUS BIJUGUS* MULSANT AND *PHAROSCYMNUS FLEXIBILIS* MULSANT, PREDATORY BEETLES OF SAN JOSE SCALE AT THANEDHAR AREAS IN HIMACHAL PRADESH

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SAN Jose scale, *Quadraspidiotus perniciosus* (Comstock) (Hemiptera: Diaspididae) is a notorious pest virtually occurring throughout the deciduous fruit-growing areas of the world. In India, the pest is believed to have entered for the first time in Kashmir (J&K) during the first decade of 20th century along with some flowering plants, but its seriousness was felt only in 1922[1]. In Himachal Pradesh, it was first reported at Kullu in 1921 and Kotgarh (Shimla) in 1924[1]. At present it is considered to be a serious pest of apple, plum, pear and peach in Jammu & Kashmir, Himachal Pradesh and Utter Pradesh. Because of its waxy covering, development of insecticidal resistance, high cost and hazardous effect of insecticides, chemical control could not gain much importance and necessitated the use of bioagents.

Successful biological control of San Jose scale has been achieved in several countries by introducing and colonizing its parasitoids and predators, a detailed account of which has been given by Tuhan *et al*[2]. To control this pest biologically in Himachal Pradesh, efforts were made by the Central Biological Control Station, Solan (HP) to rear and release its natural enemies. The nucleus cultures of these natural enemies (*Chilocorus bijugus* Mulsant (Coleoptera: Coccinellidae), *Pharoscymnus flexibilis* Mulsant (Coleoptera: Coccinellidae), *Encarsia perniciosi* (Tower)(Hymenoptera: Aphelinidae), *Aphytis* sp. *proclia*–group? *proclia* (Walker)(Hymenoptera: Aphelinidae) were obtained from the Central Biological Control Station, Srinagar (J&K) and mass-reared in the laboratory. Before release work, an extensive and intensive surveys were conducted throughout the apple-growing areas of the state, viz., Thanedhar, Kotgarh and Phagu (Shimla district), Bhuntar, Katrain, Jari and Rujak (Kullu district), Rajgarh (Shimla district) and Chail (Solan district) from April to November, 1983 to record the per cent incidence of pest and presence of its natural enemies.