A NEW MOSAIC DISEASE OF BANANA

S. J. SINGH
Indian Institute of Horticultural Research, 255, Upper Palace Orchards, Bangalore 560 080, India.

BANANA (*Musa paradisiaca*) is one of the most important fruit crops in India and other countries. In the past, banana cultivation in different parts of the world had been threatened with extinction and production was severely reduced because of the appearance of one or more diseases which developed to epidemic levels. During 1979–80, a mosaic disease of banana was observed in a farmer's field near Bangalore.

An important symptom of the disease was mosaic-like or discontinuous linear or spindle-shaped streakings, either generally distributed over the lamina, or in bands of half an inch or more in width, extending from margin to midrib. Severely affected leaves had a greenish-yellow mottled look. Symptoms were also apparent on the narrow leaves of young suckers or excised buds. In young leaves, the streaks, or linear splashes, were whitish, pale yellow or yellowish-green. The infected plants remained stunted in growth. No heart-rot symptoms were observed.

The virus was transmitted by mechanical sap inoculation from banana to banana and other herbaceous hosts and the symptoms appeared 45–60 days after inoculation on banana.

When inoculated artificially by sap inoculation, *Lycopersicon esculentum* Mill., *Nicotiana rustica*, *N. tabacum* cv. 'White Burley', *Cucumis melo*, *Datura stramonium* and *Gynura aurantiaca* were infected and showed systemic mosaic mottling symptoms 10–12 days following inoculation. However, *Chenopodium amaranticolor*, *C. quinoa* and *Nicotiana glutinosa* showed local lesions on inoculated leaves after 5–8 days. The physical properties of the virus were studied using crude infective sap from infected banana leaves by conventional virological techniques. The thermal inactivation point of the virus was found to be between 85 and 90°C, and the dilution end-point between 1 : 1000 and 1 : 10,000. The ageing *in vitro* was found up to 24 h at room temperature (20–32°C).

The virus did not show any serological reaction with antiserum to cucumber mosaic virus (CMV). However, it showed serological reaction with tobacco mosaic virus (TMV) antiserum. Electron micrographs were taken of virus particles obtained from mosaic-infected banana leaves using the leaf-dip technique. The preparation was negatively stained with 2% ammonium molybdate solution. Rod-shaped particles measuring 300 × 13 nm on an average were observed in large numbers in the transmission electron microscope (figure 1).

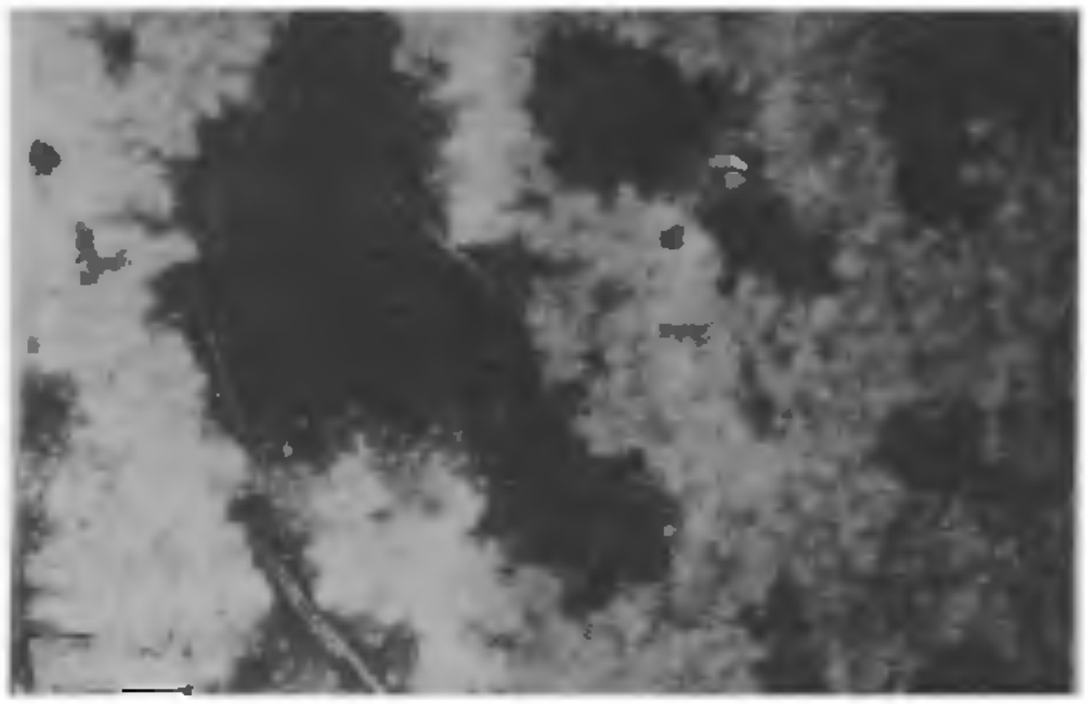

Figure 1. Transmission electron micrograph of banana mosaic virus.

Capoor[1] reported a mosaic or chlorosis disease of banana from India. The virus was transmitted from banana to cucumber and from cucumber to cucumber but not from banana to banana. He also reported that the host range of the virus was confined only to banana in nature. The virus under the present report does not resemble the virus reported by Capoor[1] because it differs in host range.

Capoor and Varma[2] reported a mosaic disease of banana caused by a strain of CMV. Joshi and Joshi[3] showed that this banana strain of CMV could infect *Cucumis sativus*, *Datura stramonium*, *Phaseolus vulgaris*, *Vigna sinensis*, *Chrysanthemum* sp. and *Zinnia elegans* when inoculated artificially by sap. In the present studies, the host range was different since the virus did not infect *P. vulgaris*, *V. sinensis*, *Chrysanthemum* sp. and *Z. elegans*. The virus under study infected *Lycopersicon esculentum*, *N. rustica*, *N. tabacum*, cv. W.B., *C. melo* and *Gynura aurantica* systemically. *C. amaranticolor* and *C. quinoa* and *N. glutinosa* showed only local lesions. Mali and Deshpande[4] reported heart-rot disease of banana from Marathwada region. This disease caused heart-rot symptoms in banana. The virus described in the present communication does not cause heart-rot symptoms and hence is different from the heart-rot disease virus. Moreover, heart-rot is caused by a strain of CMV, whose host range, physical properties and virus particle morphology do not resemble those of the present virus isolate.

Electron microscopy of leaf-dip preparations of mosaic-infected banana leaf sap revealed rod-shaped virus particles measuring about 300 nm in

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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4. Mali, V. R. and Deshpande, G. D., *Indian J. Mycol. Plant Pathol.*, 1976, **6**, 23.
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ALTERED NITROGEN AND PROTEIN CONTENTS IN BITTER GOURD (*MOMORDICA CHARANTIA* L.) DUE TO CUCUMIS VIRUS 3 INFECTION

SANDEEP PANDEY and R. D. JOSHI
Department of Botany, University of Gorakhpur, Gorakhpur 273 009, India.

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	