

A Strain of Melon Mosaic Virus on "Cucurbita Moschata Duchesne" in New Guinea*

R. VAN VELSEN†

The virus attacking Cucurbita moschata Duchesne at Keravat, New Britain, is a strain of melon mosaic virus. The host range is restricted to the systemic infection of Cucurbitaceae, including Trichosanthes anguina L. and local lesion reaction on Chenopodium amaranticolor Coste et Reyn. The thermal inactivation point lies between 57 and 60 degrees C. for an exposure of 10 minutes, dilution end point between 10^{-3} and 10^{-4} , and longevity in vitro, 72 to 96 hours. The virus is sap transmissible and is also transmitted by an aphid, Aphis gossypii Glover.

BEFORE the studies of Lindberg, Hall and Walker (1956) there was much confusion with the identification of cucurbit viruses of limited host ranges. Frietag (1952) reported that he was able to differentiate seven distinct cucurbit viruses on the basis of symptoms, insect vectors, and physical properties, but gave no results. Lindberg *et al* made a critical comparison of the cucurbit viruses, found in the United States, with limited host ranges and divided them into two main groups—squash mosaic viruses and melon mosaic viruses—on the basis of host range, insect vectors, and physical properties.

At the Lowlands Agricultural Experiment Station at Keravat, New Britain, in the Territory of Papua and New Guinea, a mosaic disease on *Cucurbita moschata* Duchesne growing in the field was observed, and the following investigations were carried out to determine the identity of the virus.

SYMPTOMS INDUCED BY THE VIRUS

a. *Cucurbita moschata*.

Following the mechanical inoculation of the cotyledons, the young leaves emerging exhibited typical mosaic symptoms. On old plants the leaves are reduced to tendrils, with a little lamina present at the point of attachment of the petiole. Infected plants are slightly stunted compared with healthy ones, and bear normal flowers and fruit.

b. *Cucumis sativus* L. variety "palmetto".

The first true leaves appearing after the mechanical inoculation of the cotyledons show

typical mosaic symptoms which increase in extent and intensity in subsequent leaves. The leaves are greatly reduced in size and are severely distorted. The petioles and stem internodes are reduced to such an extent as to give the plant a rosette appearance. Flower development is extremely poor, and no fruit is set. The mosaic symptoms develop within seven days.

c. *Citrullus vulgaris* Schrad. variety "Black Boy".

Inoculated plants exhibit a dark green systemic mosaic pattern on the leaves with a general stunting of the whole plant.

d. *Trichosanthes anguina* L.

The first true leaves, appearing after the inoculation of the cotyledons, develop a typical mosaic pattern, which becomes systemic. The infected leaves are reduced in size and are distorted by the presence of raised blisters on the leaf surface.

e. *Chenopodium amaranticolor* Coste et Reyn.

The test plants were mechanically inoculated when six leaves were present. Within three days, pale green spots were observed on the inoculated leaves, developing within the following two days into dirty, white-centred local lesions with a reddish-purple border. The lesions were not systemic, and did not produce any systemic infection.

EXPERIMENTAL RESULTS

a. Host range of the virus.

The test plants were grown in sterilized forest soil in 4-inch pots in insect-proof cages. Twenty young plants of each species were inoculated mechanically on the cotyledons, in

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† Plant Pathologist, Lowlands Agricultural Experiment Station, Keravat, New Britain.

the case of the cucurbit hosts, and on four young leaves of the remaining hosts, with the aid of 500 grit Carborundum and infectious crude sap from diseased *Cucurbita moschata*. After 28 days, leaves were taken from the test plants from above the point of inoculation, and ground. The juice was extracted by squeezing through muslin and mechanically inoculated on to *Chenopodium amaranticolor*.

Only plants belonging to the family Cucurbitaceae became systemically infected, with local lesion reaction on *Chenopodium amaranticolor* (Table I).

TABLE I.

Reaction of various hosts to inoculation with sap of the Keravat strain of melon mosaic virus.

Hosts	No. Plants Inoculated	No. Plants Infected
<i>Citrullus vulgaris</i>	20	16
<i>Cucurbita moschata</i>	20	12
<i>C. maxima</i> Duchesne	20	14
<i>C. pepo</i> L.	20	12
<i>Cucumis sativus</i> var. "Palmetto"	20	20
<i>C. melo</i> L.	20	20
<i>Trichosanthes anguina</i> L.	10 +	9
<i>Nicotiana tabacum</i> L.	20	—
<i>N. glutinosa</i> L.	20	—
<i>Datura stramonium</i> L.	20	—
<i>Vigna sinensis</i> Savi	20	—
<i>Zinnia elegans</i> Jacq.	20	—
<i>Lycopersicon esculentum</i> Mill.	20	—
<i>Phaseolus vulgaris</i> L.	20	—
<i>Petunia hybrida</i> Vilm.	20	—
<i>Chenopodium amaranticolor</i>	20	20 LL

— indicates no symptoms or recovery from inoculated plants.

LL indicates local lesions.

+ sufficient seed for only 10 plants.

b. Physical properties.

The resistance of the virus to exposure at various temperatures for 10 minutes, to ageing *in vitro* at room temperature (28 degrees C.), and to dilution was studied by the usual methods. *Cucurbita moschata* was the source plant of the virus and *Cucumis sativus* variety

"palmetto" was used for the test plant. The virus was active after an exposure of 57 degrees C. for 10 minutes, but inactive after an exposure of 60 degrees C. (Table II). It was inactivated after an exposure of 96 hours at room temperature (28 degrees C.), (Table III), and was inactivated when diluted to 10^{-4} , but active at a dilution of 10^{-3} (Table IV).

TABLE II.

Infectivity of the Keravat strain of melon mosaic virus when heated for ten minutes at various temperatures (degrees centigrades).

Temperature	No. Plants Tested	No. Plants Infected
Control	60 +	60
45	60	60
50	60	60
53	60	60
57	60	30
60	60	—
70	60	—
80	60	—

+ three tests each of 20 test plants.

— indicates no infection.

TABLE III.

Infectivity of infective extract of the Keravat strain of melon mosaic virus when aged at room temperature for various periods.

Time of Explosive in Hours	No. Plants Tested	No. Plants Infected
0	60 +	60
24	60	27
48	60	12
72	60	6
96	60	—
120	60	—

+ results of three tests each of 20 plants.

— indicates no infection.

TABLE IV.

Infectivity of various dilutions of infective sap of the Keravat strain of melon mosaic virus.

Dilution	No. Plants Tested	No. Plants Infected
	60 +	60
10^{-1}	60	60
10^{-2}	60	15
10^{-3}	60	6
10^{-4}	60	—
10^{-5}	60	—

+ results of three tests each of 20 test plants.

— indicates no infection.



c. *Insect transmission.*

Virus-free wingless adults of *Aphis gossypii* Glover were starved for one hour and then allowed an access feed of two hours. The aphids were placed on test plants of *Cucumis sativus* var. "palmetto" in groups of 10 and were allowed to remain for 24 hours. The plants were then dusted with D.D.T. After 28 days, 16 of the 40 test plants had developed mosaic symptoms. No specimens of *Myzus persicae* were found in the area.

DISCUSSION

Since no serological tests were possible due to the lack of equipment, the main criterion used in identifying the virus investigated is the host range test. Lindberg *et al.* differentiated squash mosaic, melon mosaic and cucumber mosaic viruses on host range, and physical properties. The virus investigated systemically infected only members of the family Cucurbitaceae, thus distinguishing it from cucumber mosaic virus. Thus the virus is a strain of squash or melon mosaic virus.

Considering the host range, physical properties and insect transmission studies, the virus is similar to melon mosaic virus as reported by Lindberg *et al.* However, the symptoms recorded on *Cucumis sativus* and *Citrullus vulgaris* vary from those recorded by Lindberg *et al.* Thus the author considers that the virus attacking *Cucurbita moschata* in New Britain is a strain of melon mosaic virus.

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