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A New Mosaic Disease of *Amaranthus gangeticus*

by

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Introduction: Mosaic disease of *Amaranthus* has been reported to occur under natural conditions on *Amaranthus viridis* L. by Phatak (1965) and on *Amaranthus gangeticus* by Govindaswamy *et. al.*, (1967). The present virus collection from Agricultural College Orchard, Coimbatore during January 1968 on *A.gangeticus* differs from the above and a detailed study was undertaken. The results are presented in this paper.

Materials and Methods: The sap extracted from the young infected leaves of *Amaranthus gangeticus* was inoculated on to healthy *Amaranthus* seedlings raised in the glass house. The culture thus established was used for all experiments.

Four species of aphids viz., *Myzus persicae* Sulz., *Aphis craccivora* Koch., *A.gossypii* Glov. and *A.nerii* maintained in the glass house were used for the transmission studies. The aphids were given a pre-acquisition starvation of one hour, acquisition feeding period of half an hour on infected plants and test feeding of 24 hours on healthy plants. After that period the aphids were

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killed by spraying 0.01% parathion and the plants were kept under observation in the glass house. To determine the dilution end point, raw sap extracted from infected leaf material was used at different dilutions. The thermal inactivation point was studied by using a standard extract prepared by adding 1 ml of phosphate buffer (pH 7.0) to every gram of infected leaf material used for extraction.

Results: *Symptoms:* The diseased plant exhibited slight stunting with the leaves showing crinkling and mosaic mottling of dark green areas interspersed with light green patches. The leaves were also reduced in size. On inoculation, the test plants also exhibited the same symptoms.

Transmission: The virus was found to be easily transmissible both by sap and by graft inoculation, the symptoms appearing in 25 – 30 days.

Insect transmission: Out of four species of aphids tried, *Aphis gossypii* alone was found to transmit the virus.

Host range: Thirty host plants belonging to seven different families were inoculated with the virus. The host plants and their reaction to the virus are furnished below:

Amaranthus gangeticus L. — The infected leaves exhibited mosaic mottling, crinkling and deformation of leaves.

Achyranthes aspera L. — Mosaic mottling on young leaves and vein banding.

Celosia cristata L. — Mosaic mottling on young leaves.

Gomphrena globosa L. — On graft inoculation the young leaves exhibited mild mosaic mottling.

Nicotiana glutinosa L. — Systemic mosaic mottling on young — leaves on insect transmission.

Petunia hybrida Vilm. — Mosaic mottling on young leaves.

The other hosts viz., (1) *Amaranthus caudatus* L., (2) *A.frumentaceous* L., (3) *A.virdis* L., (4) *A.flavus*, (5) *Alternanthera triandra* Lam., (6) *Digera arvensis* Forsk., (7) *Gomphrena decumbens* Jacq., (Amaranthaceae), (8) *Vinca rosea* L. (Apocyanaceae), (9) *Dianthus* (Caryophyllaceae), (10) *Chenopodium amaranticolor* Coste & Reyn., (11) *C.murale* L. (12) *C.album* L. (Chenopodiaceae), (13) *Acalypha indica* L. (Euphorbiaceae), (14) *Arachis hypogaea* Willd., (15) *Cajanus cajan* L., (16) *Crotalaria juncea* L., (17) *Cyamopsis tetragonaloba* Taub., (18) *Medicago sativa* L., (19) *Phaseolus mungo* L., (20) *Vigna sinensis* Endl. (Leguminosae), (21) *Capsicum annuum* L., (22) *Datura tatula* L.,

(23) *Nicandra physaloides* Gaertn and (24) *Physalis floridana* Rydb. (Solanaceae) gave negative results on inoculation with this virus.

Physical Properties : The dilution end point, thermal inactivation point and longevity *in vitro* of the virus was studied with sap extracted from infected leaves using *Amaranthus gangeticus* as indicator plants.

The dilution end point of the virus was found to be 1:10,000. The virus was inactivated at a temperature of 65°C but not at 60°C. The longevity *in vitro* of the virus was found to be 72 hours when stored at room temperature.

Discussion : Under field conditions, *Amaranthus blitum* and *A. virdis* were reported to be infected by a mosaic disease (Phatak, 1965). The virus was transmitted by sap and by graft. The symptoms described was a distinct mosaic mottling on young as well as old leaves, severe yellowing of veins, chlorotic irregular patches alternating with dark green areas over the entire lamina. The virus had its host range confined to members of Amaranthaceae family infecting *Amaranthus cruentus*, *A. blitum*, *A. gangeticus* and *A. mangostarum*. But the physical properties of the virus has not been studied.

Another sap transmissible mosaic disease has been reported to occur on *Amaranthus gangeticus* and *A. caudatus* (Govindaswamy *et al.*, 1967). In the infected plants the leaves exhibited mosaic mottling with yellow veins and veinlets. The chlorotic patches were restricted to the interveinal portions and the leaves became crinkled and puckered and the diseased plant was stunted. The virus infected only *Amaranthus gangeticus*, *A. caudatus*, *Petunia hybrida* and *Gomphrena globosa*. The dilution end point, thermal inactivation point and longevity *in vitro* of the virus were found to be 1:10 to 1:100, 55°–60°C and 8–24 hours respectively. The virus was found to be not transmitted by any of the aphid vectors tested.

The virus under study differs from the above two viruses reported in respect of its infection on *Nicotiana glutinosa* and *Celosia cristata* (Table 1). The dilution end point, thermal inactivation point and longevity *in vitro* of the virus were found to be 1:1000 to 1:10,000, 60°–65°C and 74 hours respectively and is much higher and distinct from the one reported from Coimbatore. In addition, this virus was transmitted by the aphid vector, *Aphis gossypii*, while the viruses already reported were not transmitted by insect vectors. It is interesting to note that the isolate under study has not passed on to *Amaranthus caudatus* and *A. viridis* the hosts on which the previous workers have reported the occurrence of the viruses they have studied upon. So, this appears to be a new virus disease on *Amaranthus*.

TABLE 1. *Comparison of viruses reported on Amaranthus*

	Mosaic disease of Amaranthus by H. C. Phatak (1965)	Mosaic disease of Amaranthus (Coimbatore) Govindaswamy *et al.* (1967)	Present isolate
1. Symptoms	Characterised by a distinct mosaic mottle in young as well as old leaves. The extent of symptom varies from severe yellowing of veins to large irregular chlorotic patches alternating with dark green areas over the lamina.	The leaves exhibited mosaic mottling of light and dark green patches. In young newly prdouced leaves the veins and veinlets turned yellow. The leaves become crinkled and slightly puctered.	Slight stunting with the leaves showing crinkling and mosaic mottling of dark green areas inter-spersed with light green patches.
2. Transmission : a) Sap	+	+	+
b) Graft	+	—	—
c) Insect (*Aphis gossypii*)	—	—	+
3. Thermal inactivation point	Not known	55°—60°C	60°—65°C
4. Dilution end point	—	1 : 10 to 1 : 100	1 : 1000 to 1 : 10,000
5. Longevity *in vitro*	—	24 hours	72 hours
6. *Host range*			
1. *Amaranthus gangeticus*	+	+	+
2. *Achyranthus aspera*	—	—	+
3. *Celosia cristata*	—	—	+
4. *Gomphrena globosa*	—	+	+
5. *Petunia hybrida*	—	+	+
6. *Nicotiana glutinosa*	—	—	+
7. *Amaranthus caudatus*	—	+	—

Summary: A mosaic disease of *Amaranthus gangeticus* characterised by mosaic mottling has been described. The causal virus has been transmitted by sap inoculation and by the vector, *Aphis gossypii* Glov. The virus infected *Nicotiana glutinosa*, *Petunia hybrida*, *Gomphrena globosa*, *Celosia cristata* and *Achyranthes aspera*. The virus was found to have a thermal inactivation point of 60°–65°C, dilution end point of 1:1,000 to 1:10,000 and longevity *in vitro* of 72 hours. This virus differs from the one described earlier by Govindaswamy *et al.* (1967).

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Studies on Method of Nitrogen Application in Relation to Frequency of Irrigation for Rice

by

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Introduction: It has been established that improvement in crop yields can be brought about by judicious use of irrigation and N. N requirements of high yielding varieties of rice are high and it is important that fertilzer N is utilized efficiently. Sub-surface application (Abaichandani and Patnaik, 1959), placement through pellets (Vachani, 1952) and split application (Vachani and Mahapatra, 1959) have been found advantageous in lowland rice fields. Rajendraprasad *et. al.*, (1970) reported that application of N in two split doses gave higher yields in irrigated upland rice. Time of application for flooded rice on a heavy clay soil at the International Rice Research Institute, Philippines demonstrated that split application did not increase the yields of IR. 8 significantly over the application of N entirely at planting (Anon. 1968).

Besides proper application of N, irrigation practice also contributes to efficient utilization of N by rice plant. Irrigation of rice may be continuous flooding or by intermittent wetting. Generally at the time of top dressing N, a temporary drainage is provided in order to bring the fertilizer close to the soil particles to enhance nutrient absorption and to minimise loss through nitrification and denitrification. At the International Rice Research Institute, however, no higher yield was obtained from draining the field for top dressing over applying the fertilizer on as much as 5 cm of water (Anon. 1970).

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