Neth. J. Pl. Path. 79(1973) 189–193

Pepper veinal mottle virus in Ivory Coast

J. J. DE WIJS[1]

Office de la recherche scientifique et technique outre mer, ORSTOM, Abidjan, Côte d'Ivoire

Accepted 2 April 1973

Abstract

A mosaic and stunt disease of chilli pepper (*Capsicum frutescens*) in Ivory Coast was found to be caused by pepper veinal mottle virus, a member of the potato virus Y group, recently described from chilli pepper in Ghana. The Ivory Coast isolate was first transmitted by aphids to *Physalis floridana* and subsequently maintained by mechanical inoculation in *P. floridana* and *Nicotiana megalosiphon*. The host range includes mainly Solanaceae, but *Solanum* species were not or very little susceptible. *Aphis gossypii*, *A. spiraecola* and *Toxoptera citricidus* transmitted the virus in a non-persistent manner. No dodder transmission was found. Serological relationship with onion yellow dwarf virus and Columbian Datura virus was established.

Introduction

The study of a mosaic and stunt disease of chilli pepper (*Capsicum frutescens*) in Ivory Coast was undertaken in 1968, at which time little was known on virus diseases in peppers in Africa. Leather (1959) had mentioned a widespread virus disease of chilli peppers in Ghana. More recently Hollings and Bock (1970) reported a virus disease of peppers in Kenya, and pepper veinal mottle virus was described from Ghana by Brunt and Kenten (1971 and 1972).

The virus isolated in Ivory Coast turned out to be identical to pepper veinal mottle virus (PVMV). In the later part of my research I have compared the Ivory Coast isolate (PVMV-CI) with the Ghana isolate (PVMV-Gh). Results of this comparison and some additional information on the virus are now given.

Materials and methods

Growth conditions. All test plants were grown in screenhouses where temperatures varied from 28–35 °C during the day. Relative humidity was always 90–100 %. The reaction of a few *Chenopodium* species was also tested in the greenhouses at Wageningen (the Netherlands) at temperatures ranging from 20–24 °C.

Isolation and maintenance of the virus. PVMV-CI was transmitted first by aphids from a diseased pepper plant (*C. frutescens*) found in the field, to *Physalis floridana* since mechanical transmission failed. The virus was subsequently maintained in *P. floridana* and *Nicotiana megalosiphon*.

Inoculations. Inocula were prepared by grinding infected leaves in 0.05 M potassium phosphate buffer pH 7, containing 1 % Na_2SO_3.

Bioassay. P. floridana, a systemic host, was used for bioassay since local lesion hosts found were not suitable under tropical conditions.
Serology. The microprecipitin reaction under paraffin oil was used for serological tests. Plant sap was clarified with an equal volume of chloroform prior to testing.
Virus and antiserum gifts. PVMV-Gh amd its antiserum (titre 2048) were obtained from Dr A. A. Brunt (Littlehampton, England). Dr R. Bartels (Braunschweig, W-Germany) kindly provided antisera against potato virus A (titre 4096), henbane mosaic virus (titre 4096), tobacco etch virus (titre 512) and Columbian Datura virus (titre 2048).

Results

Occurrence in Ivory Coast. PVMV-CI is prevalent in all *Capsicum annuum* and *C. frutescens* cultivars grown in the South of the country. In the North peppers are less affected. The virus has also been isolated from indigenous *Datura metel*.

Host range and symptoms. The reaction of a few host plants to inoculation with PVMV-CI and PVMV-Gh has been compared in Ivory Coast: No differences in symptoms were observed on *C. frutescens* 'Ferké', *C. annuum* 'Poivron doux d'amérique' and *N. megalosiphon*, but *P. floridana* showed a difference in reaction described below. The following other differences are based on comparison of my observations on PVMV-CI with literature data on PVMV-Gh.

P. floridana reacted with epinasty and vein yellowing in the young leaves five to six days after inoculation with PVMV-CI, followed by mosaic, leaf malformation and reduction in leaf and plant size. PVMV-Gh induced necrotic local lesions, necrosis and abscission of the inoculated leaves and usually stem necrosis leading to death of the plant. A few surviving plants showed the same symptoms in their young leaves as induced by PVMV-CI.

Nicotiana tabacum 'Xanthi' and 'Samsun' reacted first like PVMV-Gh with circular chlorotic local lesions but these were sometimes followed by a necrotic ringspotting (Fig. 1), 2–3 mm in diameter. Recovery of virus from young leaves was not always possible.

N. megalosiphon: necrotic or chlorotic local lesions and sometimes a ringspotting appeared after four to five days on the inoculated leaf, but the local lesions were not consistent enough for assay purposes. Systemically infected leaves showed a mosaic.

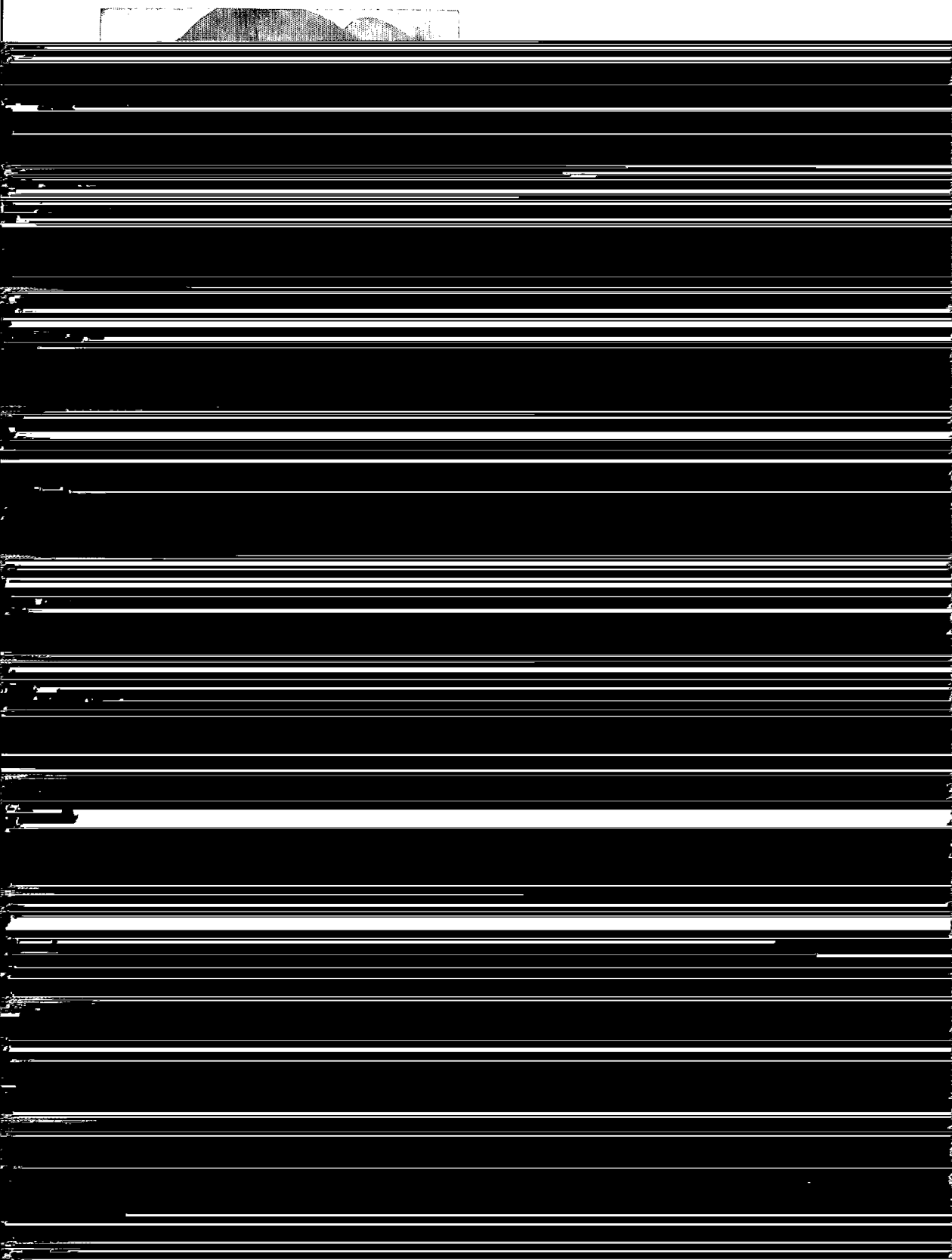
Chenopodium amaranticolor and *C. foetidum* react with local lesions at temperatures ranging from 20–24 °C but only with a faint chlorotic spotting under tropical conditions.

Hyoscyamus niger, reacting with local lesions on the inoculated leaves and systemic symptoms in the young leaves, could not sufficiently tolerate the tropical climate.

Species susceptible without showing symptoms but recorded not to be susceptible for PVMV-Gh were: *Gomphrena globosa*, *Vinca rosea* and *Zinnia elegans*. *Tetragonia expansa* and *Amaranthus caudatus*, recorded to be susceptible for PVMV-Gh, were found not susceptible.

Other Solanaceous species reacting with systemic symptoms are: *Capsicum baccatum*, *Cyphomandra betacea*, *Datura metel*, *Hyoscyamus albus*, *H. aureus*, *Lycopersicum esculentum* 'Moneymaker', *L. pimpinellifolium*, *Nicotiana bentheriana*, *N. exigua*,

Fig. 1. Leaf of 'Xanthi' tobacco with ringspotting caused by PVMV-CI on the inoculated leaf.



Purification. Inoculated and systemically infected leaves of *N. megalosiphon*, collected 12–18 days after inoculation, were used for virus purification. Freezing of leaves prior to extraction caused a nearly total disappearance of the virus from the gradients. The virus was purified according to the method of Damirdagh and Shepherd (1970) for viruses of the potato virus Y group, using urea and mercaptoethanol in the buffers to homogenize the leaves and for resuspension of the highspeed pellets. In the clarification procedure triton-X-100 detergent was used as described by Van Oosten (1972). Virus yields were between 5 and 20 mg/kg of leaf (E 280/260 = 0.80). Electron microscopy of these preparations revealed no difference in particle length (770 nm) between PVMV-CI and PVMV-Gh.

Serology. An antiserum with a titre of 4096 in the microprecipitin test was prepared to PVMV-CI. No serological difference between PVMV-CI and PVMV-Gh could be demonstrated.

The two isolates failed to react with antiserum to potato virus A, henbane mosaic virus and tobacco etch virus but a weak positive reaction was obtained with Columbian Datura virus antiserum.

PVMV-CI was furthermore tested in the Laboratory of Flower Bulb Research (Lisse, the Netherlands) with antisera to a number of filamentous viruses. The virus failed to react with the antisera to potato viruses X, S, M and Y (normal and necrotic strain), tobacco etch virus, bean yellow mosaic virus, narcissus yellow stripe virus and tulip breaking virus. However, a positive reaction was obtained with the antiserum to onion yellow dwarf virus.

Discussion

PVMV-CI shares most characteristics with PVMV-Gh. The slight differences found in symptomatology and susceptibility between the hosts of the two PVMV isolates do not permit their distinction as two different strains.

Columbian Datura virus shows a distant serological relationship to the two isolates of PVMV but does not infect *C. annuum* (Kahn and Bartels, 1968). Onion yellow dwarf virus, although serologically related to PVMV-CI, has its host range in the monocotyledones (Henderson, 1953) and *Allium* species are not susceptible to PVMV-CI. Therefore these two viruses are clearly different.

Acknowledgments

The author is very much indebted to Dr D. H. M. van Slogteren (Lisse) for serological testing, to D. Hille Ris Lambers (Bennekom) for determination of the aphids, to J. D. Mobach and Aho Kouakou for technical assistance and to Professor L. Hirth and Professor A. van Kammen for valuable discussions.

Samenvatting

'Pepper veinal mottle virus' in Ivoorkust

Een zeer algemeen voorkomende virusziekte van spaanse pepers (*Capsicum frutescens*)

in Ivoorkust bleek veroorzaakt te worden door het 'pepper veinal mottle virus' (PVMV) door Brunt en Kenten (1971 en 1972) uit Ghana beschreven. Het virus maakt deel uit van de aardappelvirus-Y-groep.

Hoewel ook de waardplantenreeks van de in Ivoorkust voorkomende stam van het virus (PVMV-CI) voornamelijk Solanaceeën omvat, bleek het geslacht *Solanum* echter in hoge mate onvatbaar. *Physalis floridana* en *Nicotiana megalosiphon* zijn goede diagnostische soorten. PVMV-CI kan op non-persistente wijze overgebracht worden door *Aphis gossypii*, *A. spiraecola* en *Toxoptera citricidus*. De laatste twee zijn nog niet eerder als vectoren vermeld. Overdracht door middel van warkruid, *Cuscuta subinclusa*, bleek niet mogelijk. Het virus werd gezuiverd uit *N. megalosiphon*, waarbij opbrengsten van 5–20 mg virus per kg vers blad verkregen werden. Een antiserum met een titer van 4096 werd bereid. Serologische verwantschap met het 'onion yellow dwarf virus' en het 'Columbian Datura virus' kon worden aangetoond.

References

Brunt, A. A. & Kenten, R. H., 1971. Pepper veinal mottle virus – a new member of the potato virus Y group from peppers (*Capsicum annuum* L. and *C. frutescens* L.) in Ghana. Ann. appl. Biol. 69: 235–243.

Brunt, A. A. & Kenten, R. H., 1972. Pepper veinal mottle virus. Commenw. mycol. Inst./Association of Applied Biologists. Descriptions of plant viruses, set 6, no 104.

Damirdagh, I. S. & Shepherd, R. J., 1970. Purification of the tobacco etch and other viruses of the potato virus Y group. Phytopathology 60: 132–142.

Henderson, D. M., 1953. Virus yellows of shallots. Plant Pathol. 2: 130–133.

Hollings, D. M. & Bock, K. R., 1970. East african survey of virus diseases in main food crops. Identification of isolates. Ann. Rep. 1969. E. Afric. Agric. For. Res. Org.: 82–90.

Kahn, R. P. & Bartels, R., 1968. The Columbian Datura virus – a new virus in the potato virus Y group. Phytopathology 58: 587–592.

Leather, R. I., 1959. Diseases of economic plants in Ghana other than Cacao. Bull no 1 Min. Food and Agric. Ghana, Agric. Div.: 28.

Oosten, H. J. van, 1972. Purification of plum pox (sharka) virus with the use of Triton-X-100. Neth. J. Pl. Path. 78: 33–44.

Swenson, K. G., 1967. Plant virus transmission by insects. In: Methods in Virology. I.: 267–307. AP, New York.

Present address

Ciba-Geigy AG, Agrochemicals Division, Ch-4002 Basel, Switzerland.