

STUDIES ON SOME VIRUSES AFFECTING GRAMINEAE

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INTRODUCTION

INTRODUCTION

Maize (Zea mays L.) and Sorghum (S. vulgare L.) are important economic crops in Egypt. The cultivated area in 1985 was 1.9 and 0.3 million feddans respectively and the average production per feddan was 13.8 and 11.5 ardeb respectively.

According to field inspection performed for maize and Sorghum plants in A.R.E., severe mosaic and dwarfing have been noticed on some Sorghum plants. Maize plants are found to be susceptible to such disease showing the same symptoms.

Therefore, the aim of this study was to identify the causal viruses. This was done according to : a) Symptoms produced on some different host range, b) Virus stability c) mode of transmission , d) particle morphology and serological reaction.

In addition, a field experiment was carried out to illustrate the effect of the causal virus on the rate of vegetative growth and plant yield. The presence of the virus

in different parts of the infected maize ears and seeds of Sorghum plants at the different normal developmental stages was also studied.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

Many viruses were found to infect maize plants i.e. maize streak virus (Storey, 1936, and Abo El Ata, 1983),, maize whorl leaf virus (Schindler, 1942). Maize leaf fleck virus (Stoner, 1952), Rice black streaked dwarf virus (Kuribayashi and Shinkai, 1952). Wheat spot mosaic virus (Slykhuis , 1956); Barley stripe mosaic virus (Nitzany and Kenneth , 1959); American wheat striate mosaic virus (Slykhuis , 1963), wheat streak mosaic virus (Sutic and Tosic , 1964) ; maize red stripe virus (Markov , 1964) ; maize ring mottle virus (Markov , 1964); Rice stripe virus (Hashioka , 1964) , maize dwarf mosaic virus (Sehgal, 1966), maize rough dwarf virus (Lovisolo and Conti , 1966) ; maize stunt virus (Granados et al., 1966) ; and maize striate virus (Abo El Ata , 1983).

In addition , it was found that some viruses infect both maize and sorghum plants i.e. Sorghum concentric ring blotch (Carter and Klessner , 1964); maize mosaic virus (Harold and Munz , 1965), Barley yellow dwarf

virus (Harper and Klain, 1965); Sugarcane mosaic virus (Frazier et al., 1965 ; Abd el Mohsen Abo-Zid, 1975 ; Abo - El-Ata , 1978 and Allam et al., 1981).

Many investigators identified maize dwarf mosaic (MDMV) according to symptomatology , host range, Mode of transmission, stability, particle morphology , and serological reactions (Dale , 1965 , Williams and Alexander , 1965 ; Bancroft et al., 1966 ; Sehgal , 1966, Signoret, 1971 and Panayotou , 1980).

In addition , MDMV was found by many investigators to cause dwarfing in maize plants (Sehgal , 1966 ; Parayotou , 1980), therefore its deleterious effect on plant yield was considered (Mikel et al., 1981 ; and Jajces and Uyemoto, 1983).

1- Symptomatology :

The initial symptom of MDMV on corn (Zea mays L.) in the green house as recorded by Williams and Alexander , (1965); Sehgal (1966); HSi and Shannon ,(1968) , and Panayotou (1980) was described as follows:

- a) a mosaic or mottling at the bases of young leaves.
- b) The light areas coalesce into narrow continuous or broken streaks along the veins.
- c) younger leaves in the whorl are more chlorotic

especially at the sides and tips.

The same symptoms were observed on Sorghum vulgare L. (Sehgal, 1966) ; Sudangrass , and broomcorns (Hsi and Shannon , 1968); and Johnson grass (Panayotou , 1980) infected with the virus. Furthermore, maize (Williams and Alexander , 1965 ; Sehgal , 1966 ; and Hsi and Shannon , 1968) and Sorghum plants (Hsi and Shannon, 1968 ; and Panayotou , 1980) showed varying degrees of dwarfing ; as well as the development of small poorly filled ears on early-infected corn plants (Williams and Alexander , 1965).

The heads of Sorghum and Sudangrass of MDMV- infected plants showed sometimes sterility and partial sterility (Hsi and Shannon, 1968).

II- Host range:

Many hosts belong to family gramineae were found to be susceptible to MDMV-A , i.e. Zea mays L., Sorghum vulgare L. , and S. halepense (Dale , 1965 ; Williams and Alexander , 1965 ; Bancroft et al., 1966 ; Mackenzie et al., 1966 ; Sehgal , 1966 ; Gillaspie , 1967 ; Toler et al., 1967 ; Kuhn and Kozelnicky , 1968 ; Roane and Tolin, 1969 ; Zummo and Gordon , 1971 ; Signoret, 1971 , Arny et al., 1980 ; and Rosenkranze, 1980, 1983). In addition, Sorghum sudanense (Dale , 1965 ; Williams and Alexander , 1965 ; Mackenzie et al., 1966 ; Sehgal , 1966 ; Roane and Tolin , 1969 and Signoret,

1971); Digitaria sanguinalis (Dale,1965 ; Williams and Alexander , 1965 ; Bancraft et al.,1966 ; Kuhn and Kozelnicky , 1968 ; and Roane and Tolin , 1969); Setaria italica (Dale , 1965 ; Williams and Alexander, 1965 ; Sehgal , 1966 ; Signoret , 1971 ; and Rosenkranze, 1980, 1983). S. viridis (Williams and Alexander , 1965; Bancroft et al., 1966 ; Kuhn and Kozelnicky , 1968 and Signoret , 1971); S. magna (Williams and Alexander,1965; Sehgal,1966 and Signoret , 1971 , S. faberii (Dale , 1965 and Bancroft et al., 1966), Saccharum officinarum (Williams and Alexander , 1965 ; Sehgal , 1966; and Gallaspie , 1967), Euchlaena mexicana (Williams and Alexander ,1965 ; Bancroft et al., 1966 and Sehgal , 1966); Panicum Sp. and Eleusine indica (Williams and Alexander, 1965; Bancroft et al., 1966); and Broms japonicus (Bancroft et al.,1966 and Sehgal,1966) were recorded to be susceptible with such virus. Tinson and Deema(1965) found that ninety-three wheat - corn varieties were susceptible to MBMV infection. Furthermore, Arundinaria Sp., Andropogon scoparius, Eragrostis trichodes, and Sorghastrum nutas (Williams and Alexander,1965); Bromus tectorum, Muhlenbergia schreberi, polytoca macrophylla, and Tripsaueum floridanum (Bancroft et al., 1966); Echinochloa frumentaceum, Panicum antidotale, P. decompositum, P.miliaceum, P.ramosum, setaria sphaceleta, S. verticillata, Tricholaena monachna , and Tripsaueum doctyloides

(Sehgal, 1966); *Arundo donax* (Signoret, 1971) were susceptible to HDHV virus strains. Louie and Knoke (1975) recorded that four new strains of HDHV were isolated from corn in southern Ohio and designated as strains C, D, E and F. They were distinguished from each other by:

i) Characteristic symptoms on corn inbred H 20, and
ii) differential host response in corn inbreds CCl, C144, Ky61: 2335, Ky 61:2500, M 14, H 018 W, Nb3, Oh 41, Oh 14, and Va 35. Tosic and Ford (1972) recorded that many new hosts were susceptible with sugarcane mosaic virus (SCHV) and HDHV. The hosts set for separating SCHV from HDMV-A and HDHV-B were Muhlenbergia frondosa, H. racemosa, Sorghum alnum, S. halepense, Sporobolus polirekii, Paspalum dilatatum, Stipa sparsa, Bromus rubens, and Heterontherium piliferum. Rosenkranz (1980) found that Eragrostis oxylepis, Sporobolus poliretii, and Tridens flavus were susceptible to HDHV-A and HDHV-B infection but immune with SCHV-B infection.

On the other hand, Paspalum ciliatifolium, and P. floridanum were susceptible to HDHV-A and SCHV-B but immune with HDHV-B infection, Leptochloa univervia, and Sorghum halepense were only susceptible with HDHV-A infection. Singh (1980) found that HDHV-B produce characteristic symptoms in sweet corn, dent corn and sorghum but not in oat, barley and wheat. Rosenkranz (1983) reported that 13 grass families contained 72 hosts and 34 nonhost species

of MDMV-A , MDMV-B , and SCMV-B. : Sixty -eight from 79 host Species were new hosts which were divided into 63 species susceptible to MDMV-A, 47 species susceptible to MDMV -B ; 45 species susceptible to SCMV-B and 40 species were susceptible to all the three strains.

III-Transmission:

a) Aphid transmission:

Maize dwarf mosaic virus (MDMA) was transmitted by Rhopalosiphum maidis (Dale,1965 ; Sehgal,1966 ; Bergquist and Ishii,1974 ; Thongmeoarkom et al., 1976 ; and Panayotou, 1980), R. Padi (Thongmeoarko et al., 1976 ; and Panayotou, 1980), Myzus persicae (Anzalone and Pirone , 1964, Messieha, 1967; and Thongmeoarkom et al., 1976); and Aphis gossypii (Messieha,1967).

Other aphids were reported as vectors for MDMV such as Schizaphis graminum (Daniels and Toler, 1969; Forstor et al.,1980; and Berger et al., 1983).

b) Seed transmission:

MDMV was not transmitted by the corn (Bancroft, et al.,1966 and Sehgal,1966) and Sorghum Seeds (Bancroft, et al.,1966). However, Williams et al., 1968) observed very low percentage of seed transmission (6.7×10^{-5}) in Seeds resulted from MDMV-infected corn plants.