

A survey on some maize viruses and control measures using cultural practices

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Abstract

Maize is the most important cereal food crop. It is subjected to infection with many viruses. A survey on viruses affecting maize was conducted in El-Monfia, Kafr-El-Sheikh, Al Ismailia, and El-Menia Governorates in 2010 and 2011 seasons. In addition, weeds existing in maize field were also tested. Maize dwarf mosaic virus (MDMV) is the most economically significant virus infecting maize crop in Egypt. The percentage of infection differs from one location to another. MDMV was isolated from naturally infected maize plants at El-Monfia. These samples were checked for virus presence using Indirect ELISA. A number of cultural practices were evaluated as control measures against MDMV to minimize the virus infection in maize crop.

Introduction

Maize (*Zea mays* L.) is one of the major cereal crops, and it is one of the important strategic cereal crops in Egypt. Chiykowski (1981) detected indicated about 52 virus or virus-like diseases of maize that are transmitted by aphids or leafhoppers have been recorded world wide. Thottappilly et al. (1993) pointed out the endemic nature of some viral diseases of maize as one of the major factors responsible for low production in many countries. Abou-Zeid (1975) isolated maize

dwarf mosaic virus (MDMV) from naturally infected maize plants showing dwarf and mosaic symptoms at Giza Agricultural Experiment Station using mechanical and insect transmission, MDMV is one of the most economically important virus diseases in maize. Ammar *et al.* (1982) found symptoms like maize streak virus (MSV) on maize plants adjacent to sugarcane fields in Upper Egypt during 1975, Ammar (1983) identified maize streak virus (MSV) by serological studies, electron microscopy and transmission of

the virus using leafhopper. Aboul-Ata (1983) and Ammar *et al.*(1984) recorded the maize yellow stripe virus (MYSV) in Egypt in maize plants, Also Cucumber mosaic virus (CMV) infected maize plants (Anonymous, 2003)was also recorded .

MATERIALS AND METHODS

I- Field survey:

Field survey of Maize (*Zea mays* L.) viruses was carried out in two successive seasons (2010 and 2011). Maize plants growing at Shebin EL-Kom El-Monfia, El Hamoul Kafr-El-Sheikh, Al Qantara Shark Ismailia, and Malawi El-Menia Governorates were tested. Two hundred maize leaf samples were collected from each Governorate and indexed by Indirect ELISA (Hobbs *et al.*, 1987) against MDMV, MSV, MYSV and CMV. In addition, weeds samples existed in maize fields, viz. *Cyperaceae cyperus*, *Cynodon dactylon*, and *Echinochoa colonum*, were also tested. Data were recorded as Abd-El-Raouf and Belal (1978).

II-Isolation of MDMV:

Samples which reacted positively were separated and used for virus source. The virus in relatively pure form. Single local lesion technique (Kuhn, 1964) was

carried out to obtain using the local lesion host.

III- Effect of some cultural practices on MDMVas control measures:

One experiment was conducted at Al Qantara Shark Ismailia, in 2011 growing season using maize cv. Giza 123 under natural infection. A split plot design with three replicates was used, every replicate contained four whole plots. Giza 123 maize seeds were cultivated in four sowing dates (May15, June1, July20 and August10) and were distributed at random in the whole plots. Each whole plot comprised 8 ridges 65cm in between and three meters long. Seeds were planted on both sides of the ridge in double seed/ hills 15cm apart (about 33plants/sequare meter). All treatments (rouging and without rouging and spraying and without spraying with insecticide (sumithion 50% EC) were randomized in subplots. All replicates reserved care as regards cultivation manuring fertilization and irrigation

Results and Discussion

I-Field survey:

Indirect ELISA is the most commonly used immunological technique in plant virology. The accuracy of ELISA makes this

assay suitable for quantitative measurement for instance, determine virus concentration and the degree of relatedness between viruses. Field survey of maize viruses were carried out by collecting two hundred leaf samples randomly from maize plants (cv, Giza 123) growing at Shebin EL-Kom El-Monfia, El Hamoul Kafr-El-Sheikh, Al

Qantara Shark Ismailia, and Malawi El-Menia Governorate, in two successive seasons 2010 and 2011. All samples collected from different location were analyzed through indirect ELISA to detect the important maize viruses (MDMV, MSV, MYSV and CMV) . Obtained results were shown in Table. (1 & 2).

Table (1). Natural infection of Maize plants with different viruses as indexed by

Governorate	No.of tested samples	MDMV		MSV		MYSV		CMV		%Total infection
		No.*	%	No.*	%	No.*	%	No.*	%	
Shebin EL-Kom El-Monfia	200	38	19	11	5.5	25	12.5	16	8	45
El Hamoul Kafr-El-Sheikh	200	20	10	5	2.5	19	8.5	14	7	28
Al Qantara Shark Ismailia	200	9	4.5	0	0	4	2	9	4.5	11
Malawi El-Menia	200	36	18	8	4	29	14.5	22	11	47.5

ELISA test (2010).

Table (2). Natural infection of Maize plants with different viruses as indexed by ELISA test (2011).

Governorate	No.of tested samples	MDMV		MSV		MYSV		CMV		% Total infection
		No.*	%	No.*	%	No.*	%	No.*	%	
Shebin EL-Kom El-Monfia	200	45	22.5	10	5	29	14.5	22	11	53
El Hamoul Kafr-El-Sheikh	200	22	11	9	4.5	20	10	24	12	37.5
Al Qantara Shark Ismailia	200	9	4.5	0	0	11	5.5	15	7.5	17.5
Malawi El-Menia	200	44	22	6	3	48	24	36	18	69

No.*= Number of infected plants

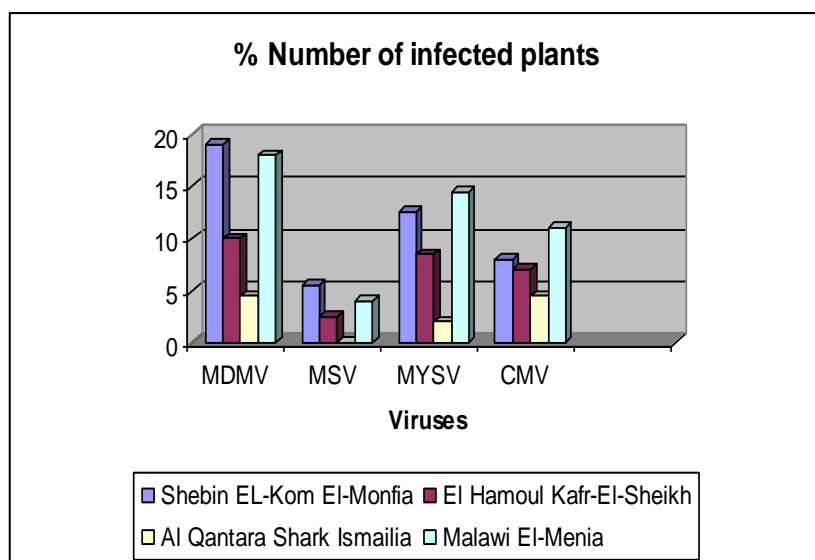


Fig. (1): Percentage of natural infection of maize plants with different viruses as indexed by ELISA test in four Governorates at season 2010.

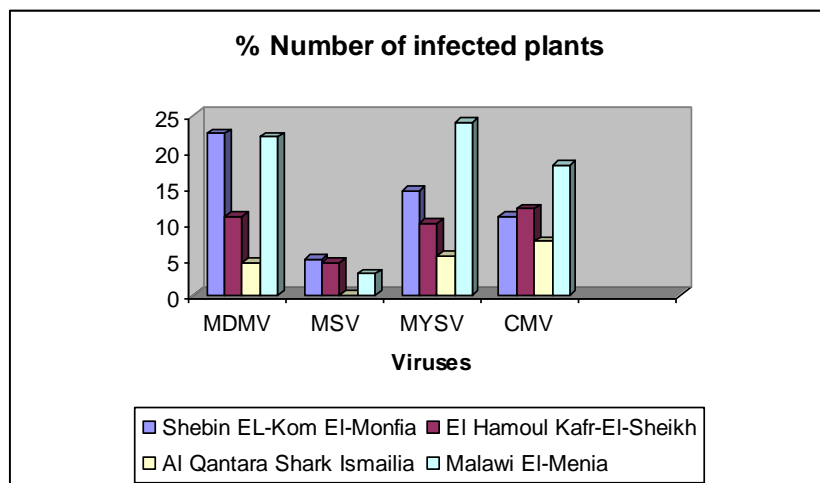


Fig. (2). Percentage of natural infection of maize plants with different viruses as indexed by ELISA test in four Governorates at season 2011.

Table (3). Natural infection of weed plants with different viruses as indexed by ELISA test in the four Governorates (2010).

Weeds.	MDMV	MSV	MYSV	CMV
<i>Cyperaceae cyperus</i>	-	-	-	+
<i>Cynodon dactylon</i>	+	+	+	+
<i>Echinochoa colonum</i>	-	-	-	+

Table (4). Natural infection of weed plants with different viruses as indexed by ELISA test in the four Governorates (2011).

Weeds.	MDMV	MSV	MYSV	CMV
<i>Cyperaceae cyperus</i>	+	-	+	+
<i>Cynodon dactylon</i>	+	+	+	+
<i>Echinochoa colonum</i>	-	-	-	+



Fig.(3): Symptoms of MDMV on maize plants show mosaic and dwarfing symptoms.

Data in Table (1) and Fig. (1) revealed that in season 2010:

Results obtained from Shebin EL-Kom El-Monfia Governorate, indicated that 19% were infected with MDMV, 5.5% with MSV, 12.5% with MYSV and 8% with CMV, The total percentage of viruses' infection reached 45%. As for El Hamoul Kafr-El-Sheikh Governorate, 10% were infected with MDMV, 2.5% with MSV, 8.5% with MYSV, and 7% with CMV. The total percentage of viruses' infection reached 28 %. While in the case of Al Qantara Shark Ismailia Governorate, among 200 tested maize plants 21 (4.5%) were infected with MDMV, 2% with MYSV, and 4.5% with CMV, while neither MSV was detected. The total percentage of viruses' infection reached 11%. As regards,

Malawi El-Menia Governorate, 18% were infected with MDMV, 4% with MSV, 14.5% with MYSV, and 11% with CMV. The total percentage of viruses' infection reached 47.5%.

Natural infection of weed plants with different viruses as indexed by ELISA test in the four Governorates 2010. *Cyperaceae cyperu* plantss were infected only with infected CMV. As for

Cynodon dactylon was infected with MDMV, MSV, MYSV and CMV. Concerning *Echinochoa colonum* plants were infected only with CMV.

On the other hand *Cynodon dactylon* plants were infected with the four viruses (Table 3).

Data in Table (2) and Fig. (2) revealed that in season 2011

Results obtained from Shebin EL-Kom El-Monfia Governorate, indicated 22.5% were infected with MDMV, 5% with MSV, 14.5% with MYSV and 11% with CMV, The total percentage of viruses' infection reached 53%. As for El Hamoul Kafr-El-Sheikh Governorate, among 200 tested maize plants 11% were infected with MDMV, 4.5% with MSV, 10% with MYSV, and 12% with CMV. The total percentage of viruses' infection reached 37.5 %. While in the case of Al Qantara Shark Ismailia Governorate, 4.5% were infected with MDMV, 5.5% with MYSV, and 7.5% with CMV, while MSV was not detected in any plants. The total percentage of viruses' infection reached (17.5%).

As regards, Malawi El-Menia Governorate, 22% were infected with MDMV, 3% with MSV, 24% with MYSV, and 18%

with CMV. The total percentage of viruses' infection reached 69%.

Natural infection of weed plants with different viruses as indexed by ELISA test all Governorates (2011). tested *Cyperaceae cyperus* plants were infected with MDMV, MYSV and CMV, while MSV was not detected in any weed plants. As for *Cynodon dactylon* plants were infected with MDMV, MSV, MYSV and CMV. Concerning *Echinochoa colonum* were infected with infected CMV, while MDMV, MSV and MYSV were not detected (Table 4).

II: Effect of some cultural practies as control measures

Results demonstrated in Table (5) revealed a wide variation of the virus incidence among maize treatments in the four planting dates.

By using rouging and primer insecticide spray, the perecentage of virus incidence was lower in the 1st (May15). 2nd (June1) , 3rd (July20) and planting date (2, 7 and 12% respectively) compared with the other treatments.

In treatments with out rouging & without spraying the percentage of virus incidence was very higher (10, 14, 25 and 38%). in the four planting dates.

Results showed also that in primer spray treatments without using rouging. The virus incidence

was 5, 7, 12 and 17% in 1st, 2nd, 3rd and 4th planting dates respectively.

Moreover the virus incidence was 7% and 12% in the 1st and 2nd planting date with rouging and without spraying treatment, whereas it was 17 and 28% in 3rd and 4th planting date, respectively.

The best time to sow will depend on the time of migration of the vector, if it migrates early. Late sowing may be advisable, if it is a late migration. Early sowing may allow the plants to become quite large before they are infected. For any particular crop. The effectiveness of changed planting or harvesting dates in minimize virus infection has to be considered in relation to other economic factors ... Thus in May15 with using rouging and spraying the virus incidence was reduced to 2% compared with the other planting dates and treatments . Sometimes it may be worthwhile to remove infected plants from a crop. If the spread is occurring rapidly from sources outside the crop, rouging the crop will have no beneficial effect. If the virus spread is relatively slow and mainly from within the crop, then rouging may be worthwhile, especially early in theseason (Matthews, 1991) . Annual and perennial forage cereal, weeds reservoir and over withering hosts of MDMV affecting maize plantings.

Table (5): Effect of some cultural practices as control measures

Control measures			No. of inf.pl No. of healt. pl	Infection%
Sowing date	Rouging	Primor Insecticide spray		
May15	+	+	2/100	2
	-	+	5/100	5
	+	-	7/100	7
	-	-	10/100	10
June1	+	+	7/100	7
	-	+	9/100	9
	+	-	12/100	12
	-	-	14/100	14
July20	+	+	12/100	12
	-	+	13/100	13
	+	-	17/100	17
	-	-	25/100	25
August10	+	+	17/100	17
	-	+	23/100	23
	+	-	28/100	28
	-	-	38/100	38

+ = with rouging or with spraying.

- = with rouging or without spraying.

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