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MANAGEMENT OF YELLOW MOSAIC VIRUS FOR ZYMV ZUCCHINI USING PLANT BARRIERS

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Abstract

Zucchini yellow mosaic virus (ZYMV) returns to the genus *Potyvirus* of the *Potyviridae* species. The plant Glob Amaranth (*Gomphrena globosa*) given topical spots where these patches adopted as a source of isolated virus isolation on pumpkin plants, others respond to the appearance of systemic symptoms and Including pumpkin and cucumber. The *Myzus persicae Sulz* insect also carried out the insect transport. The plants reacted with their medium and the pumpkin plants showed a response to the appearance of systemic symptoms represented by the appearance of mosaics and the formation of veins and the appearance of blisters on the leaves. For the purpose of virus resistance or reduction of infection, several methods used in the ZYMV disease management program through a field experiment in autumn 2017 agricultural season. The experiment repeated in 2018 and 2 planting dates used, as well as two planting spaces (30, 35 cm). used of plants resistance to infection *Vicia faba* and *Zea mays*. By using the RCBD design the average number of insect pests in experimental plants and the average percentage of disease were calculated. The results of the diagnosis showed that the virus subject of the experiment often referred to as ZYMV. The second planting date was more likely to be infects with the virus than the first date. The results also indicated that the distances of agriculture (35) cm better than 30cm if it used. The use of plant barriers (*Vicia faba*, and *Zea mays*) has given a significant indicator of the delayed entry of *Myzus persicae Sulz* insects. To the plant field and delay the incidence of infection ZYMV, where the results indicated the positive use of plant barriers to the preparation of insects and its reflection on the incidence rates and the timing of occurrence. The first barrier consisted of Broad Bean plants on the second barrier *Zea mays* in the management and control of ZYMV.

Key words : ZYMV, Plant Barriers, Disease Management.

Introduction

Cucurbita pepo L. one of the important vegetable crops to the *cucurbitaceae* family, is grown in different regions of the world, including Iraq. Its average production per hectare for 2012 is 2066.4 tons (Central Bureau of Statistics 2012). The importance of pumpkin for the use of food for humans and its uses in the medical fields (Al-Musli, 2007). Its original home is Central and North America (Dilson, 2002). There are more than 32 viruses infected the family of the *cucurbitaceae*, including pumpkin, which is the main cause of low productivity (Matthwes, 2002) Zucchini Yellow Mosaic Virus (ZYMV) is one of the most important viruses infecting the plant and causes great economic losses (Lecoq *et al.,* 2003; Agrios, 2005; Bananej *et al.,* 2008).

ZYMV is one of the most common species of *Potyviridae* in the world, which reduces the yield of crops (Fletcher *et al.,* 2000); Alhudaib and El-Mazaly, 2000; Younes, 2003). This virus like the rest of the viruses has several methods that depend on its diagnosis, including the study of the symptoms that appear on the detector plants and is one of the basic methods for diagnosing most viruses (Matthwes, 2002; Gally, 2006). The plants *Gomphrena globosa* L. and *Chenopodium amaranticolor Cost & Reyn* from the plants that used to diagnosing the virus, while the yellow maize plant was not responding to the virus (Kassem and Al-Baydani, 2010), and accurate methods must be adopted in the diagnosis of these viruses, such as serological methods Transport modes and virus stability In the cell plasma (Sherif, 2012). ZYMV found to mediate by *Myzuse persicae Sulz* in a non-existent way (Kassem and Al-Baydani, 2010).

The resistance of viral diseases is more complicated

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and difficult than other plant diseases caused by other pathogens, because of the absence of special pesticides that affect these viruses, and not affect the cells of the infected plant, for reducing the incidence of viruses, there have been several attempts and transactions. In addition, most of which have focused on insect resistance and control using chemical pesticides and some mineral oils. Others have resorted to the use of reflective metal chips, use of agricultural and chemical applications combined (Mansour *et al.,* 2000; Yunus, 2000; Makkouk and Kumari, 2001; Bayati *et al.,* 2012). while Mendo *et al.* (2011) used some kinds and varieties of zucchini and yellow melon to reduce the impact of the virus, also some studies indicated the use of plant barriers impregnable and non-sensitive to viruses (Nameth, 2002; Bayati *et al.,* 2010, Al Bayati, 2018). Insecticides are thought to lose their viral load when they are transferred to field crops when they collide with plant barriers surrounding crops (Paysad and Kudada, 2005) and from this idea of this study came to manage ZYMV disease using plant barriers.

Materials and Methods

The study carried out in the Khanaqin area in Diyala governorate for the autumn season of 2017. The experiment was repeated in 2018, and on two dates for planting (10/7 and 20/7 each year), the crops were grown broad been (*Vicia faba* L.) Maize (*Zea mays*) as a buffer crop and at the level of two parallel lines between 40 cm surrounded by the main plant (the target of the study) pumpkin gourd, before planting the seeds of pumpkin by 7 days and use the design of random segments (Random Complete Block Design) RBCD (Aziz, 1980). In the planning of the land of the experiment after we had good tillage and settlement, the land of the experiment divided into three replicates, and each one contains 30-experiment unit and it consisted of 13 experimental units, 13 plants for planting distance of 30 and 35 cm for two seasons of the agricultural year. The area of the experimental unit was 7 × 3 m, leaving a distance of 50 cm between the replicates to serve the crop. Chemical fertilizers used as recommended. The land planted with ZYMV in 2 parallel lines, 75 cm in diameter, in the experimental area and at a distance of 5 m for 10 days before planting the seeds of cucumber grouse.

Diagnosis of the virus / study of symptoms on the plants of the detection of the virus

The source of the first vaccine

The collection of leaves from the plants of kosa kernels, showing the symptoms of a viral infection was the emergence of mosaics and packing of veins with the presence of pustules on the phenomenon of leaves. as well as deformation and yellowing from different areas of Khanaqin, for the spring season 2017, The nylon was taught and the samples were kept frozen until they were used.

Preparation vaccine and making infection

A total of 1.362 g/L KH_2PO_4 and 1.42 g/L of NA_2HPO_4 mixed with 49 cm 3 and 51 cm 3 respectively. The solution, with a concentration of 0.02 m and pH = 7.2 (El-Mazaty and Abdudaib, 2000). The succulent vaccine was attended by taking 1g of preserved gourd leaves, which showed the symptoms of viral infection and was crushed by adding 4 ml of the phosphate solution prepared above, Extracted through two layers of sterile mulch. Wiped out with zucchini and other test plants, the leaves then sprayed with distilled water after 1-2 minutes, leaving intact plants to compare (Al Ani *et al.,* 2011). The spots that appeared on the rose plant and was extracted from the gastric juice for the purpose of repeated infection of the plant ward code to obtain the isolation as far as possible, and saved on the plants of percussion, which was later approved in the mechanical vaccination of some plants for the virus ZYMV. After planting seeds within 10 cm pots described in table1, As well as the formation of pumper percussion plants For the purpose of infection and transmission to the land of experience and adoption of sources of the virus in the field of experience. Rates of infection calculated according to the dates of agriculture and its distances, taking into account the presence of barriers plant.

Table 1: Showing the names of the plants used to test and diagnose the virus ZYMV.

Scientific Name	Common Name	No.
Vicia faba L.	Broad Bean	1
Cucumis melo L.	Cantaloupe	2
Vigna sinensis	Cowpea	3
Luffa acutangula	Loofa	4
Chenopodium amaranticolor	Pigweed	5
Malva rotundifolia	Malva	6
Cucumis sativus	Cucumber	7
Cucurbita pepo	Squash	8
Nicotiana tabacum cv.	Tobacco	9
Zea mays	Yellow corn-Maiz	10
Gomphrena globosa L.	Glob amaranth	11

Infection by *Myzus*

The plants were taken and found on the insect *Myzus persicae Sulz* From one of the fields near the ground of the experiment, and placed in a pot diameter of 20 cm, and placed inside a cage covered with a cloth and boredom and transferred insects to the plants Kusa planted newly to make sure they are free from the virus and left for breeding. Any symptoms of gourd infection during the period of the presence of pests of insects, after more than two weeks, took members of the insects and placed inside Petri dishes containing wet paper wet and left for 1 hour to starve, and then taken individuals by a soft brush to pumpkin plants Infected with ZYMV, which showed positive interaction in the ELISA test, left the insects fpr 1-2 minutes for feeding. The insecticide killed with an insecticide and the plants were incubated under the conditions of a plastic house at a temperature of 20-25^{0}C. The plants were fertilized with NPK (Agrios, 2005; Kassem and Al-Baydani, 2010).

Eliza test

Enzyme Linked Immunosorbent Assay (ELISA) been used to detect the ZYMV in plant samples taken from different locations.

Results and Discussion

Virus diagnosis

Phenomenon on the plants

From table 2 to determine whether the virus is infected with virus infection or not, after it has been vaccinated with the selected virus extract from the spot of the ZyMV *Gomphrena globosa*, some indicate that the virus is ZYMV, where systemic and systemic symptoms are clear As pointed out by the researcher shuttle and others, 2008.

Transportation by *Myzus*

The plants which infected by the virus, showed systemic symptoms, such as the appearance of mosaics, the formation of veins, and the appearance of blister lesions on leaves. These results coincided with the findings of Jarjis and Nizar (2014).

Table 2: Results of the mechanical pollination test with ZYMV vaccine for test plants.

Symptoms	Scientific Name	Common Name	No.
NR	*Vicia faba L.*	Broad Bean	1
S S	*Cucumis melo L.*	Cantaloupe	2
N R	*Vigna sinensis*	Cowpea	3
S S	*Luffa acutangula*	Dishcloth gouard	4
LLY	*Chenopodium amaranticolor*	Pigweed	5
N R	*Malva rotundifolia*	Malva	6
S S	*Cucumis sativus*	Cucumber	7
S S	*Cucurbita pepo*	Squash	8
N R	*Nicotiana tabacum cv. Turkish*	Tobacco	9
N R	*Zea mays*	Yellow corn-Maiz	10
L L	*Gomphrena globosa L.*	Glob amaranth	11

N R –No Reaction, S S- Systemic Symptoms .L LY – Local Lesion Yellow

Detection of the virus using Eliza technology

The results of the ELISA test for plant samples taken from the experimental field of spring and autumn season, which showed the symptoms of a viral infection, showed positive interaction with the yellow mosaic vaccine on ZYMV. Eliza refers to the presence of the virus in question, and no interaction shown during the excavation of the Aliza dish in the samples taken from the samples of healthy percussion plants.

Read insect numbers

By reviewing table 3 for the average numbers of the insects *Myzuse persicae Sulz*, which is located on the plants of pumpkin Kossa experience during the autumn of 2017. It is estimated that zero infection happen, until the fourth week after germination in the plants of both plants and both areas of agriculture, while The average number of insect pests in the comparison treatment for both dates and both distances was 13, 14 and 12, 15 respectively, during the fourth week of the autumn planting season of 2017 and the increase in the average number of insects followed by the multiplication in the control throughout the agricultural season. The existence of the barriers of surrounding plants experience has stopped the entry of aphids and is loaded with ZYMV being the subject of the experiment (insect) has emptied its charge in the containment of viral plants, which are not responding to infection of ZYMV and may be entered into the experiment plants without a vicious viral.

Table 4 showed the average number of *Myzuse persicae Sulz*. insects present on the Kossa pumpkin plant during the autumn season of 2018. Where the average of these numbers was zero until the third week, after germination in the plants of the buffer of both distances and both groups of agriculture, while the average numbers of insects in the comparative treatment of both dates and both distances amounted to 10, 11 and 12.12 during the third week Of the autumn planting season of 2018, and the increase in the average number of insects followed by the fold in the comparison treatment throughout the agricultural season, which enables us to say that the presence of plant barriers surrounding the plants of the experiment has impeded the entry of the insects and the virus is infected with the virus ZYMV) Has discharged its viral load in the plants that are immune and are not sensitive to the virus and may be entering the plants of the experiment and is free of viral

Table 3: Average weekly readings of the number of insects *Myzuse persicae Sulz*. In the trial transactions during the fall of 2017.

Average number of insects per week on pumpkin plants									Treatments
Days									
63	56	48	42	35	28	21	14	7	
9	7	6	5	2	0	0	0	0	$T_1D_1B_1I$
12	10	8	6	1	0	0	0	0	$T_1D_2B_1I$
8	7	5	3	1	0	0	0	0	$T_1D_1B_2I$
10	8	7	6	1	0	0	0	0	$T_1D_2B_2I$
57	44	34	28	22	13	6	1	0	T_1D_1I
59	37	35	29	23	14	7	2	0	T_1D_2I
7	6	5	4	1	0	0	0	0	$T_2D_1B_1I$
11	8	7	4	1	0	0	0	0	$T_2D_2B_1I$
8	7	5	4	1	0	0	0	0	$T_2D_1B_2I$
12	8	8	5	1	0	0	0	0	$T_2D_2B_2I$
48	32	28	22	16	12	5	2	0	T_2D_1I
56	38	31	25	19	15	5	2	0	T_2D_2I

T- Time $_{1,2}$, D- Distance $_{1,2}$ B- Barriers $_{\text{Broad Bean, Maze,}}$ C – Control $_{1,2}$, I- Insect.

Table 4: Average weekly of insects number of *Myzuse persicae Sulz.* In the treatments during the autumn of 2018.

Average number of insects per week on pumpkin plants									Treatments
Days									
63	56	48	42	35	28	21	14	7	
11	8	6	5	2	1	0	0	0	$T_1D_1B_1I$
13	10	7	5	4	2	0	0	0	$T_1D_2B_1I$
12	8	7	4	2	1	0	0	0	$T_1D_1B_2I$
18	11	8	6	4	3	0	0	0	$T_1D_2B_2I$
43	30	24	19	17	10	5	2	0	T_1D_1I
47	35	28	21	14	11	7	4	0	T_1D_2I
12	9	6	5	4	2	0	0	0	$T_2D_1B_1I$
17	12	7	6	4	4	0	0	0	$T_2D_2B_1I$
14	10	9	5	4	2	0	0	0	$T_2D_1B_2I$
19	13	10	6	5	4	0	0	0	$T_2D_2B_2I$
45	37	27	22	16	12	7	4	0	T_2D_1I
49	40	30	24	18	12	7	5	0	T_2D_2I

T- Time $_{1,2}$, D- Distance $_{1,2}$ B- Barriers -$_{\text{Broad Bean, Maze,}}$ C – Control $_{1,2}$, I- Insect.

shipments.

Read the proportions of the virus

By calculating the average number of Kousa squash plants planted in the experimental area in Khanaqin region in the autumn season of 2017, which showed the symptoms of viral infection represented by the appearance of mosaics and dwarfing and deformation of the leaves, table 5 shows the averages of the treatments using two dates for planting and two types of (35 cm) between the jaws had a clear effect in reducing the rate of infection at the time of the first planting, and the figures indicate the distinction of the treatment of the first plant barrier (broad) on the plant (Yellow corn) in the protection of pumpkin plants surrounded by plants. At the same time, we note that both treatments of the two plants were characterized by the lowest rates of infection in the virus when compared with the treatment of comparison (without a barrier plant), indicating that both plants have contributed To reduce the incidence of infection or prevented from transmission from outside the field to the inside through the seizure of the insects of the carrier of the virus, and therefore reflected the delay of infection more than four weeks from the start of germination, gave positive results on the rates of infection and productivity of the plant itself.

Also, we find that it is almost similar during the second agricultural year (2018), where we find that the plants pump infected at the time of the first cultivation was less than the number of squash plants infected and planted with the second date, and the same when we find that the treatment of the distance of agriculture first (30) (5 cm). The treatment of the first barrier plant (whole) on the treatment of the second barrier plant (maize) in the average number of plants infected with the virus under study, We also find the date of injury or response of the incidence of injury in the treatment of inhibitory plants has been significantly delayed when compared with the treatment of comparison in the occurrence of infection or its response to the disease and the time difference of the onset of the disease has many indications and is very important in reducing the incidence and incidence, delaying the incidence of injury for more than four weeks May be reflected in the future on the productivity of the plant itself by delaying the occurrence of the disease and the lack of the proportion of the disease, the reasons may delay the occurrence of viral infection in the treatment of plants in the control of the experiment because of the role of these plants by holding the insects carrying the virus and before moving viral into the experiment field and fed on plants pumpkin.

Conclusions and Recommendations

1. The results of the tests (mechanical pollination and transport by insects and the Eliza test) to detect the pathogenic virus showed that the virus studied is mostly ZYMV.

Table 5: Average ZYMV infection rates by date of planting and their presence with the vegetative barrier of 2017 - autumn season.

Percentages taken after germination during the week									**Treatments**
Days									
11	10	9	8	7	6	5	4	3	
5	3	3	2	2	0	0	0	0	$T_1D_1B_1$
9	6	5	4	3	0	0	0	0	T_1 D1B_2
10	4	4	4	3	0	0	0	0	$T_1 D_2 B_1$
7	6	6	6	5	0	0	0	0	$T_1 D_2 B_2$
28	22	18	14	11	7	4	2	0	T_1 C_1D_1 compared1
28	20	17	15	11	7	5	3	0	T_1 C_1 D_2compared1
3	3	2	2	1	0	0	0	0	T_2 D_1 B_1
7	7	5	5	2	0	0	0	0	$T_2 D_1 B_2$
5	4	3	2	1	0	0	0	0	$T_2 D_2 B_1$
8	5	4	4	3	0	0	0	0	$T_2 D_2 B_2$
32	22	18	13	11	8	6	4	2	$T_2 C_2 D_1$Compared2
21	21	17	13	13	10	8	5	2	$T_2 C_2 D_2$Compared2

T- Time $_{1,2}$, D- Distance $_{1,2}$ B- Barriers $_{\text{Broad Bean , Maze ,}}$ C – Control $_{1,2}$

Table 6: Mean ZYMV infection rates by planting date and their presence with plant barrier of 2018 - autumn season.

Percentages taken after germination during the week									**Treatments**
Days									
11	10	9	8	7	6	5	4	3	
7	4	3	2	1	0	0	0	0	$T_1D_1B_1$
8	7	5	4	3	0	0	0	0	T_1 D1B_2
6	4	3	3	0	0	0	0	0	$T_1 D_2 B_1$
7	7	5	4	3	0	0	0	0	$T_1 D_2 B_2$
26	22	18	15	10	7	4	2	0	T_1 C_1D_1 compared1
28	21	18	16	12	7	5	3	0	T_1 C_1 D_2compared1
3	3	2	1	0	0	0	0	0	T_2 D_1 B_1
7	8	7	5	2	0	0	0	0	$T_2 D_1 B_2$
5	4	4	3	0	0	0	0	0	$T_2 D_2 B_1$
8	8	6	4	3	0	0	0	0	$T_2 D_2 B_2$
32	22	19	15	9	8	6	4	0	$T_2 C_2 D_1$Compared2
37	22	17	13	14	10	8	5	2	$T_2 C_2 D_2$Compared2

T- Time $_{1,2}$, D- Distance $_{1,2}$ B- Barriers $_{\text{Broad Bean , Maze ,}}$ C – Control $_{1,2}$

2. Using the dates of cultivation and different distances of agriculture gave an indication of the possibility of reducing the infection that emerged during early farming and our use of the second distance (35) cm.
3. The use of plant barriers has reduced the possibility of the entry of HIV-carrying insects into the Kusa-induced field and was the cause of delayed viral infection when compared to the comparison treatment (without plant barriers).
4. Decreased average numbers of insect-carrying insects in the Kusa-infected field reduced the mean viral infection rates when compared with comparable plants.
5. We recommend using ZYMV-resistant plant barriers to delay injury and reduce the risk of infection.

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