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STUDIES ON SUGAR BEET MOSAIC VIRUS ISOLATED FROM BENI-SWEIF REGION, THEIR TRANSMITTING APHIDS AND CHEMICAL COMPOSITION OF SUGAR BEET ROOTS

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ABSTRACT

A field experiments were carried out in Beni-Sweif region during 2004/2005 and 2005/2006 seasons to detect aphid species and population density throughout two plantation dates on eight sugar beet varieties, in addition to their susceptibility to beet mosaic virus infection. All varieties were infested with two species of aphid; *Myzus persicae* and *Aphis fabae*. The later insect was more abundant than *M. persicae*. The results assert that aphids have capability to attack all sugar beet varieties. Oscar and Pleno varieties were the highest resistant varieties while Gazelle and Gloria were the highest susceptible varieties for BtMV infection. The infected plants with both aphids and BtMV showed a reduction of root weight percentage ranged from 41.1 to 54.0%

A virus was isolated from sugar beet (*Beta vulgaris* L.) and was identified according to symptomatology, host range, physical properties, modes of transmission, ELISA, and hybridization test. Isolate of beet mosaic virus (BtMV) has visible symptoms on some hosts. Physical properties of the virus were, dilution end point 10-3, thermal inactivation point 55-60 C and lost infectivity after 2 days. The virus was mechanically transmitted as well as *Myzus persicae* insect. ELISA and non-radioactive molecular hybridization methods can be used for the detection of virus. Physiological effects of BtMV on sugar beet plants were studied. Infected plants showed more reduction in total sugars, reducing sugars, non reducing sugars, total carbohydrates, total free amino acids than healthy ones. On the other hand, phenol content was more high in the infected plants than healthy ones.

Key words: Beet mosaic virus, identification, ELISA, hybridization and insects.

INTRODUCTION

Sugar beet (*Beta vulgaris* var. *saccharifera*) is an important crop cultivated in large area in lower and middle Egypt, and is considered a new sugar crop in Egypt because of the insufficient cane sugar for the Egyptian consumers. This crop infested with many insect pests especially aphids which not only pierce plant tissues and suck plant juice but also transmit many virus diseases. The main aphid species attacking

sugar beet include *Myzus persicae* (Sulzer) and *Aphis fabae* Scop. These two aphid species are widespread in UK., Germany, Italy, Belgium, Hungary, U.S.A. and Iran (Geza *et al.* 1999, Haylock and Dewar, 2002 and Irbab and Laanen 2005): Of aphid transmitted viruses; Beet mosaic potyvirus (BtMV) which has been reported to occur in many regions where beet crop is grown (Polak, 1981; Yuan and Qiu,1991; Juretic,1998; Dusi, 1999; Mali *et al,* 2000; Piszczek, 2000; Choueiri *et al.* 2001 and Wintermantel, 2005). Virus was also recorded to infect beet plants in Egypt (Abdel-Ghaffar *et al.* 2003). The virus belongs to the genus potyvirus and infects a number of plant species causing a variety of symptoms.

Initial symptoms of BtMV infection are, numerous small yellow spots on one or several central leaves. A light mosaic occurs on young leaves as disease develops. Leaflets with initial symptoms are stunted, with curling and rolling of leaf margins and leaf tip necrosis. In severe cases, diseased leaves roll into a tubular shape.

The present study was designed to:

a. Throw the light on the population densities and species of aphids and associated viruses on different sugar beet varieties to determine susceptibility of the these varieties to aphid infestation and associated viruses and their effect on the yield loss of root weight.
b. Isolation and identification the causal virus of beet mosaic disease.
c. Studying the changes in the chemical constituents, especially sugar contents, of beet sugar roots due to BtMV infection.

MATERIALS AND METHODS

A: Sugar beet varieties under study:

Eight sugar beet varieties (Gazelle, Gloria, Oscar poly, Pleno, Farida, Top, Dema poly and Lola) were planted in Beni-Swief region in private fields during 2004/2005 and 2005/2006 seasons. Seeds of these varieties were sown in two plantation dates in mid September and mid October. The experimental area for each variety was 1/4 Fadden. The experimental field received the normal agricultural treatments and no insecticides were used.

Three months after emergence a random sample of 100 leaves from each variety were collected within 15 days intervals, transferred to the laboratory and examined with hand lens to record species and numbers of aphids per plant for each variety.

B: Field virus studies:

In the previously mentioned experiment, a sample of randomly 200 stand plants were examined to record the number of virus infected plants per variety and the infected plants were flagged with red label. At harvest, a sample of 40 infected and healthy plants regardless of variety were collected and weighed to obtain the effect of virus infection on the root yield.

C: Virus isolation and identification:

Sugar beet plants showing symptoms suspected to be due to BtMV infection were collected from a private field, in Beni-Swief region. Infected samples were used to inoculate *Chenopodium quinoa* plants. The virus was maintained in *Beta vulgaris*

L. plants in greenhouse. Typical chlorotic local lesions symptom of BtMV appeared on *Chenopodium quinoa* plants were mechanically transferred onto *Beta vulgaris* L. plants. The virus was purified biologically through two consecutive passages onto the local lesion host, *Chenopodium quinoa*. Single local lesion from the resulting local lesions was mechanically transferred onto *Beta vulgaris* L. plants for virus propagation. The virus was identified on the basis of symptoms on beet plants, mode of transmission, host range, physical properties in the infectious sap, ELISA and hybridization test.

1. Transmission:

1.1. Mechanical transmission:

About 10 sugar beet plants were mechanically inoculated with BtMV and 3 plants were maintained as control without inoculation. To test the possibility of mechanical transmission of BtMV, infected beet plants collected from the field were grinding in phosphate buffer solution (pH 7.0). The extract was filtered through cheesecloth. Healthy beet seedlings were dusted with carborandum and inoculated with infectious leaf extract diluted with the phosphate buffer(1:1, v/v) as described by Rawlins and Tompkins (1936).

1.2. Insect transmission:

Myzus persicae was used to transmit BtMV from infected beet plants to healthy ones. Insects were fastened for a bout one hour in petri dishes and then given an acquisition feeding for about 10 min. on the virus infected beet plants then transferred to healthy beet plants for an inoculation feeding of about 10 min. Insects were later killed by spraying with Malathion and plants were maintained in an insect proof plastic-house. Ten aphids were used per plant and five healthy plants were also used for this experiment. The same procedure was used for the control except that virus-free aphids were used.

2. Host range:

About 130 plant species belonging to the Amaranthaceae, Chenopodiaceae, Compositae, Cruciferae, Cucurbitaceae, Fabaceae, Malvaceae and Solanaceae were inoculated with the studied BtMV isolate under green house conditions.

3. Physical properties:

Thermal inactivation point (TIP), longivity in vitro (LIV) and dilution end point (DEP) of the isolated viruses were determined as described by Noordam, (1973).

4. Enzyme linked immunosorbent assay:

Enzyme linked immunosorbent assay (ELISA) method described by Clark and Adams (1977) was used for rapid serological identification of beet mosaic virus (BtMV).

5. Hybridization:

The hybridization was carried out as described by Boehringer Mannheim, Manual Protocol. About 0.3 g leaf tissues of sugar beet plants infected with BtMV, were placed in microfuge tubes with 100 µl of extraction buffer(0.2 M potassium phosphate, 5 mM dithiothreitol, 0.1 % Triton X-100, 10

mM mercaptoethanol, pH 8.3). Then, ground tissues using knots pestles. Equal volume of denaturation solution, 1x SSC (15 mM Nacl, 15 mM sodium citrate, pH 7.0, 50 % formaldehyde) was added an heated at 60 C for 10 min. Then centrifuge in microfuge tubes at 10,000 rpm for 5 min. Dot blot hybridization was carried out according to Loebenstein *et al.* (1997).

6. Physiological tests:

All experiments were repeated twice. Four replicates were used for each treatment. Total and reducing sugars were determined according to A.O.A.C. (1995). Non reducing sugars were obtained by subtracting reducing sugars from total sugars. Total carbohydrates mg/g dry weight were determined colorimetrically according to the method described by Michel *et al.* (1956). Total free amino acids mg/g dry weight were determined colorimetrically according to the method described by Jayarman (1981). Total phenols mg/g dry weight were determined according to Snell and Snell (1953).

RESULTS AND DISCUSSION

A: Insect studies:

1. Species and population density of aphids on sugar beet:

Data shown in Table (1) revealed that sugar beet plants in Beni-Swief region infested with two species of aphids (the green peach aphid, *Myzus persicae* (Sulzer) and the black bean aphid *Aphis fabae* Scop.). The population density of *A. fabae* was higher than *M. persicae* in both seasons. In 2004/5 season it was 1.87 and 2.1 insect/leaf in mid September and mid October plantations for *A. fabae*, while were 1.21 and 1.19 insect/leaf for *M. persicae*. In 2005/6 seasons it was 2.07 and 3.14 insect/leaf in mid September and mid October plantations for *A. fabae*, while was 1.39 and 1.51 insect/leaf for *M. persicae*.

Also the percentages of infested leaves with *A. fabae* was higher than M. persicae being 5.63 and 7.25 in mid September and mid October plantations for *A. fabae* corresponding to 2.38 and 2.38 for *M. persicae* in 2004/5 season. These percentages were 5.63 and 8.25% corresponding to 3.0 and 3.5% in 2005/6 season. In general, the presence of aphids in sugar beet fields were low and the insect were not severely colonized beet plants under Beni-Swief conditions whereas the total percentage of infested leaves were 6.63 and 7.75% for mid September and mid October plantations in 2004/5 season while were 5.5 and 8.38% in 2005/6 season. In this respect. Williams *et al.* (1999) record two species of aphids colonizing sugar beet in the UK; *M. persicae* and A. fabae. M. persicae is usually less abundant on the crop than *A. fabae*. The previous aphid species were recorded in Belgium by Irbab and Laanen (2005).

2. Susceptibility of sugar beet varieties to aphid infestation:

Data in Table (1) showed that the sugar beet varieties differed in susceptibility to be infested with the two aphid species from plantation date or season to season. In 2004/5 season the tested varieties could be arranged according to their susceptibility to aphid infestation as; Gloria, Gazelle, Top, Dema poly, Farida, Pleno, Oscar and Lola with infestation percentage 10.5, 9.5, 8, 7.5, 7, 6, 5 and 4%,

respectively. Contrast arrangement was found in 2005/6 season and the infestation percentage ranged 2.5 - 10.5%. This results assert that aphid have capability to attack all sugar beet varieties and the later don't have resistant factors to aphid infestation. In this respect Wintermantel (2005) found that Sugar beet lines exhibited different degrees of susceptibility to the virus yellows complex.

3. Susceptibility of sugar beet varieties to Beet mosaic virus BtMV infection:

As shown in Table (1), the sugar beet varieties varied in its susceptibility to BtMV infection from season to season and the percentage of infection ranged 0.62 – 3 % and 0.75 – 2.5% in 2004/5 and 2005/6 seasons, respectively. In this respect, Farzadfar et al. (2006) in Iran found that the percentage of BtMV incidence in sugar beet was 7.4%. In 2004/5 season the tested varieties could be arranged according to their susceptibility to BtMV infection as; Gazelle, Gloria, Top, Dema poly, Farida, Lola, Pleno and Oscar with infection percentage 3, 2.5, 1.5, 1.5, 1.25, 1.0, 0.87 and 0.62 4%, respectively. In 2005/6 season this arrangement was Gloria, Gazelle, Lola, Top, Dema poly, Pleno, Oscar and Farida with infection percentages 2.5, 1.9, 1.75, 1.63, 1.38, 1.13, 1.13 and 0.75, respectively. The results of the tow seasons indicated that Oscar and Pleno were the highest resistant varieties while Gazelle and Gloria were the highest susceptible varieties for BtMV infection. In Slovakia, BtMV incidence ranged from 5 to 45% (Mali, 2000).

4. Effect of aphids and BtMV on root yield of sugar beet plants:

Data in Table (2) showed that the aphid infestation and BtMV infection were strongly effected on root yield of sugar beet in the two plantation dates and seasons. The root yield was higher in mid September than mid October plantations in both seasons but the yield losses of root weight were also higher whereas the reduction percentages of root weight were 47.7 and 54.0% in mid September plantation in 2004/5 and 2005/6 season while it recorded 41.1 and 49.5% in mid October plantation in 2004/5 and 2005/6 season. In this respect, Dusi (1999) suggested that BtMV infection reduced yield in sugar beet especially when disease incidence was high in early season..

B: Virus studies:

Virus isolation:

Samples collected from naturally infected beet plants were tested and the virus was obtained from a single local lesion produced on Chenopodium quinoa test plant. To insure the purity of the isolated virus, two cycles of consecutive serial transfer of single local lesion developed on *Chenopodium quinoa* were carried out. Virus was maintained on beet seedlings which were used as a source of virus during subsequent studies. Virus was easily transmitted by sap (Glasa *et al.* 2000 and Mali, 2000). *Chenopodium quinoa* was used as a local lesion diagnostic host because it reacts by BtMV with local lesions.

2. Virus identification:

According to symptomatology on beet plants, host range, physical properties, mode of transmission, ELISA, and hybridization test, the virus isolated was identified as beet mosaic virus (BtMV).

Table (1): Effect of population density of aphid and BtMV infection percentage on sugar beet in Beni-Sweif region during 2004/5 and 2005/6 seasons.

Varieties	Aphids					BtMV %	Aphids					BtMV %	Aphids %	BtMV %
	M. persicae		*A. fabae*		Total %		*M. persicae*		*A. fabae*		Total %			
	N/L*	%	N/L	%			N/L	%	N/L	%				
2004/5 season														
Mid September plantations							**Mid October plantations**							
Gloria	1	6	1	10	12	3	1	4	1	8	9	2	10.5	2.5
Gazelle	1.75	3	3.25	9	11	2	1	2	1	6	8	4	9.5	3
Top	1.5	2	2.5	6	6	2	1	2	2	10	10	1	8	1.5
Demapoly	1	2	1.5	6	7	1.5	1.4	3	3	8	8	1.5	7.5	1.5
Farida	1	1	1.5	4	5	0.5	1.2	3	1.5	8	9	2	7	1.25
Pleno	1.4	2	1.2	3	4	0.5	1.2	2	4.3	8	8	1.25	6	0.87
Oscar	1	1	2	4	4	0.5	1.5	2	1	6	6	0.75	5	0.62
Lola	1	2	2	3	4	1	1.2	1	3	4	4	1	4	1
Mean	1.21	2.38	1.87	5.63	6.63	1.38	1.19	2.38	2.1	7.25	7.75	1.68	7.19	1.53
2005/6 season														
Mid September plantations							**Mid September plantations**							
Gloria	1.5	3	3	3	4	2	1.6	5	2.8	8	11	3	7.5	2.5
Gazelle	1.2	3	1.8	5	7	1.6	1.2	9	1.2	9	14	2.2	10.5	1.9
Top	1	1	2	2	2	1.5	1	2	3	3	3	1.75	2.5	1.63
Demapoly	1	3	1.8	5	6	1	1.6	2	2.5	7	7	1.75	6.5	1.38
Farida	1	1	1.6	5	6	0.5	2	2	2	8	8	1	7	0.75
Pleno	1.4	8	2.2	14	8	0.75	1	2	4	12	12	1.5	10	1.13
Oscar	3	4	2.3	9	9	1	2.7	4	7.1	16	9	1.25	9	1.13
Lola	1	1	1.75	2	2	2	1	2	2.5	3	3	1.5	2.5	1.75
Mean	1.39	3	2.07	5.63	5.5	1.29	1.51	3.5	3.14	8.25	8.38	1.74	6.94	1.51

*N/L: mean number of aphid/leaf

Table (2): Effect of aphids and BtMV on root yield of sugar beet in Beni-Swief region during 2004/5 and 2005/6 seasons.

Season	Planting date	Mean weight of root (kg)		Yield reduction %	L.S.D. 5%
		Healthy	Infected		
2004/2005	Mid September	2.22	1.16	47.7	0.31
	Mid October	1.32	0.78	41.1	0.23
2005/2006	Mid September	2.03	0.93	5.0	0.29
	Mid October	1.67	0.84	49.5	0.27

2.1. Symptoms:

Initial symptoms of BtMV infection are numerous small yellow spots on one or several central leaves. A light mosaic occurs on young leaves as disease develops. Leaflets with initial symptoms are stunted, with curling and rolling of leaf margins and leaf tip necrosis. In severe cases, diseased leaves roll into a tubular shape.

2.2. Host range:

The reaction of certain host range to the isolated virus can be summarized in Table (3).

Table (3): Host range of BtMV under plastic-house conditions.

Plant	Family	Reaction
Gomphrena globosa L.	Amaranthaceae	Local lesion
C. quinoa L.	Chenopodiaceae	Local lesion
Beta vulgaris L cv.	Chenopodiaceae	Mosaic
Chrysanthemum indicum L	Compositae	-----
Lactuca sativa L.	Compositae	-----
Raphinus sativus L.	Cruciferae	-----
Brassica oleracea var. *capitata* L.	Cruciferae	-----
Brassica oleracea var. *botrytis* L.	Cruciferae	-----
Brassica rapa L.	Cruciferae	-----
Cucumis sativus L. cv. *Madina*	Cucurbitaceae	-----
Cucurbita pepo L. cv. Eskandarany	Cucurbitaceae	Mosaic
Pisum sativum L	Fabaceae	Mosaic
Trifolium alexandrium L	Fabaceae	-----
Vicia faba L	Fabaceae	Mosaic
Vigna unguiculata L	Fabaceae	-----
Glycine max L	Fabaceae	Mosaic
Phaseolus vulgaris L	Fabaceae	-----
Hibiscus canabinus L	Malvaceae	Mosaic
Capsicum annum L. cv. California Wonder	Solanaceae	-----
Datura metel L.	Solanaceae	-----
Datura stramonium L	Solanaceae	------
Lycopersicon esculentum Mill cv. Castle Rock	Solanaceae	-----
Nicotiana glutinosa L	Solanaceae	Mosaic
Petunia hybrida L	Solanaceae	-----
Solanum tuberosum L cv. Desire	Solanaceae	-----

(__-) No reaction

Data obtained in Table (1) agreed with that obtained by Chod (1983); Merkuri and Russo (1983); Briest and Kegler (1987); Halliwell and Johnson (1988) and Kassim *et al.*(1993).

2.3. Physical properties:

The Physical properties of the isolated viruses can be summarized in Table (4).

Table (4): Physical properties of BtMV.

Virus			
	Thermal inactivation point	**Longivity in vitro**	**Dilution end point**
BtMV	55-60 °C	2 days	10^{-3}

Similar results were obtained by Rogov *et al.* (1989); Glasa *et al.* (2000) and Abdel-Ghaffar *et al.* (2003).

2.4. Insect transmission:

The obtained results indicate that BtMV could transmitted by Myzus persicae insect used in this study. Insect could transmit virus to 10% of plants. Similar results were obtained Katis and Gibson (1984); Katis *et al.* (1986); Tanne *et al.* (1987); Dusi and Peters (1999) and Mali (2000).

2.5. Enzyme linked immunosorbent assay(ELISA):

Results showed the possibility of using ELISA as a tool for rapid identification of BtMV (Borges *et al.* 1981; Rogov *et al.* 1989 and Abdel-Ghaffar *et al.* 2003).

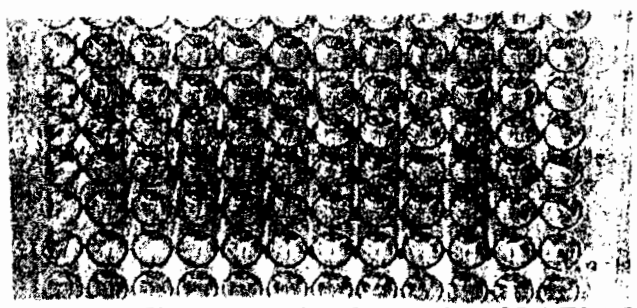

Fig. (1): Photograph of ELISA test showing the reaction of BtMV-IgG against crude sap of beet leaves infected with BtMV (yellow wells).

2.6. Hybridization test:

The dot blot hybridization technique, Fig. (2), employing the digoxigenin-labelled c.DNA as a cold probe was used as a sensitive and rapid method to diagnose the BtMV infection. Many investigators used the same technique to diagnose different viruses (Bennewicz, 1987; Szota, 1997; and Wintermantel, 2005). The dot blot hybridization technique is time saver since it depend on the formation of a probe which can be made and multiplied in a short time with the

aid of the polymerase chain reaction (PCR). Further, some viruses are known to be poor immugen and can best be detected by dot blotting (or ds.RNA) tests rather than by serological tests. In addition, c.DNA probe can be made directly from ds.RNA without steps of purification and nucleic acid extraction (Valverde, 1990 and Harber *et al,* 1992).

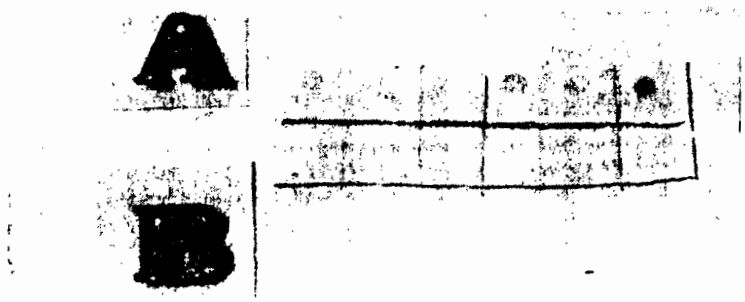

Fig. (2): Detection of BtMV using hybridization test. (A): Extracts of infected plants. (B): Healthy plants. Dark color indicates positive reaction.

3. Physiological tests:

3.1. Total, reducing and non-reducing sugars:

Result in Table (5) show that that total, reducing and non-reducing sugars in the tubers of infected plants were lower than that of the healthy ones. The concentrations of total, reducing and non-reducing sugars in healthy plants were 37.50, 7.11, 30.39 mg/g dry weight, and in the infected plants were 33.33, 4.34, 27.99 mg/g dry weight respectively.

3.2. Total phenols:

Data tabulated in Table (5) show that BtMV-infected beet plants show high significant increase compared with healthy beet plants in the content of total phenol. The concentration of total phenol in healthy and infected plants was 0.77 and 1.91 mg/g dry weight respectively. Hampton et al. 1964 reported that, the accumulation of phenol compounds is probably a nonspecific effect, connected with the death of cells caused by viruses. Such increasing effect of total phenols may be attributed to that phenolic compounds constitute a part of cellular solvents and provide a reducing environment that could be adaptive mechanism for scavenging oxygen free radicals during stress (El- Shewy *et al.*, 2001).

3.3. Total carbohydrates:

Data represented in Table (5) show that BtMV-infected beet plants contain significant lower content of total carbohydrates than that of the healthy ones. The concentration of total carbohydrates in healthy and infected plants was 312.50 and 264.58 mg/g D.W. respectively. Decrease of carbohydrates content as a result of virus infection may be due to inhibition of photosynthesis as reported by Ambrosaw and Shchutskaya (1974). Diener (1963) found that, the decreased photosynthetic activity, coupled with the increase respiration generally observed in virus infected leaves lead to a decreased concentration of the assimilate such as carbohydrates.

3.4. Total free amino acids:

Data in Table (5) show that total carbohydrates in the leaves of infected plants was lower than that of the healthy ones. The concentration of total carbohydrates in healthy and infected plants was 8.20 and 3.70 mg/g D.W. respectively. The decrease in total free amino acids may be due to the reduction in photosynthesis and the increase in respiration rate.

Table (5): The effect of BtMV on the chemical constituents of sugar beet roots.

Component	Healthy plants	Infected plants	L.S.D. 5%
Total sugars (mg/g D.W.)	37.50	33.33	2.7
Reducing sugars (mg/g D.W.)	7.11	4.34	1.4
Non-Reducing sugars (mg/g D.W.)	30.39	27.99	2.1
Total phenols (mg/g D.W.)	0.77	1.91	0.29
Total carbohydrates (mg/g D.W.)	312.50	26.58	4.3
Total free amino acids (mg/g D.W.)	8.20	3.70	1.7

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دراسات علي فيروس موزيك بنجر السكر معزول من منطقة بني سويف والحشرات الناقلة له والتحليل الكيماوى لجذور بنجر السكر

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** قسم آفات محاصيل الحقل–معهد بحوث وقاية النباتات–مركز البحوث الزراعية

أجريت دراسة حقلية في منطقة بني سويف خلال موسمي ٢٠٠٤/٢٠٠٥ و٢٠٠٥/٢٠٠٦ وذلك للتعرف علي أنواع حشرا ت المن وكثافة تعداداها علي ثمانية اصناف من بنجر السكر خلال موعدي زراعة. بالاضافة الي التعرف علي قابلية هذه الاصناف للاصابة بفيروس موزيك بنجر السكر. أصيبت كل اصناف بنجر السكر بنوعين من المن هما من الخوخ Myzus persicae ومن الفول Aphis fabae . وكان تعداد الحشرة الاخيرة اكثر من تعداد حشرة من الخوخ. اكدت النتائج ان كلا النوعين لديهما القدرة علي مهاجمة كل الاصناف المستخدمة في هذه الدراسة. من ناحية اخرى كان الصنفان اوسكار Oscar و بلينو Pleno اكثر الاصناف مقاومة لفيروس موزيك البنجر. في حين كان الصنفان جازيل Gazelle و جلوريا Gloria اكثر الاصناف قابلية للاصابة بالفيروس. اظهرت النباتات المصابة بكل من حشرات المن وفيروس موزيك البنجر نقصا في وزن جذور نباتات البنجر تراوح من ٤١,١ الي ٥٤%.

تضمن البحث أيضا تعريف فيروس موزيك البنجر الذي تم عزله من نباتات البنجر بواسطة دراسة الأعراض– المدي العوائلي– الخواص الطبيعية– طرق النقل– الإليزا– اختبار التهجين. أوضحت الدراسة وجود فيروس موزيك البنجر. وكانت عزلة الفيروس قد اظهرت اعراض علي بعض العوائل. وبدراسة الخواص الطبيعية وجد ان نقطة التخفيف النهائية للفيروس كانت ١٠-٣ ودرجة الحرارة الموقفة لنشاط الفيروس ٥٥-٦٠ م وفترة البقاء علي درجة حرارة الغرفة كانت يومان. وكانت هذه العزلة تنتقل ميكانيكيا بالعصير وكذلك وجد ان حشرة من الخوخ Myzus persicae ذات كفاءة في نقل هذا الفيروس. أمكن استخدام الاختبار السيرولوجي الإليزا ELISA وكذلك طريقة التهجين الجزيئي Hybridization في الكشف عن الفيروس. تم دراسة التأثيرات الفسيولوجية الناتجة عن الإصابة بفيروس موزيك البنجر. أظهرت النباتات المصابة محتوي اقل من كل من السكريات الكلية– السكريات المختزلة– السكريات الغير مختزلة– الكربوهيدرات الكلية– الأحماض الأمينية الكلية، إلا ان محتواها من الفينول كان أعلي عن النباتات السليمة