

## EVALUATION OF SOME BIOPESTICIDS FOR CONTROL POTATO TUBER MOTH *PHTHORIMAEA OPERCULELLA* (Zeller) (Lepidoptera Gelechiidae)

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**ABSTRACT:** A field experiment was conducted at the experimental farm attached to El-Khanater, Horticulture Research station, Qalubia Governorate in two successive seasons of 2003 and 2004 to study the population density of potato tuber moth (PTM) in five potato varieties. The effect of some biopesticides against potato tuber moth (PTM) in storage was also studied. Summarized results show the following:

- 1) The most susceptible variety to the potato tuber moth (PTM) was Spunnt followed by Diamont, Draga, and alpha variety while Cara variety is the least susceptible one.
- 2) The test compounds could be arranged descendingly according to the average effect (% reduction in infestation) as follows:

Sumithion, Granulosis virus (GV) + Dieple-2X, dieple-2X and GV.

**Key word:** Potato tuber moth, Biopesticides.

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### INTRODUCTION

The potato tuber moth *Phthorimaea operculella* (Zeller) is considered a serious pest of Solanaceous crops. It causes serious damage to potato leaves as well as tubers in the field and in traditional rustic stores. Losses to farmers consist of discards; reduced prices for damaged potatoes and increased handling costs.

Farmers also sustain an opportunity cost when they are forced to sell to low prices at avoid pest damage. So, the control of *Phthorimaea operculella* (Zeller) has incorporated the use of transgenic potato which offer certain degree of protection against feeding damage by potato tuber moth (Ebora *et al.*, 2005, Haines, 2002; Ali 2001 ; Arx *et al* 2003; Baklanova *et al* 2004 and Raman and Redalfi, 2000), repellent plant extracts (Lal, 2003 ; Fugle *et al* 2003 ; Lagnaoui and El-Bedewy 2004 and Raman and Redolfi 2000). The chemical insecticide for controlling this insect pest is undesirable. There safer and yet effective methods for control of *Phthorimaea operculella* (Zeller) are being necessary. The promising alternative methods are the use of Granulosis virus, *Bacillus thuringiensis* as well as the insecticide namely Sumithion on the PTM. The experiments were conducted in Qalubia Governorate, Egypt.

The aim of present work was direct to study the population density of PTM on different five potato varieties and evaluate the possibility of using some non-chemical methods for controlling potato tuber moth *Phthorimaea operculella* (Zeller) in Qalubia Governorate.

## **MATERIALS AND METHODS**

Five imported potato varieties planting namely Spunta, Alpha, Draga, Diamont, and Cara were cultivated at the experimental farm attached to EL-khanater Horticulture Research station, Qalubia Governorate in two successive seasons of 2003 and 2004. The field experiments carried out to estimate the population fluctuation of the PTM, *Phthorimaea operculella*, during the summer season and to evaluate the transition of the PTM from potato plants in the field to potato tubers in the store. All agricultural practices were done and no pesticidal treatments were applied. During the growing period hundred plants per variety were chosen weekly at random to be inspected and number of infested leaves with PTM was recorded. At harvest time hundred of different potato equal size tubers were picked at random from the yield of each plot (300 tubers / variety) to be inspected in the field for the potato tuber worm.

### **Materials used:**

#### **Granulosis Virus (GV)**

*Phthorimaea operculella* diseased larvae. Twenty diseased larvae were Frieze dried with one kg of talk powder. The material was kept for used. Stored potato tubers were dusted with the obtained powder at the rat of 300 gm powder / 1000 kg tubers.

#### **Bacterial formulations**

Dieple 2x ( $32 \times 10^3$  IU/ mg. Is known as *B. Thuringiensis* var. Kurstaki. The compound was used at the rat of 300 gm powder / 1000 kg tubers.

#### **Chemical treatment**

Potato tuber seeds were dusted with Sumithion 3% at the recommended rat of one kg / ton of potato tubers.

#### **Mixtures**

Mixing Granulosis virus (GV)) with bacteria (BT) at the rat of (150 g of GV + 150 g of BT) powder / 1000 kg tubers

Taking into account the percentage of PTM infestation under storage after 21 days of application.

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**RESULTS AND DISCUSSION**

The data of susceptibility of different potato varieties to *Phthorimaea operculella*. Presented in Tables (1 and 2) indicated that the susceptibility of the five tested varieties are differed to PTM *Phthorimaea operculella* infestation during the summer plantation of the two investigated years (2003 and 2004).

**Table (1): The population density of *Phthorimaea operculella* larvae in five potato varieties during the season of 2002**

Variety	Mean no. of larvae / 100 leaves at different inspection date											Mean
	23/3	30/3	6/4	13/4	20/4	27/4	4/5	11/5	18/5	25/5	1/6	
Spunta	0.0	2.4	3.2	4.1	5.0	5.3	6.4	8.7	10.3	11.3	13.2	6.4
Diamont	0.0	1.8	2.8	4.0	4.0	4.8	5.7	6.3	7.97	8.77	9.44	5.1
Draga	0.0	0.0	2.0	2.7	2.9	3.0	4.3	5.0	8.88	9.32	10.5	4.4
Alpha	0.0	0.0	0.0	1.5	2.3	3.9	4.9	5.9	6.22	7.75	8.75	3.8
Cara	0.0	0.9	1.4	1.8	2.0	2.9	3.9	4.8	5.11	6.4	7.5	3.3

"F" value = .6511 ns

**Table (2): The population density of *Phthorimaea operculella* larvae in five potato varieties during the season of 2004**

Variety	Mean no. of larvae / 100 leaves at different inspection date											Mean
	21/3	28/3	4/4	11/4	25/4	2/5	8/5	16/5	23/5	30/5	6/6	
Spunta	0.0	2.7	3.7	4.0	4.9	5.1	5.9	8.3	11.1	12.3	13.7	6.5
Diamont	0.0	0.9	2.2	2.9	3.1	5.2	6.2	7.4	11.0	12.8	14.4	6.0
Draga	0.0	1.5	2.4	3.1	4.0	4.4	5.2	6.1	8.76	9.77	11.5	5.2
Alpha	0.0	2.0	2.8	3.1	4.4	4.0	5.9	6.1	7.00	9.5	12.5	5.1
Cara	0.0	0.3	0.7	1.9	2.2	3.4	4.0	5.7	7.49	9.4	10.5	3.3

"F" value = .483 ns

According to the weekly numbers and PTM density during the season of 2003 the data obtained results revealed that Spunta variety proved to be the most susceptible variety where it had the highest infestation level (6.4 larvae / 100 leaves). These data is in agreement with Das *et al* (1992) who mentioned that Spunta and Diamont are the varieties are the most susceptible varieties.

Where the larval number averages were 5.1, 4.4, 3.8 and 3.3 for Diamont, Draga, Alpha, and Cara varieties respectively. It is clear that Cara variety is the less susceptible to PTM infestation during the 2003 season.

According to the weekly numbers of the PTM density during the season of 2004 the data revealed that Spunta variety proved to be the most susceptible variety where it had the highest infestation level (6.5 larvae / 100 leaves). These larval number averages were 6.0, 5.2, 5.1 and 3.3 for Diamont, Draga, Alpha, and Cara varieties respectively. It is clear that Cara variety is the least susceptible variety to PTM infestation during the season of 2004.

There are no significant differences between susceptibility of the different aforementioned potato to *Phthorimaea operculella*.

### **Efficacy of some non-classical methods for PTM control.**

From data based on the levels of infestation and presented in table (3) in season of 2003. It is clear that Sumithion or GV + BT (mixture of granulizes virus with Bacteria Dieple 2x with ratio 1: 1) were considered the most effective method on reducing the potato infestation rates by *Phthorimaea operculella*.

As respect to number of larvae / 100 tubers. Spunta variety harbored (9.48, 8.42, 5.38, 6.18 and 24.33 larvae / 100 tubers) according to the treatments with GV, Dieple 2X, Sumithion, GV+BT and control respectively. Concerning Diamont variety corresponding that's of infestation with PTM after treatments with the foregoing compounds were (9.45, 8.94, 4.55, 5.49 and 23.11 larvae / 100 tubers; respectively). Whereas Draga variety infested with (9.22, 7.25, 4.96, 3.25 and 19.21 larvae / 100 tuber; respectively as a result of using the formentioed compounds). On the other hand, Alpha variety . Infested with the numbers of (8.71, 6.75, 4.24, 3.25 and 17.28 larvae / 100 tubers); respectively thus Cara variety considered the least susceptible variety to PTM infestation. There are highly significant differences between susceptibility of Cara and Alpha varieties. Alpha and Draga varieties had a moderate infestation levels where the average numbers of larvae / 100 tubers were 7.49, 6.88, 4.24, 4.39 and 15.86 for Cara variety with GV, Dieple 2X, Sumithion, GV+ BT and Control, respectively. These data are in agreement with those of Abd EL - Salam *et al*. (1998) who mentioned that Alpha variety has a moderate susceptibility to infestation with PTM. Iskander (1992) mentioned that alpha and Diamont varieties have moderate susceptibility. On the other hand these data are disagreed with Heeder (2003) who stated that Alpha had a light infestation variety.

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**Table (3): Efficacy of (GV) granulosis virus, (BT) bacillus thuringiensis, GV + BT, and Sumithion on the PTM infection during 2003 season**

Treatment	Variety	Infected tubers in different stages			
		1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	% Reduction
GV	Spunta	6.95	7.75	9.48	75.82
	Diamont	6.23	8.33	9.45	75.99
	Draga	6.25	7.09	9.22	77.44
	Alpha	5.52	6.75	8.71	79.02
	Cara	4.75	6.55	7.48	81.22
Dieple 2X	Spunta	5.85	7.75	8.42	77.98
	Diamont	6.72	7.58	8.94	76.76
	Draga	5.25	6.58	7.25	80.92
	Alpha	5.55	5.25	6.75	82.45
	Cara	4.77	5.74	6.88	82.61
Sumithion	Spunta	1.15	2.54	5.38	90.93
	Diamont	1.85	2.12	4.55	91.48
	Draga	1.08	2.33	4.96	91.63
	Alpha	1.52	2.36	4.24	91.88
	Cara	1.33	2.41	3.34	92.92
GV+BT	Spunta	1.95	5.64	6.18	86.23
	Diamont	1.52	4.74	5.49	88.25
	Draga	1.25	3.54	5.47	89.74
	Alpha	2.33	3.55	3.25	90.87
	Cara	1.68	2.64	4.39	91.29
Control	Spunta	9.75	15.23	24.33	-
	Diamont	8.28	11.54	23.11	-
	Draga	7.55	10.32	19.21	-
	Alpha	6.55	10.23	17.28	-
	Cara	5.18	8.94	15.86	-

"F" value = 3.695 \*\*

LSD 0.01 = 2.564

LSD 0.05 = 1.942

During 2004 season the susceptibility of different varieties to infestation with PTM as respect to the average number of larvae / 100 leaves gave similarity trend to the previous formentioned year of 2003.

During the season of 2004 data presented in Table (4) showed that the effect of different treatments on the infestation reduction by PTM during the season of 2003. The results cleared that the Sumithion or GV + BT (mixture of granulizes virus with Bacteria Dieple 2x with ratio 1:1) were the most effective method for reducing the potato infestation rates by *Phthorimaea operculella*. There are a significant differences between susceptibility of Spunta and both of Alpha and Cara varieties. On the other hand, there are no significant differences between Spunta susceptibility and both Draga and Diamont varieties. As respect to number of larvae / 100 tubers with GV, Dieple 2X, Sumithion, GV+ BT and Control, respectively. Spunta variety recorded infestation levels of (9.25, 8.45, 4.38, 5.48, and 25.36 larvae / 100 tubers), respectively. Diamont variety infestation rates of ( 9.5, 8.1, 4.22, 5.35 and 22.52 larvae / 100 tubers ; respectively) . Draga variety harbored (9.22, 7.52, 3.98, 5.0 and 19.69 larvae / 100 tubers ; respectively). On the other hand, Alpha variety had the infestation of ( 8.75, 6.68, 3.5, 3.87 and 18.36 larvae / 100 tubers respectively ) thus Cara variety considered the least susceptible variety to PTM infestation.

It could be concluded that there are highly significant differences between Cara variety susceptibility and other varieties except Alpha and Draga varieties. According to the numbers of larvae/100 leaves there is no-significant difference between Cara and Alpha varieties. Alpha and

Draga varieties had a moderately infestation levels where the average numbers of larvae / 100 tubers were 7.18, 6.32, 2.88, 2.88 and 12.89 for Cara variety treated with GV, Dieple 2X, Sumithion, GV+ BT and Control respectively. These data are agreed with those of Abd EL - Salam *et al.* (1998) who mentioned that Alpha variety had a moderately susceptibility to PTM. In this field of study Iskander (1992) mentioned that alpha and Diamont varieties had moderately susceptibility to PTM infestation. On the other hand these data are disagreed with Heeder (2003) who stated that Alpha variety had light infestation to PTM results.

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**Table (4): Efficacy of (GV) granulosis virus, (BT) bacillus thuringiensis, GV + BT, and Sumithion on the PTM infection during 2004 season**

Treatment	Variety	Infected tubers in different stages			
		1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	% Reduction
GV	Spunta	6.68	8.53	9.25	75.54
	Diamont	7.13	7.75	9.50	75.62
	Draga	6.52	7.51	9.22	76.75
	Alpha	5.45	6.25	8.75	79.55
	Cara	4.50	6.42	7.18	81.09
Dieple 2X	Spunta	6.58	7.52	8.45	77.45
	Diamont	5.13	7.38	8.10	77.39
	Draga	5.62	6.15	7.52	80.71
	Alpha	5.00	5.42	6.68	82.29
	Cara	4.54	5.18	6.32	80.96
Sumithion	Spunta	1.25	2.24	4.38	92.13
	Diamont	1.00	3.11	4.22	91.67
	Draga	0.68	2.96	3.98	92.38
	Alpha	0.74	2.68	3.5	93.08
	Cara	0.09	2.00	2.88	95.03
GV+BT	Spunta	1.56	3.88	5.84	88.72
	Diamont	1.49	3.55	5.35	89.61
	Draga	1.25	3.00	5.00	90.75
	Alpha	1.00	2.88	3.87	92.25
	Cara	0.88	2.00	2.88	94.24
Control	Spunta	6.58	14.66	25.36	-
	Diamont	6.66	15.36	22.52	-
	Draga	5.94	15.00	19.69	-
	Alpha	5.55	14.8	18.36	-
	Cara	4.89	10.23	12.89	-

"F" value = 4.253 \*\*

LSD 0.01 = 1.546

LSD 0.05 = 1.171

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## تقييم فعالية بعض المركبات الحيوية لمكافحة فراشة دودة درنات البطاطس

سامية زين سيد

معهد بحوث وقاية النباتات - مركز البحوث الزراعية - الدقى - جيزه - مصر .

### الملخص العربي

أجريت هذه الدراسة خلال الفترة من ( ٢٠٠٣ \_ ٢٠٠٤ ) بهدف دراسة التذبذب الطبيعي لفراشة دودة درنات البطاطس لأهم الأصناف المنزرعة في مصر وهي ( اسبونتا - ديامنت - دراجا - الفا - كارا ) لمعرفة حساسية هذه الأصناف للإصابة وكذلك تقييم استخدام بعض المركبات الحيوية لمكافحة هذه الآفة . أظهرت النتائج المتحصل عليها كمايلي :

لا يوجد أى فروق معنوية بين حساسية الأصناف المختلفة للإصابة بل وقد \* - ل - الصنف اسبونتا اعلى معدل أصابه من حيث متوسط عدد اليرقات / ١٠٠ ورقة حيث بلغت متوسطات الإصابة ( ٦,٤ - ٦,٥ يرقة / ١٠٠ درنة ) خلال موسمي الدراسة ٢٠٠٣ , ٢٠٠٤ على الترتب

كما سجل الصنف كارا اقل معدل إصابة من حيث عدد اليرقات / ١٠٠ ورقة حيث بلغ متوسط الإصابة في نهاية الموسم ( ٣,٣ - ٣,٣ يرقة / درنة ) خلال موسمي الدراسة , ٢٠٠٤ على الترتب.

كما أوضحت الدراسة فاعلية المستحضر الفيرسي مخلوطا مع البكتريا دايبيل 2x وكذلك مبيد السومثيون من حيث خفض تعداد الآفة داخل المخزن لذا يراعى اختيار الصنف المناسب والمقاوم للإصابة لفراشة دودة درنات البطاطس وكذلك عدم الاعتماد على مكافحة الكيماوية وحدها ولكن يجب استخدام وسائل مكافحة متكاملة لمكافحة الآفة لتقليل سرعة انتخاب السلالات من الآفة لفعل المبيد.