Minufiya J. Agric. Res. Vol.38 No. 5: 1199- 1205 (2013) "http://www.mujar.net"

RELATIVE SUSCEPTIBILITY OF ELEVEN POTATO CULTIVARS TO INFESTATION WITH *PHTHORIMAEA OPERCULELLA* (ZELLER) AND *MYZUS PERSICAE* (SULZER), UNDER FIELD AND STORE CONDITIONS

M.I. Shedeed
Plant Protection Research Institute, ARC, Dokki, Giza

(Received : Jul. 29 , 2013)

ABSTRACT: *The susceptibility of eleven potato cultivars to the infestation with the potato tuber moth, Phthorimaea operculella (Zeller) (Lepidoptera: Gelechiidae), and the green peach aphid, Myzus persicae (Sulzer), (Hemiptera: Aphididae) were determined during the Summer potato plantations in 2012 and 2013 years at Elkantaer district , Qaliobia Governorate. The obtained results showed the cultivar of Andifor recorded a high resistant against the infestation with the aphid , Myzus persiae, while the cultivars of Herms , Diamont, Conket , and Andifor in the field and Altra , Herms, Diamont, and Andifor in the store recorded a high resistant against the infection with the potato tuber moth , Phthorimaea operculella.*

Key words: *Potato tuber moth, Phthorimaea operculella , potato, susceptibility, green peach aphid , Myzus persicae.*

INTRODUCTION

Potato tuber moth, *Phthorimaea operculella* (Zeller) is one of the most significant insect pests attacking potato (*Solanum tuberosum*) tubers which are considered the most important food crop all-over the world. This pest causes reliable damage to potato plants in the field and great losses in quality and quantity of the yielded tubers during storage, Sileshi and Teriessa (2001). The analysis of age-specific life tables is an important and is conducted through easy procedures based on biological parameters when the key factors governing the changes in the population dynamics, Khattab *et al.,* (1995). In the mean time, forecasting growth parameters; i.e. fertility and mortality rates, provide a rational and predictive basis for pest control.

In this respect, many investigators studied the susceptibility of potato cultivars to infestation with many insect pests including *Ph. operculella* either in the field or in the stores i.e. Fenemore (1980); Trivedi *et al*., (1994); Khattab *et al*., (1995); El-Saadany *et al*., (1998); Gurr and Symington (1998); Ibrahim (2000); Chandel *et al.* (2001); Sileshi and Terissa (2001) ; Ghazala (2005) ; Al-Taweel *et al*., (2006) ; Tiwari *et al*., (2006); Golizadeh and Razmjou (2010); Horgan *et al.* (2010); Randon (2010) Al-Omairy (2012) and Abdallah *et al*., (2012). During the last twenty years, potato cultivated area has steadily increased in Egypt mainly due to the increase in demand for the crop in local markets and for export.

Damage to the foliage and tubers occur throughout the growing season, but is more conspicuous in the late summer plantations in the field, the initial sources of infestation, each season, are the insects which have over wintered on wild hosts or on cultivated Solanaceae plants in the area. The damage to the foliage appears as different degrees of shriveling whereas to the tuber. The occasional severe damage, in certain years, in Egypt, could be attributed to : suitable environmental conditions, hence a large population of pests in the field; inadequacy of the insecticidal treatments of the infestation. Khattab *et al.,* (1995), in Egypt studied the relative susceptibility of 11 potato cultivars to infestation by *Ph. operculella* and *Myzus persicae* .

From the previous preview, the present study aimed to evaluate the susceptibility of eleven potato cultivars to the infection with *Ph. operculella* (Zeller), and *Myzus persicae* (Sulzer) under field and store conditions.

MATERIALS AND METHODS

The experiment was conducted at a private farm at Elkantaer district , Qaliobia Governorate during the Summer potato plantations of 2012 and 2013 years. An area of about one feddan 4200 m2 was divided into 33 plots , each plot was about 500 m2 (20 x 25 m) . Experiment was arranged in a complete randomized block design in three plots for each cultivar.

In Feb. 8th, 2012 and Feb. 13th 2013, eleven potato cultivars were planted in each season. The agricultural practices were the same in all treatments. Forty days after tuber planting, weekly samples of 30 leaves from each replicate were picked, at random, and collected in a paper bag for laboratory examinations. Sampling was continued for 11 weeks and the weekly infestation averages were registered for each cultivar.

At the end of the season, 100 tubers from each replicate (i.e. 400 tubers per cultivar) were collected for examination.

Data were analyzed by the computer, using ANOVA test with LSD at 5% level (SAS Institute. 2003).

RESULTS AND DISCUSSION

1- Susceptibility of 11 potato cultivars to the infestation with *Myzus persicae* along two summer seasons (20 March to 6 June) of 2012 and 2013 years:

Results in Table (1) show the average numbers of aphid stages on the leaves of 11 potato cultivars. It could be observed that aphid population was increased by increasing the age of potato plant reaching its highest numbers during May and June months at both of examined seasons. Statistical analysis of data in Table (1) indicated that there were significant differences in the numbers of aphid stages among potato cultivars along the two seasons of study 2012 & 2013 years (LSD 5% = 16.93) .

Regarding to the results of 2012 season, the highest population density of aphid stages were recorded with the Osirus and Froza cultivars giving 98 and 92 individuals / 30 leaves as a grand total of mean values, respectively followed by Lanorma cultivar reporting 79 individuals / 30 leaves as a grand total of mean values . The least numbers of aphid stages were recorded with Conket, Accent, and Andifor cultivars recording 68 , 65, and 53 individuals / 30 leaves as a grand total of mean values, while the rest cultivars occupied intermediate status of infection.

As for the results of 2013 season, the highest population density of aphid stages were recorded with the Froza and Accent cultivars giving 139 and 126 individuals / 30 leaves as a grand total of mean values, respectively followed by Osirus cultivar reporting 122 individuals / 30 leaves as a grand mean values without significant differences . The least numbers of aphid stages were recorded with Tisia , Altra , and Andifor cultivars recording 75 , 68, and 53 individuals / 30 leaves as a grand mean values, while the rest cultivars occupied intermediate status of infection.

2- Susceptibility of 11 potato cultivars to the infestation with *Phthorimaea operculella* along two summer seasons (20 March to 6 June) of 2012 and 2013 years:

Results in Table (2) show the average numbers of potato tuber worm stages on the leaves of 11 potato cultivars, in the field. It could be observed that potato tuber worm population was increased by increasing the age of potato plant reaching its highest numbers during May and June months at both of examined seasons. Statistical analysis of data in Table (2) indicated that there were significant differences in the numbers of potato tuber worm stages among potato cultivars along the two seasons of study 2012 & 2013 (LSD 5% = 16.93) .

Regarding to the results of 2012 season, the highest population density of potato tuber worm stages infecting vegetative parts of potato plants were recorded with Froza cultivar giving 263 individuals / 30 leaves as a grand total of mean values, followed by Akra and Altra cultivars giving 152 and 149

Table 1

Table 2

individuals / 30 leaves as a grand total of mean values, respectively. The least numbers of potato tuber worm stages were recorded with Diamont , and Herms cultivars recording 67 , and 58 individuals / 30 leaves as a grand mean values , respectively, while the rest cultivars occupied intermediate status of infection.

As for the results of 2013 season, the highest population density of potato tuber worm stages were recorded with Froza cultivar giving 357 individuals / 30 leaves as a grand mean value, followed by Osirus cultivar reporting 248 individuals / 30 leaves as a grand mean values with significant differences . The least numbers of potato tuber worm stages were recorded with Lanorma , Altra , and Andifor cultivars recording 106 , 103, and 91 individuals / 30 leaves as a grand mean values, respectively, while the rest cultivars occupied intermediate status of infestation.

3- Average numbers of Potato tuber yields of 11 potato cultivars and the average numbers of potato tuber worms infect tubers in stores:

Data presented in Table (3) show the tuber yields of the tested potato cultivars along two successive seasons. Statistical analysis of the data Table (3) indicated that there were significant differences in the tuber yields (2012 and 2013 years), among the tested cultivars (LSD 5 % = 156.7, 184.3). The highest yields were recorded with Andifor , Altra , Diamont , and Herms, resulting 1047 , 1034, 1022 and 1008 kg / 500 m2 , respectively at 2012 season , while at 2013 season the highest yields were recorded with Andifor , Altra , Diamont , and Herms, resulting 1057 , 1042, 1019 and 1003 kg / 500 m2 , respectively.

Regarding to the average numbers of potato tuber worm stages in the store, results in Table (3) show the mean numbers of worms per 100 tuber, at harvest time, 20 and 30 days after harvesting.

Statistical analysis of the data indicated that there were significant differences in the numbers of potato tuber stages infesting potato tuber in store , (LSD 5 % = 2.13), where the highest numbers of worms were recorded with the cultivars of Froza and Osirus giving 30 and 29 individuals per 100 tuber at 2012 season, respectively, while the least numbers of potato tuber worm infesting tuber in stores was recorded with Herms and Altra cultivars recording 12 and 11 individuals per 100 tuber at 2012 season, respectively.

As for the results of 2013 season there were great similarity between the two seasons, where the highest numbers of worms were recorded with the cultivars of Froza and Osirus giving 32 and 30 individuals per 100 tuber, respectively, while the least numbers of potato tuber worm infesting tuber in stores was recorded with Diamont, Herms and Altra cultivars recording 14, 12 and 12 individuals per 100 tuber, respectively.

Finally it could be concluded that the cultivar of Andifor recorded a high resistant against the infection with the aphid, *Myzus persiae,* while the cultivars of Herms , Diamont, Conket , and Andifor in the field and Altra , Herms, Diamont, and Andifor in the store recorded a high resistant against the infection with the potato tuber moth , *Phthorimaea operculella.*

These results are in partially agreement with those of Doss (1987) who studied the relative susceptibility of 17 potato cultivars to infestation by *Phthorimaea operculella, Euzophera osseatella* and *Gryllotalpa gryllotalpa* in tubers at harvest in Qaluobia and Minia Governorates in Egypt. The cultivar Spunta was the only one resistant to all 3 insect species; the others least susceptible to the pests were Diamond for *P. operculella,* King Edward for *G. gryllotalpa* and Grata, Draga and Claudia for *E. osseatella.* Furthermore, Khattab *et al.,* (1995) reported that no correlation was observed between leaf and tuber infestation by *Ph. operculella*, but Van Goch cultivar had a lower infestation level on leaves and tubers, furthermore, “Van Goch" and "Gigant" cultivars were only slightly infested with *Ph. operculella* whereas the "Mondial" cultivar was heavily infested with *Ph. operculella* .

Table (3). Average numbers of Potato tuber yields of 11 potato cultivars and the average numbers of potato tuber worms infect tubers in stores.

Potato cultivars	Potato tuber yield per 500 m^2 in kgs		Mean numbers of potato tuber worms per 100 tuber							
	2012	2013	At harvest time		20 days of storage		30 days of storage		Grand mean	
			2012	2013	2012	2013	2012	2013	2012	2013
Akra	869 cd	891 abcde	7	6	7	8	10	12	24 cde	26 c
Altra	1034 ab	1042 ab	4	3	3	4	4	5	11 k	12 jk
Froza	711 ef	706 f	10	9	8	10	12	13	30 ab	32 a
Andifor	1047 a	1057 a	4	5	5	5	6	6	15 hi	16 hi
Tisia	879 bcd	882 abcdef	8	7	6	9	9	9	23 def	25 cd
Conket	721 f	869 bcdef	7	6	8	7	7	7	22 efg	20 g
Osirus	736 def	714 ef	10	9	9	10	10	11	29 b	30 ab
Lanorma	864 de	873 def	8	7	6	6	8	8	22 efg	21 fg
Accent	842 de	887 cdef	6	7	5	4	5	6	15 hi	17 h
Herms	1008 abc	1003 abc	4	3	4	4	4	5	12 jk	12 jk
Diamont	1022 abc	1019 abcd	5	4	6	6	6	4	17 h	14 ij
LSD 5%	156.7	184.3							2.13	

Means in each column followed by the same letter (s) are not significantly different at 5% level

REFERENCES

Abdallah, Y.E.Y., M. S. Abdel-Wahed and Gh. A. Youssef (2012). Life table parameters as indicator of potato Cultivars susceptibility to infestation with *Phthorimaea operculella* (Zeller) . Egypt. Acad. J. Biology Sci., 5(1):127-136 (2012).

Al-Omairy, Kh. O. (2012). Laboratory study of life tables of potato tuber moth, *Phthorimaea operculella* (Zeller) under constant temperature. The 11th Conf. Agric. Dev. Res., Cairo, Egypt, 27-30 March, pp 162. (Abstract).

Al-Taweel, A. A., N. S. Zeyab and M. K. El-Jaborry (2006). Reaction of some potato cultivars to infestation by potato tuber moth, *Phthorimaea operculella* (Zeller).Arab J. Pl. Prot., 24: 53-55. (Arabic Language).

Chandel, R. S., K. Rajnish and N. P. Kashyab (2001). Bioecology of potato tube moth, *Phthorimaea operculella* Zeller in mid hills of Himachal Pradesh (2001). J. Ent. Res., 25 (3): 195-203.

Doss, S. A. (1987). Relative susceptibility of seventeen potato cultivars to infestations by three insect pests in the field and the density of potato tuber moth infestation in stores. Journal Bulletin de la Société Entomologique d'Égypte 1984/1985, publ. 1987 No. 65 pp. 157-167.

El-Saadany, G. B., F. M. Mariy, F. M. Daoud and M. Y. Ibrahim (1998). Life table studies on potato tuber moth, *Ph. operculella*. Zagazig H. Agric. Res., 25 (4:(649 – 657).

Fenemore, P. G. (1980). Susceptibility of potato cultivars to potato tuber moth, *Phthorimaea operculella* Zell.

(Lepidoptea:Gelechiidae). N. Z. J. Agric. Res,. 23 : 539 – 546 .

Ghazala, E. M. A. (2005). Studies on potato tuber moth *Phthorimaea operculella* (Zeller). M. Sc. Thesis, Fac. Agric. Alex. Univ., 145 pp.

Golizadeh, A. and J. Razmjou (2010). Life table parameters of *Phthorimaea operculella* (Lepidoptera:Gelechiidae), feeding on tubers of six potato cultivars. J. Econ. Ent., 103 (3): 972 - 996.

Gurr, G. M. and C. A. Symington (1998). Resistance to the potato tuber moth, *Phthorimaea operculella* (Zeller) (Lepidoptea:Gelechiidae), in potato (*Solanum tuberosum* spp. *tuberosum tuberosum* L.) tubers. Australian J. Ent., 37(1): 49 – 51.

Horgan, F. G., D. T. Quiring, A. Lagnaoui, A. R. Salas and Y. Pelletier (2010) .Variations in resistance against *Phthorimaea operculella* in wild potato tubers. Entomol. Exp. Appli., 371 (3): 269-279.

Ibrahim, M. Y. (2000). Further ecological and biological studies on some potato pests in Egypt. Ph. D. Thesis, Fac. Agric., Ain Shams Univ., pp 236.

Khattab, M. M., A. N. Fayad and R. H. G. Mikhael (1995). Relative susceptibility of potato cultivars to infestation with insect pests. Annals Agric. Sci. Moshtohor,33 (4) : 1539 – 1552.

Randon, Silvia I. (2010). The potato tuber worm: A literature review of its biology, ecology and control. Am. J. Pot. Res., 87: 149-166.

SAS Institute. (2003). SAS/STAT Version 8.2. SAS Institute, Cary, NC. USA.

Sileshi, G. and J. Teriessa (2001). Tuber damage by potato tuber moth, *Phthorimaea operculella* Zeller (Lepidoptera: Gelechiidae) in the field in Eastern Ethiopia. Internat. J. Pest Manag., 47 (2): 109-113.

Tiwari, D. B., R. B. Thapa, S. M. Shrestha and S. L. Joshi (2006). Field survey and monitoring of potato tuber moth, *Phthorimaea operculella* (Zeller) (Lepidoptera: Gelechiidae). J. Inst. Agric. Anim. Sci., 27: 157-160.

Trivedi, T. P., D. Rajagopal and P. L. Tandon (1994). Life table for establishment of potato tuber moth, *Ph. operculella*. J. Indian Potato Assoc., 12 (1-2): 97-105.

الحساسية النسبية لاحدى عشر صنف من نباتات البطاطس للاصابة بدودة درنات البطاطس وحشرة من الخوخ تحت ظروف الحقل والمخزن

محمد ابراهيم شديد

معهد بحوث وقاية النباتات – قسم بحوث افات الخضر – الدقى الجيزة – مصر

الملخص العربي

تم إجراء هذة التجربة في محطة القناطر للبحوث الزراعية بمحافظة القليوبية وذلك لإختبار درجة حساسية ومقاومة بعض أصناف البطاطس للإصابة بدودة درنات البطاطس وحشرة من الخوخ الأخضر تحت ظروف الحقل والمخزن. وقد أجريت الدراسة علي إحدي عشرصنف من البطاطس في العروة الصيفية لموسم 2012 وموسم 2013 ، وهذه الأنواع هي : أكيرا ، ألترا ، فروزا ، أنديفور، تيسيا ، كونكت ، أوسيرس ، لانورما ، أكسنت ، هيرمس ، دايمونت ، وقد أوضحت نتائج الدراسة أن الصنف أنديفور سجل أعلي درجات المقاومة للإصابة بحشرة من الخوخ الأخضر بالمقارنة بباقى الاصناف المختبرة ، بينما سجلت الاصناف هيرمس ودايمونت وكونكت واندیفور أعلي درجات المقاومة للإصابة بدودة درنات البطاطس. أعطت اصناف إنديفور ، الترا ، دايمونت ، هيرمس اعلى محصول من درنات البطاطس .

Table (1): Weekly numbers of Green peach aphid stages infest 11 potato cultivars at Elkantaer district , Qaliobia Governorate along two summer seasons (20 March to 6 June) of 2012 and 2013 years.

Potato cultivars	Mean numbers of Aphid stages, *Myzus persicae* per 30 leaves at dates of inspection												Grand total	Mean numbers of Aphid stages, *Myzus persicae* per 30 leaves at dates of inspection											Grand total
	Summer plantation of 2012 year													Summer plantation of 2013 year											
	Mar. 20	Mar. 27	Apr. 4	Apr. 11	Apr. 18	Apr. 25	May 2	May 9	May 16	May 23	May 30	Jun. 6		Mar. 20	Mar. 27	Apr. 4	Apr. 11	Apr. 18	Apr. 25	May 2	May 9	May 16	May 23	May 30	Jun. 6	
Akra	1	1	2	2	3	1	3	6	9	12	16	15	71 c	0	2	2	3	3	5	8	8	10	15	12	14	82 cd
Altra	0	3	3	4	3	4	5	8	10	12	11	10	73 c	1	2	3	2	4	5	3	6	9	11	10	12	68 d
Froza	1	2	2	3	5	8	6	8	11	15	9	22	92 ab	1	1	2	3	6	8	12	21	15	18	25	27	139 a
Andifor	1	1	3	5	5	4	5	6	5	5	5	8	53 d	0	2	2	3	3	0	6	6	8	6	8	9	53 e
Tisia	0	2	3	2	4	6	5	6	8	12	12	14	74 c	0	0	2	3	3	6	8	8	10	13	12	10	75 d
Conket	2	2	1	2	4	5	3	6	8	9	14	12	68 cd	1	2	3	2	3	5	6	9	14	13	13	12	83 cd
Osirus	2	1	2	2	2	3	6	9	13	18	16	24	98 a	1	1	2	4	6	9	12	13	15	17	19	23	122 b
Lanorma	0	0	3	2	3	3	2	11	12	14	16	13	79 bc	0	2	2	3	3	8	9	12	17	13	15	14	98 c
Accent	3	3	2	2	4	5	3	5	6	10	9	13	65 cd	2	3	2	4	12	8	9	14	19	18	16	19	126 ab
Herms	2	3	3	4	2	5	9	8	13	6	9	9	73 c	3	2	5	4	6	8	10	9	11	10	9	7	84 cd
Diamont	4	4	3	3	6	8	7	6	6	8	11	8	74 c	2	5	5	6	15	3	3	15	10	11	11	9	95 c

Means in each column followed by the same letter (s) are not significantly different at 5% level

LSD 5 % for 2012 season = 16.93 for 2013 season = 16.93

Table (2): Weekly numbers of Potato tuber moth stages infest 11 potato cultivars at Elkantaer district , Qaliobia Governorate along two summer seasons (20 March to 6 June) of 2012 and 2013 years.

Potato cultivars	Mean numbers of Potato tuber moth stages per 30 leaves at dates of inspection												Grand total	Mean numbers of Potato tuber moth stages per 30 leaves at dates of inspection											Grand total
	Summer plantation of 2012 year													Summer plantation of 2013 year											
	Mar. 20	Mar. 27	Apr. 4	Apr. 11	Apr. 18	Apr. 25	May 2	May 9	May 16	May 23	May 30	Jun. 6		Mar. 20	Mar. 27	Apr. 4	Apr. 11	Apr. 18	Apr. 25	May 2	May 9	May 16	May 23	May 30	Jun. 6	
Akra	0	2	5	8	14	16	11	14	17	20	22	20	149 bc	1	3	8	11	15	18	9	15	19	23	25	26	173 d
Altra	3	5	6	8	12	10	19	19	14	18	22	16	152 b	0	3	6	7	9	9	6	9	10	13	14	17	103 hi
Froza	3	4	8	13	14	19	25	32	36	35	38	36	263 a	2	5	10	12	15	36	48	42	47	45	46	49	357 a
Andifor	2	2	5	8	11	10	12	11	13	12	14	18	118 de	1	3	3	5	6	6	8	10	12	12	11	14	91 i
Tisia	0	2	3	6	7	9	9	11	13	12	14	19	105 ef	0	4	5	8	9	11	14	12	15	14	17	22	131 f
Conket	1	1	6	4	9	8	9	8	7	11	18	17	99 f	0	1	3	5	6	9	9	12	13	15	18	19	110 gh
Osirus	2	3	1	3	4	9	10	13	15	18	26	29	133 cd	3	7	9	11	15	23	26	27	29	31	33	34	248 b
Lanorma	1	1	3	5	8	9	11	10	12	16	18	18	112 ef	0	0	1	2	3	8	12	14	13	13	18	22	106 ghi
Accent	0	3	5	8	11	10	12	9	11	13	14	19	115 ef	2	5	8	11	12	15	24	21	23	24	27	25	197 c
Herms	0	0	1	3	2	2	4	7	6	8	12	13	58 g	0	1	3	4	6	12	15	15	16	18	16	14	120 fg
Diamont	0	1	1	3	3	2	5	8	8	10	12	14	67 g	5	6	9	10	15	18	15	12	15	17	15	13	150 e

Means in each column followed by the same letter (s) are not significantly different at 5% level.
LSD 5 % for 2012 season = 16.93 for 2013 season = 16.93