

Abundance of some potato homopterous pests as affected by potassium fertilization level

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ABSTRACT

Experiments were conducted during potato winter seasons of 2007/08 and 2008/09 at Dakahlia, Egypt. Four potassium fertilization levels (0, 100, 150 and 200 kg/fed) were applied to clarify their effects on the population density of *Myzus persicae* (Sulzer), *Aphis gossypii* Glover, *Aphis craccivora* Koch, *Bemisia tabaci* (Gennadius) and *Empoasca* sp. in potato fields. The obtained results showed that the highest population densities of these pests occurred at no potassium fertilization (control) followed by 100 kg/fed and 150 kg/fed, respectively. The lowest population densities were recorded at 200 kg/fed treatment. *A. gossypii* and *M. persicae* were the most affected pests by potassium fertilization. *A. craccivora* and *Empoasca* sp. were affected in relatively moderate way. *B. tabaci* was the least affected one. On the other hand, epidermal thickness of potato leaves was significantly increased by fertilization level increase.

Keywords: Potassium fertilization, potato, *Myzus persicae*, *Aphis gossypii*, *Aphis craccivora*, *Bemisia tabaci*, *Empoasca* sp. abundance.

INTRODUCTION

Potato, *Solanum tuberosum* L. is the world's most important food crop with annual production of nearly 300 million tons produced by more than 12 million hectares (Martin *et al.* 1990).

Homopterous pests have great economic importance to potato plants. They cause serious damage directly by sucking plant sap or indirectly by transmission of virus and mycoplasma diseases (El-Nahal *et al.*, 1977; Aboul-Ata, 1983; Hegab *et al.*, 1987 and El-Gindy, 2002). These pests interferes with leaves physiology by mechanically plugging the phloem and xylem vessels, causes stunting, curling and browning of the leaves (Borrer *et al.*, 1981).

Fertilization had an important role on homopterous pest infestations; where the high rates of potassium reduced the population density of these pests on cereal, legumes and maize plants (Hegab, 2001; El-Gindy, 2002 and El-Gindy, 2006).

The present work aimed to evaluate the relation between some homopterous pests infesting potato plants and the epidermal thickness of potato leaves in response to different potassium fertilization levels on potato plants.

MATERIALS AND METHODS

This experiment was conducted during two potato seasons of 2007/08 and 2008/09. Observations started from the 1st week of Oct. to the 2nd week of Jan. (harvest time). An area about 1050 m² was chosen to carry out this investigation in El-Mansoura Distract, Dakahlia Governorate (Esponta potato variety).

The area was divided into 12 plots, arranged as completely randomized design. Nine plots were fertilized with levels of fertilization as 100, 150 and 200 kg/fed (3 plots/ level as replicates) and three plots were no fertilized (as control). Potassium fertilization (as potassium sulphate 48% K₂O) was added after five weeks early in the growing season.

Weekly samples of 10 leaves/ plot were picked at random from the three levels of the plants (low, mid and upper). Each sample was kept in tight closed paper bag and transferred to the laboratory in the same day for inspection by the bionocular microscope. The homopterous pest, *Myzus persicae* (Sulzer), *Aphis gossypii* Glover, *Aphis craccivora* Koch, *Bemisia tabaci* (Gennadius) and *Empoasca* sp. were counted and recorded. All plots received normal agricultural practices and were kept free of any insecticide treatment.

*** Effect of fertilization on the thickness of potato epidermal cells:**

Samples of potato leaves were collected and cleaned up with tap water, cut into suitable parts, fixed in formalin, acetic acid, alcohol (F.A.A.) solution for at least 36 hours, dehydrated with n-butyl alcohol, infiltrated and embedded in pure paraffin wax (M.P.56 – 58°C) (Johancen, 1940). Sectioning at thickness of 14 micron was performed by using a rotatory microtome. Paraffin ribbons were mounted on thin slides and stained with safranin and light green. Stained sections were mounted in Canada balsam then examined microscopically. The epidermal cell thickness was measured by ocular micrometer.

Data were subjected to correlation and simple regression using Costat (1990) soft ware.

RESULTS

The effect of four levels of potassium fertilization (0, 100, 150 and 200 kg/feddan) on the population density of *M. persicae*, *A. gossypii*, *A. craccivora*, *B. tabaci* and *Empoasca* sp. infesting potato plants were studied during the two successive seasons of 2007/08 and 2008/09.

Obtained data illustrated in Figures (1 and 2) showed that the highest population densities of these pests occurred without any potassium fertilization (control) followed by using of 100 and 150 kg/fed, respectively. Lowest population densities were recorded when 200 kg/fed were used.

A. gossypii and *M. persicae* were the most affected pests by potassium fertilization, where the correlation coefficient values between their populations and potassium fertilization were negative and highly significant during the first ($r = -0.997^{**}$ and -0.995^{**}) and second ($r = -0.998^{**}$ and -0.991^{**}) seasons (Table, 1). *A. craccivora* and *Empoasca* sp. were affected by the potassium fertilization with relatively moderate values; where the correlation coefficient values between their populations and potassium fertilization were negative and significant during the first ($r = -0.989^{*}$ and -0.988^{*}) and second ($r = -0.969^{*}$ and -0.988^{*}) seasons. *B. tabaci* was the least affected pest by potassium fertilization; where the calculated r-values were -0.971^{*} and -0.890^{ns} during the first and second season, respectively.

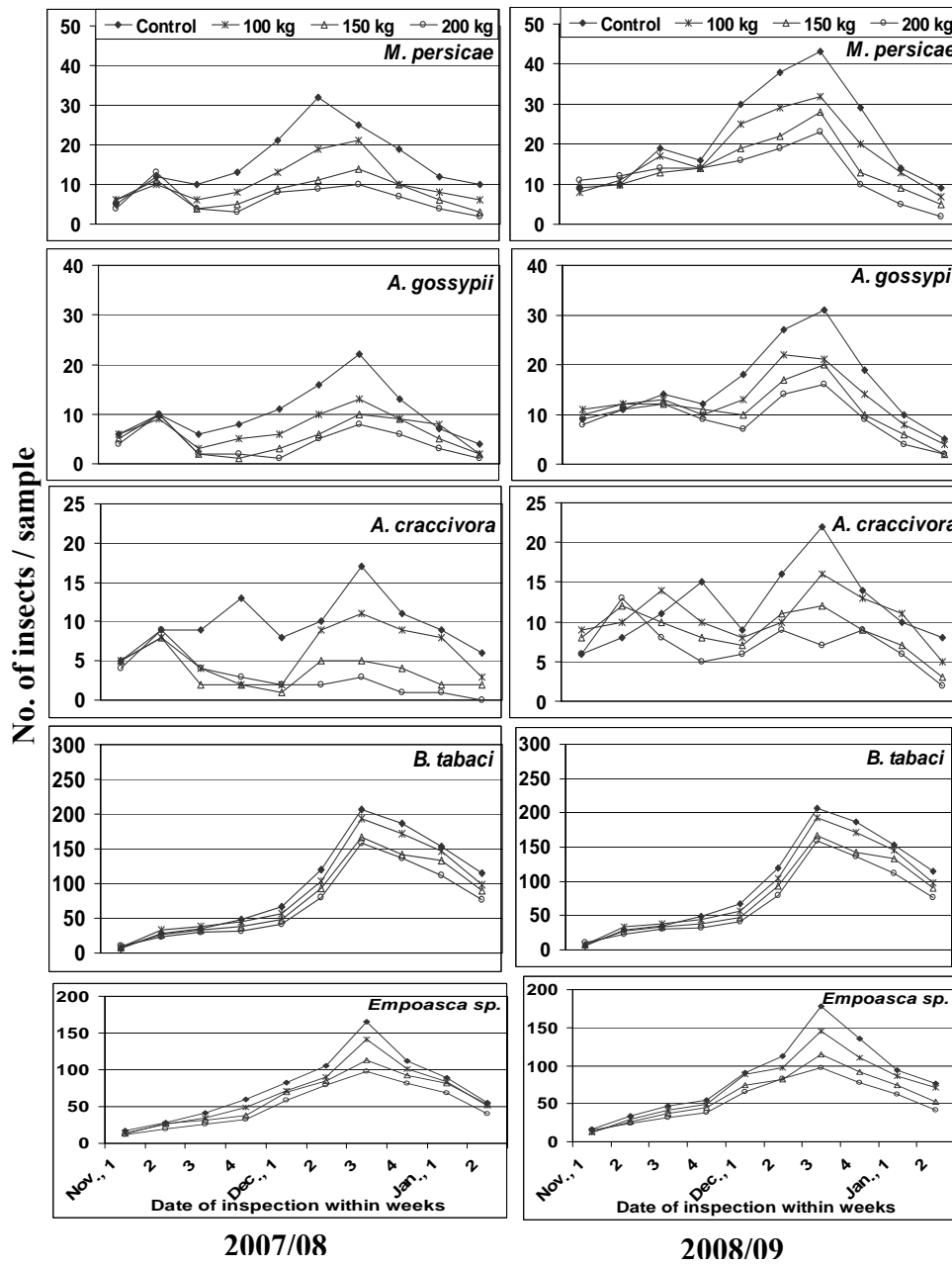


Fig. 1: Population fluctuations of homopterous pests infesting potato plants at different levels of potassium fertilization during 2007/08 and 2008/09 seasons.

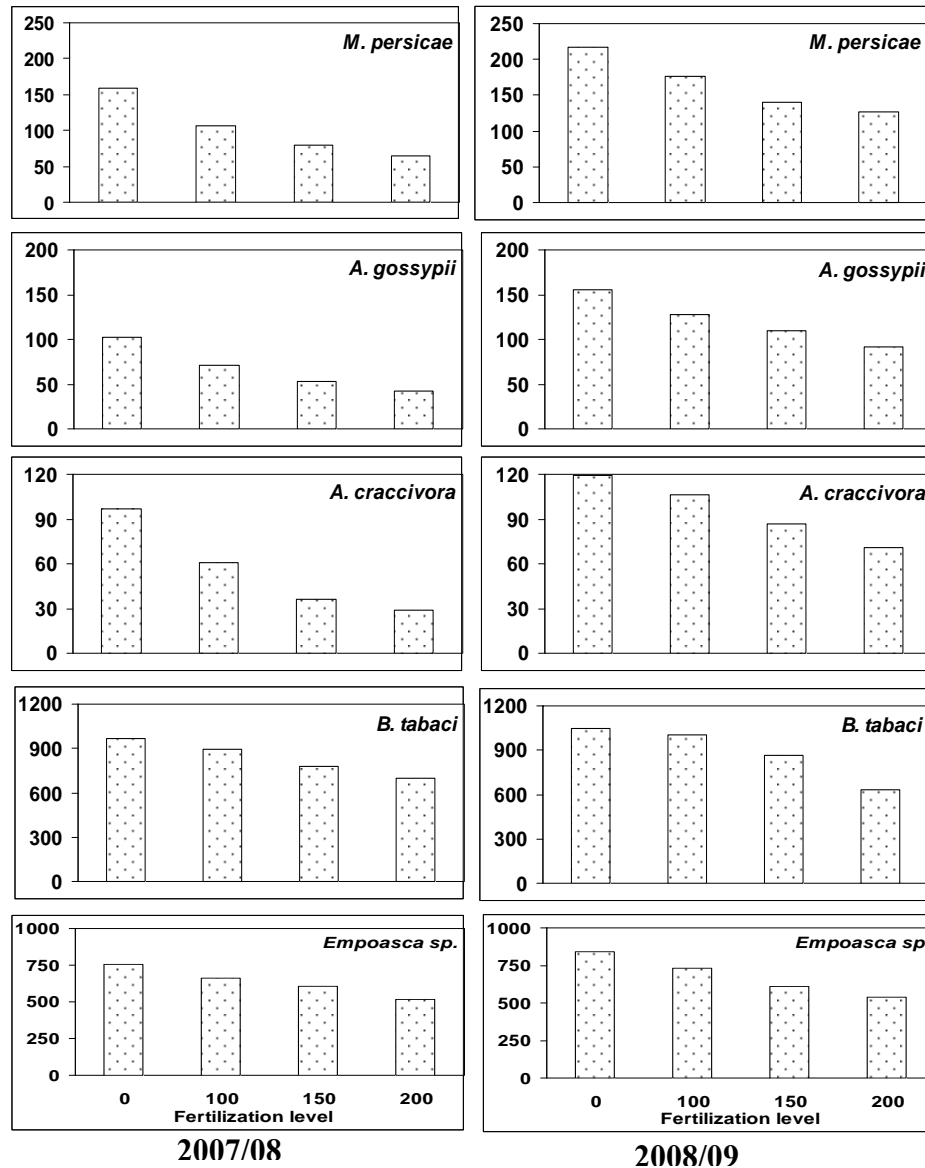


Fig. 2: Total number of homopterous pests infesting potato plants at four potassium fertilization levels (0, 100, 150, 200 kg/fed.) during 2007/08 and 2008/09 seasons.

Table 1: Correlation coefficient and regression values between homopterous pests' populations and potassium fertilization levels in potato fields during 2008 and 2009 seasons.

Homopterous pest	2007/08			2008/09		
	r	a	b	r	a	b
<i>M. persicae</i>	-0.995**	157.0	-0.49	-0.991**	218.0	-0.47
<i>A. gossypii</i>	-0.997**	102.0	-0.31	-0.998**	157.0	-0.32
<i>A. craccivora</i>	-0.989*	95.8	-0.36	-0.969*	123.0	-0.24
<i>B. tabaci</i>	-0.971*	987.0	-1.35	-0.890	1105.0	-1.94
<i>Empoasca sp.</i>	-0.988*	765.0	-1.16	-0.988*	854.0	-1.55

The obtained data revealed that there is a relationship between the tested pests' densities and potassium fertilization levels. However, each increase in potassium fertilization level results a reduction in each pest population density.

As shown in Figures (3 and 4), epidermal thickness increased as the potassium fertilization level increased. At the levels of 0, 100, 150 and 200 kg/feddan the epidermal thickness was 2.50, 3.33, 3.60 and 4.45 micron, respectively.

Statistically, epidermal thickness was significantly increased by potassium fertilization level increase. Each increase of potassium fertilization by 1 kg/feddan epidermal thickness increases by 0.01 microns (Fig. 3).

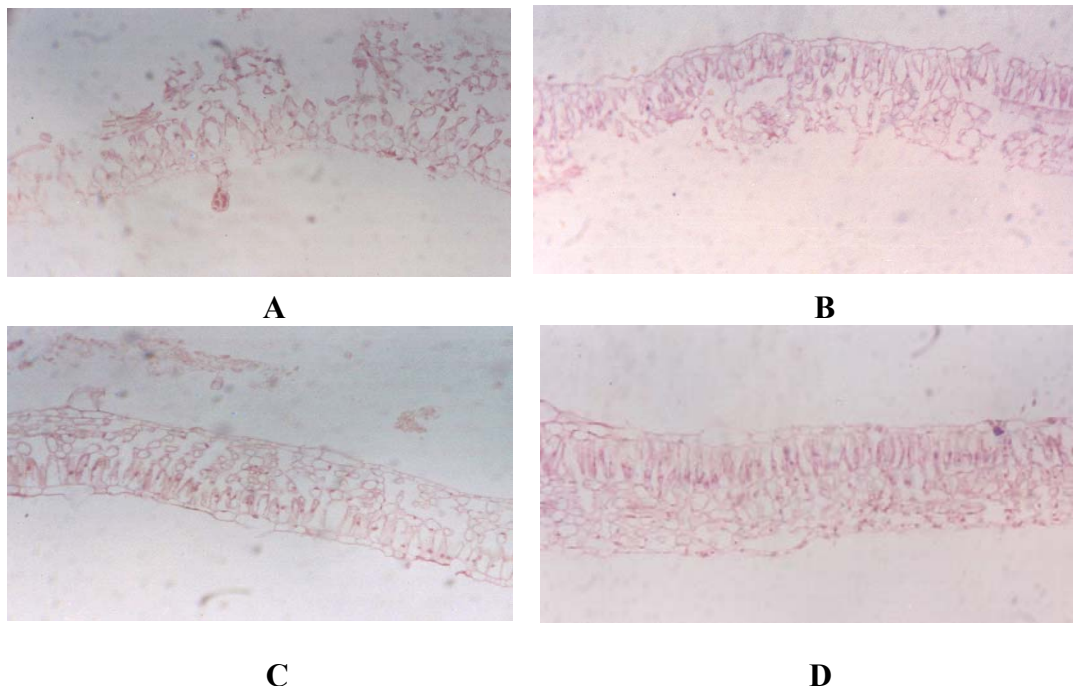


Fig. 3: Epidermal thickness of potato leaves under 0 (A), 100 (B), 150 (C) and 200 (D) kg potassium fertilization / feddan treatments.

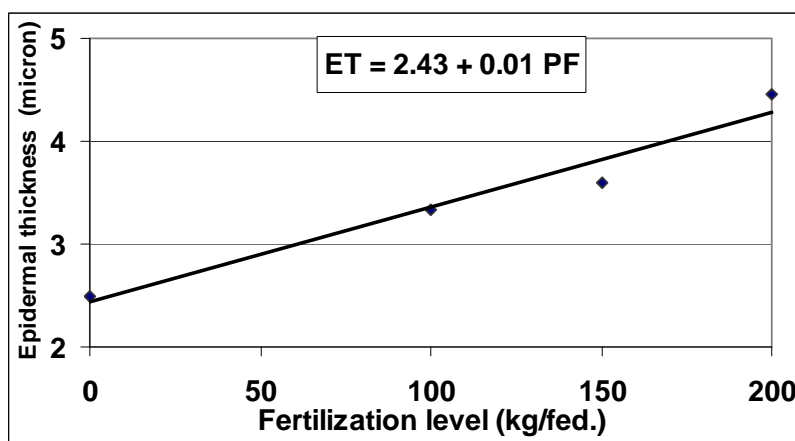


Fig. 4: Effect of potassium fertilization (PF) on the epidermal thickness (ET) of potato plants.

DISCUSSION

The present results revealed that potato plants at the studied location was infested with *M. percicae*, *A. gossypii*, *A. craccivora*, *B. tabaci* and *Empoasca* sp.. These pests were recorded on potato plants by Parihar *et al.* (1996) and Kuroli (2001).

On another hand, *M. percicae*, *A. gossypii*, *A. craccivora*, *B. tabaci* and *Empoasca* sp. populations were most at zero potassium fertilization in comparison with 100, 150 and 200 kg/feddan, respectively. These results are in same line of

Hegab (2001), El-Gindy (2002), El-Gindy (2006) and El-Gindy *et al.* (2006). They mentioned that as the increase of potassium fertilization the population density of many homopterous pests decreased. The present results revealed that population density of the tested pests could be predicted according to the potassium fertilization level.

Results concluded that increase of potassium fertilization level increase the thickness of epidermal leaves. This consequently suppressed the ability of homopterous insect mouth parts to pierce the leave cells of potato plants to feed. Therefore, the potassium fertilization could be recommended as agent of integrated pest management against homopterous pests.

Similar conclusion was obtained by Hegab (2001), El-Gindy (2002), El-Gindy (2006) and El-Gindy *et al.* (2006). They found that potassium fertilization increased the thickness of epidermal leaves and suppressed the infestation of several piercing and sucking insect pests on cereal, legumes and maize plants.

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ARABIC SUMMARY

وفرة بعض آفات البطاطس متشابهة الأجنحة وتأثرها بمستوى التسميد البوتاسي

محمد عبد الوهاب الجندي - رشا محمد الرفاعي - إفتخار السيد أبو حطب
معهد بحوث وقاية النباتات - مركز البحوث الزراعية - وزارة الزراعة

أجريت هذه الدراسة في عروة البطاطس الشتوية من موسمي ٢٠٠٧/٢٠٠٨ و ٢٠٠٨/٢٠٠٩ بمحافظة الدقهلية. حيث تم تقييم تأثير أربعة معدلات من التسميد البوتاسي (صفر، ١٠٠، ١٥٠، و ٢٠٠ كجم/فدان) على تعداد كل من من الخوخ الأخضر، من القطن ومن البقوليات، الذبابة البيضاء ونطاطات الأوراق بحقول البطاطس. وأوضحت النتائج ان أعلى تعداد من هذه الآفات سجل في حالة عدم التسميد البوتاسي يليه التعداد في حالة المعاملة ب ١٠٠، ١٥٠، و ٢٠٠ كجم/فدان، على التوالي. كما تبين أن من القطن ومن الخوخ الأخضر أكثر هذه الآفات تأثراً بالتسميد البوتاسي يليهما كل من البقوليات ونطاطات الأوراق، بينما وجد أن الذبابة البيضاء هي أقلهم في التأثر بالتسميد البوتاسي. ومن ناحية أخرى أظهرت نتائج الدراسة أن سمك طبقة بشرة ورقة نبات البطاطس يزداد بدرجة معنوية بزيادة التسميد البوتاسي.