Annals of Agric. Sci., Moshtohor **ISSN 1110-0419**
Vol. 56(1) (2018), 95 -100 **http://aasj.bu.edu.eg/index.php**

Relative susceptibility of certain recommended maize cultivars to infestation by *Sesamia cretica* Led. and *Ostrinia nubilalis* Hub. in relation to the sowing date.

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Abstract

The present study was conducted in Experimental Farm, Faculty of Agriculture, Moshtohor, Qaliubiya Governorate, Egypt to evaluate the susceptibility of thirteen of maize cultivars against the natural infestation by *Sesamia cretica* Led and *Ostrinia nubilalis* Hub. during 2014 and 2015 seasons. The experiment was designed at randomized complete blocks (R.C.B.D). Moreover, the influences of two sowing dates (May and June 20th) were also tested. The highest perforated leaves and dead heart rates were recorded for SC30N11 cultivar (8.0%, 7.4%) and (2.5%, 1.7%) for the two seasons, respectively. While, TWC Maged 7 cultivar recorded the least infestation rate showed (2.7%, 2.0%) and (0.7%, 0.7%) for both seasons, respectively. On the other hand, the remaining maize cultivars showed moderate infestation rates by *S. cretica*. As for *O. nubilalis* infestation, SC30b74 cultivar showed the highest mean number of holes / 10 plants (18.67 and 22.67) for two seasons of study, respectively. On the contrary, SC 3062 cultivar was the highest resistant one among all the tested maize cultivars where the recorded mean numbers of holes were (2.67 and 6.33) during two successive seasons, respectively. As for the relationship between the sowing date and infestation, maize plants were sown on May 20th received the least infestation rate by *S. cretica* while, those were sown on June 20th harbored the highest infestation. Also, plants were sown in May (recommended date) received the lowest number of larvae and subsequent holes of *O. nubilalis*. The determination of the susceptibility or resistance rates in the different varieties is an essential prerequisite to the maize breeder seeking the development of varieties that could resist or tolerate *S .cretica* or *O. nubilalis* infestations.

Keywords: susceptibility, maize cultivars, corn, *Sesamia cretica* , *Ostrinia nubilalis*

Introduction

Maize (*Zea mays* L.) is an important cereal crop in Egypt and several countries of the world. It represented an important source of animal and poultry feeding also as human food. Maize is ranked as the third cereal crop in the world (F.A.O 1988).

In Egypt, maize plants are usually attacked and injured by many insect pest species. The pink stem borer, *Sesamia cretica* Led. and the European corn borer, *Ostrinia nubilalis* Hub. are considered the major serious pests affecting maize productivity (Abd El-Rahman *et al*., 1984 and Aguiler *et al*., 1987). Maize insect pests cause great yield losses. James (2003) stated that 9% of the world maize crop is lost annually due to damage caused by insect pests. Oloyede *et. al.* (2011) found that grain yield losses by *S. calamistis* infestation ranged from 25-30%. Moreover, results reported by Semeada (1988) proved a positive and highly significant relationship between percentage of yield reduction and *S. cretica* infestation rates.

One of the recent trends in insect control is cultivating resistant or at least tolerant varieties for pest control without causing any environmental pollution. The first step in this trend is to evaluate different strains and varieties (Galal *et. al.*, 1980 and Awadallah *et. al*., 1982) for their liability to borers attack. It is known that different maize varieties, if grown under certain conditions, those will show different reaction against borers infestation. Therefore, the present investigation was dedicated to study on relative susceptibility of certain recommended maize cultivars to infestation by *S. cretica* Led. and *O. nubilalis* Hub. in relation to the sowing date.

Materials and methods

Two experiments were carried out to determine the relative susceptibility of thirteen maize cultivars to infestation by the corn borers, *S. cretica* Led. and *O. nubilalis* Hub. during 2014 and 2015 maize seasons. These experiments were done in the experimental farm of the Faculty of Agriculture, Moshtohor, Qaliubiya Governorate.

The area of each season was 1/2 feddan cultivated with either of 13 maize cultivars at two sowing dates, May and June 20th. The experimented cultivars were TWC Maged 7, SC pioneer 30k8, SC pioneer 30k9, SC pioneer 30b74, SC Hyteck 2066 yellow, SC 176 yellow, SC pioneer 3737 yellow, SC Hyteck 2031, SC 7071, SC pioneer 3062, SC 131, SC pioneer 30N11and SC Moshtohor 101 yellow. Each cultivar was sown in three replicates, each of 3.5 m. long and 3.0 m. wide. All plots were arranged in a complete block design. The plants were left for natural infestation. The normal agricultural practices were followed except for the absence of any pesticidal treatment.

Sampling started 15 days after sowing. Ten plants were examined from two crossing diagonal directions from each replicate, the number of perforated leaves and dead hearted plants were counted. The percentages of infestation by *S. cretica* were calculated according to the following formula:

$$\% \text{ of infestation} = \frac{\text{No. of infested plants}}{\text{Total no. of inspected plants}} X100$$

At harvest time, a similar sampling technique was followed in the second date of plantation for *O. nubilalis* infestation. Ten plants free from *S. cretica* infestation were randomly chosen from each replicate and dissected carefully as well as numbers of holes and those of larvae were counted and recorded.

Assessment of cultivars susceptibility was adopted according to the infestation rating system proposed by Semeada (1988) and Metwally (1988).

Statistical analysis

Obtained data were subjected to statistical analysis using SAS 9.0 software and least significant difference (LSD) for comparison between means calculated from each treatment.

Results and Discussion

1-The pink sugarcane borer, *Sesamia cretica*:

The mean percentages of perforated leaves and mean percentages of dead hearted plants by *S. cretica* for the thirteen tested maize cultivars planted in two different sowing dates are shown in Tables (1&2).

The results indicated that infestations with *S. cretica* (mean of perforated leaves) were comparatively high and ranged from (2.7 to 8.0%) during 2014 season and from (2.0 to 7.4%) during 2015 maize season. Also, during first season, SC 3062, SC 131 and SC 30N11 cultivars received the highest infestation rates (7.3, 8.0 and 8.0%, respectively). On the contrary, TWC Maged 7, SC30k9, SC176 and SC 30 k8 gave the lowest infestation rates (2.7, 3.4, 4.0 and 4.0%, respectively). The remaining cultivars (SC 3737, SC 30b74, SC 2066, SC 2031, SC 7071 and SC 101) represented intermediates infestation rates (4.3, 4.7, 5.0, 6.0, 6.7 and 7.0%, respectively). The same trend was detected during the second season.

Results in the same tables indicated also, that all tested maize cultivars differed significantly in their infestation percentages in both seasons.

As for the effect of sowing date on the rate of infestation by *S. cretica*, maize cultivars sown in May 20th harbored the least infestation (2.7 and 2.2) while those sown in June 20th received the highest infestation rates (8.9 and 8.1 for both seasons, respectively). These results agree with those obtained by El- Sappagh (1999) who stated that, June plantation received more infestation by corn borers than May plantation where the mean of infestation percentages were (11.4 & 4.8) and (12.0 & 3.1) during 1996 and 1997, respectively. Metwally (1976) found that, May plantation received the least infestation by *S. cretica* than maize plants sown in June. On the other hand, these results disagree with those obtained by Abd El-Rahim *et al.* (1991) they found that maize cultivars (SC107, DC204, DC215, 3W310, Comp.45, G.2 and SC10) which were sown at Sakha region, Kafr El- Sheikh Governorate in May received more infestation by *S. cretica* than those were sown in June or July.

Table 1. Mean infestation percentages of *S. cretica* as perforated leaves and dead heart of the tested maize cultivars of two sowing dates in 2014.

Maize cultivars	% mean of perforated leaves		Two dates mean	% mean of dead hearted plants		Two dates mean
	First sowing date	Second sowing date		First sowing date	Second sowing date	
TWC Maged 7	2.0 bc	3.3 b	2.7 b	0.7 b	0.7	0.7 b
SC30 k9	2.7 abc	4.0 ab	3.4 ab	2.0 ab	1.3	1.7 ab
SC 176	2.7 abc	5.3 ab	4.0 ab	1.3 ab	2.0	1.7 ab
SC 30 k8	2.7 abc	5.3 ab	4.0 ab	0.7 b	1.3	1.0 ab
SC 3737	3.3 ab	5.3 ab	4.3 ab	1.3 ab	0.7	1.0 ab
SC 30b74	1.3 c	8.0 ab	4.7ab	1.3 ab	1.3	1.3 ab
SC 2066	2.0 bc	8.0 ab	5.0 ab	2.7 ab	١.٣	٢.٠ ab
SC 2031	2.0 bc	10.0 ab	6.0 ab	٠.٧ b	١.٣	١.٠ ab
SC 7071	2.7 abc	10.7 ab	6.7 ab	٠.٧ b	١.٣	١.٠ ab
SC 101	2.7 abc	11.3 a	7.0 ab	1.3 ab	٢.٠	١.٧ab
SC 3062	3.3 abc	11.3 a	7.3 ab	2.0 ab	1.3	1.7 ab
SC 131	5.3 a	10.7 ab	8.0 a	٢.0 ab	١.٣	١.٧ab
SC 30N11	3.3 abc	12.7 a	8.0 a	3.3 a	2.0	2.5 a
Mean	2.7 b	7.3 a	5.5	1.54	1.37	1.46
LSD at 5%	2.7	8.9	4.7	2.2	1.8	1.6

L.S.D at 5% between

a) Varieties: 4.7
b) Sowing dates: 0.7

a) Varieties: 1.6
b) Sowing dates: nonsignificant

Significant differences were detected in percentages of perforated leaves between all tested maize cultivars under study in both seasons. Also, there are significant differences were found between two sowing dates in consideration of the L.S.D. values at 5% level (0.7 and 0.8), respectively, these finding agree with Farag *et al*.(1991).

Concerning to the dead hearts symptom, data revealed that percentages of dead hearted plants ranged from 0.7 to 2.5 during 2014 season and from 0.7 to 1.7 during 2015 season.

TWC Maged 7, tended to receive the least of attack (0.7) while, SC 30N11 harbored the greatest infestation (2.5) during first season. During the second season, TWC Maged 7, SC30 k 8, SC 3737, SC 2031 and SC 7071 varieties had the lowest infestation rate (0.7%), while, SC 2066 and SC 30N11 showed the highest infestation rate showed (1.7%) during second season. The remaining cultivars (SC 30K 9, SC 176, SC 30b74, SC 131, SC 101 and SC 3062) showed intermediate infestation rates.

Table 2. Mean infestation percentages of *S. cretica* as perforated leaves and dead heart of the tested maize cultivars of two sowing dates in 2015.

Maize cultivars	% mean of perforated leaves		Two dates mean	% mean of dead heart plants		Two dates mean
	First sowing date	Second sowing date		First sowing date	Second sowing date	
TWC Maged 7	0.7 b	3.3 b	2.0 b	0.7 b	0.7	0.7
SC30 k9	2.7 ab	4.0 b	3.4 ab	1.3 ab	0.7	1.0
SC 176	1.3 ab	6.7 ab	4.0 ab	1.3 ab	1.3	1.3
SC 30 k8	0.7 b	8.0 ab	4.4 ab	0.7 b	0.7	0.7
SC 3737	2.7 ab	6.7 ab	4.7 ab	0.7 b	0.7	0.7
SC 30b74	0.7 b	9.3 ab	5.0 ab	1.3 ab	0.7	1.0
SC 2066	2.7 ab	7.3 ab	5.0 ab	2.7 a	0.7	1.7
SC 2031	2.7 ab	9.3 ab	6.0 ab	0.7b	0.7	0.7
SC 7071	3.3ab	9.3 ab	6.3 ab	0.7 b	0.7	0.7
SC 101	0.7 b	12.7 a	6.7 a	1.3 ab	1.3	1.3
SC 3062	2.7 ab	10.7 ab	6.7 a	0.7 b	1.3	1.0
SC 131	٤.٧ a	9.3ab	7.0 a	2.0 ab	0.7	1.4
SC 30N11	2.7 ab	12.0 ab	7.4 a	2.7 a	0.7	1.7
Mean	2.20 b	8.40 a	5.30	1.30	0.84	1.1
LSD at 5%	3.5	8.1	4.4	1.5	1.1	1.2

L.S.D at 5% between

a) Varieties: 4.4
b) Sowing dates: 0.8

a) Varieties: nonsignificant
b) Sowing dates: nonsignificant

It could be also noticed that the first sowing date received significantly, more infestation by *S. cretica* as dead heart symptom. However, the second sowing date represented the superior cultivation had the least infestation and bearing the lowest levels of attack as shown in Table (1&2).

There were, also, slight significant differences between all tested maize cultivars of the two sowing dates of both seasons.

Generally, the cultivar SC 30N11 had the highest mean percentages of dead heart (2.5 and 1.7) during both seasons, respectively.

The lowest mean percentages of dead heart and total infestation were observed in TWC Maged 7 (0.7) during first season but, most of tested maize cultivars showed the low mean percentages of dead heart during the second season Tables (1&2)**.**

In general, the tested maize cultivars may be classified according to their response to *S. cretica* infestation ascending to 3 groups:

Group (1): Highly resistant; include one cultivar TWC Maged 7 where average infestation in that cultivar amounted (2.7 and 2.0) for the two studied seasons 2014 and 2015, respectively.

Group (2): Relatively resistant; include that cultivar SC 30K9 where average infestation 3.4 for both growing maize seasons.

Group (3): Susceptible; include the remaining tested maize cultivars where average infestation rates ranged between (4.0 to 8.0) and (4.0 to 7.4) during the two seasons, respectively.

From the mentioned data in Tables (1&2) it could be concluded that TWC Maged 7 and SC 30k9 may be fairly, considered as candidate cultivars to replace the other cultivars in the near future.

2-The European corn borer *Ostrinia nubilalis*:

Mean number of holes and mean number of larval content caused by *O. nubilalis* on the experimented maize cultivars planted in two different sowing dates

during both maize seasons, are presented in Table (3). Statistical analysis in respect to the mean number of *O. nubilalis* holes clarified significant differences during both growing maize seasons taking into consideration the L.S.D value at 5% level (8.72 and 10.19) during both seasons, respectively.

In general, the tested cultivars may be categorized in ascending order according to the number of holes to 5 groups as follows:

a- highly susceptible: SCb74 and SC2066; b- moderately susceptible: SC 131, and SC 7071; c- Susceptible: SC 176 and TWC Maged 7; d- moderately resistant: SC 101, SC 30K9, SC 30N 11, SC 30K8, SC 3737 and SC 2031 and e- highly resistant including the cultivar SC 3062 which showed the lowest number of holes during the first season. The same trend was detected during the second season.

The cultivar SC 30b74 demonstrated the highest susceptibility to *O. nubilalis* infestation as it showed the mean numbers of (18.67 and 22.67 holes/10 plants) during both seasons, respectively. On the other hand, SC 3062 cultivar considered the highest resistant against *O. nubilalis* (2.67 and 6.33 holes/10 plants). The remaining maize cultivars ranked in an intermediate position.

The analysis of variance of the tested maize cultivars considering the mean number of larvae/ 10 plants indicated significant differences taking into consideration the L.S.D values at 0.05 levels.

Table 3. Mean numbers of holes and number of present larvae/10 plants of the tested maize cultivars during 2014/2015 seasons.

Maize cultivars	Mean no. of holes/10 plants		Mean no. of larvae /10 plants	
	2014	2015	2014	2015
SC 3062	2.67 c	6.33 b	2.00 cd	3.33 d
SC 2031	5.67 bc	9.33 bc	1.67 d	3.33 d
SC 101	6.67 bc	10.00 b	2.00 cd	4.00 cd
SC 3737	8.00 bc	11.33 b	2.33 bcd	4.00 cd
SC 30 k8	8.00 bc	11.33 b	2.00 cd	3.67 cd
SC 30 N 11	8.33 bc	11.67 b	2.33 bcd	4.00 cd
SC 30 k 9	8.33 bc	13.33 ab	2.00 cd	3.67 cd
TWC Maged 7	10.67abc	14.67 ab	2.33 bcd	4.33 cd
SC 176	11.33 abc	18.33 ab	2.33 bcd	4.33 cd
SC 7071	13.33 ab	17.33 ab	2.33 bcd	4.67 bc
SC 131	14.33 ab	17.67 ab	3.00 bc	4.67 bc
SC 2066	18.33 a	22.33 a	3.33 b	5.67 ab
SC 30b74	18.67 a	22.67 a	4.67 a	6.67 a
Mean	10.33	14.33	2.49	4.33
LSD at 5% level	8.72	10.49	1.11	1.07

Mean followed by the same letters are not significantly differed at 5% level

The highest means in number of larvae (4.67 and 6.67 larvae/ 10 plants) were found in SC 30b74 maize cultivar while, the lowest (1.67 and 3.33) were detected in SC 2031 during both seasons, respectively. The remaining maize cultivars occupied an intermediate position in this respect.

Regarding to the effect of sowing dates, data indicated that, June plantation received more infestation by *O. nubilalis* than plants planted in May which received very lowest of infestation. These findings agree with Farag *et. al*. (1991), Metwally (1976) and Abd EL-Rahim *et. al*. (1991).

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القابلية النسبية لبعض أصناف الذرة الشامية الموصى بها للاصابة بدودة القصب الكبيرة ودودة الذرة الأوربية وعلاقة ذلك بميعاد الزراعة

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تم دراسة قابلية ثلاثة عشر صنفا من أصناف الذرة الشامية خلال موسمى ٢٠١٤ و ٢٠١٥ للإصابة بدودة القصب الكبيرة ودودة الذرة الأوربية تحت الظروف الطبيعية فى المزرعة التجريبية بكلية الزراعة بمشتهر بمحافظة القليوبية .كما تم دراسة تأثير ميعادين للزراعة (مايو و يونيو) على معدل إنتشار الاصابة بالافتين وأوضحت النتائج مايلى:

أظهرالصنف (هجين ثلاثى ماجد ٧) مقاومة عالية للإصابة بدودة القصب الكبيرة حيث كان متوسط معدل الإصابة (٢.٠ و٢.٧ %) على التوالى خلال موسمى الدراسة.

كما وجد أن الصنف ٣٠ ك ٩ أظهر مقاومة نسبية للإصابة حيث كان معدل الإصابة ٣.٤ % خلال موسمى الدراسة .

كذلك أظهرت النتائج أن بقية الأصناف المختبرة كانت متوسطة حساسية للإصابة حيث تراوح معدل الإصابة (٤.٠ الى ٨.٠ %) و (٤.٠ الى ٧.٤%) خلال موسمى الدراسة على التوالى.

كما أوضحت النتائج أن نباتات الذرة الشامية التى زرعت فى مايو (الميعاد الموصى بة) تعرضت لأقل نسبة إصابة بدودة القصب الكبيرة بمقارنتها بمثيلتها التى زرعت خلال شهر يونيو.

كما أوضحت النتائج أن نباتات الذرة الشامية التى زرعت فى أول مايو كانت تحتوى على أعداد قليلة جدا من الثقوب وبرقات دودة الذرة الاوربية بمقارنتها بتلك التى زرعت خلال شهر يونيو.