

PRELIMINARY STUDIES ON APHID POPULATION ON CERTAIN MAIZE CULTIVARS AND ITS RELATION TO YIELD

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ABSTRACT

Field experiments were carried out at Sakha Agric. Res. Station, in 1999 season to evaluate the population density of aphids on nine maize cultivars (SC 10, SC 120, TWC310, TWC320, TWC321, TWC322, TWC323, TWC324, and Giza 2) and its relation to the yield.

The obtained results revealed that aphid numbers were more on the terminal leaf than leaf of ear, bottom leaf and tassel for all the tested cultivars. Based on the general mean of aphids throughout the whole growing season Giza 2 was more susceptible to aphid infestation than the other cultivars, while SC10 was the least susceptible. Also, it can deduced that aphid number-yield loss relationship was not clear, since the highest yield loss was obtained in case of SC10 in spite of receiving the lowest number of aphids. On the other side, Giza 2 that exhibited the highest number of aphids recorded an increase in yield loss. But, in case of TWC320, 321, and 323, the increase in yield loss was correlated with the high number of aphids on the plant tassel. Both, SC120 and TWC310 cultivars approved to be the more tolerance cultivars to aphid infestation and recorded the lowest yield losses.

INTRODUCTION

Maize, *Zea mays* L. is one of the most important food crop in the world. Great efforts have been done to improve and increase the production to cover the increasing demand year after year. In Egypt, this crop was planted in about 1.882.000 feddans in season in 1998 with an average yield of 21.4 ardab/fed. According to 1998 season statistic. (FAO, 1998) Egypt.

Aphids, particularly corn leaf aphid, *Rhopalosiphum maidis* (Fitch.) and *Rhopalosiphum padi* (L.) are the most important insect pests attacking maize plants in the field causing considerable yield reduction (Salem *et al.*, 1986, Abd El-Rahim *et al.*, 1991 and Mansour *et al.*, 1994). The aphid damage to maize is a result of sucking the plant sap and excretion of honeydew which accumulate on the pollen grains of the male tassel spikelets. Aphids, also act as vector of plant viral diseases such as maize dwarf mosaic virus (Minks and Harrewijn, 1989).

In general, the chemical control of insect pests causes serious environmental hazards. Therefore, it is strictly necessary to select tolerant or resistant varieties as one of the simplest and useful tactic in integrated pest management programs (Dent., 1991). Also, Horber (1972) pointed out that resistant varieties may improve the effectiveness of insecticides.

So, the present work was conducted to evaluate the population density of aphids on nine maize cultivars grown under field conditions at Kafr El-Sheikh Governorate as well as its relation to the yield.

MATERIALS AND METHODS

The present investigation was carried out at the Farm of Sakha Agricultural Research Station, Kafr El-Sheikh to evaluate the population density of aphids on nine maize cultivars as well as its relation to the yield

during 1999 season. The tested cultivars were the single cross 10 and 120. Three way cross 310, 320, 321, 322, 323 and 324 and an open pollinated plant Giza 2. The experimental area was divided into plots, each of 1/100 fed. (6 m long and 7 m apart). Every tested cultivar was replicated three times in a complete randomized block design. The seeds of the tested cultivars were sown on 15th June, 1999. Normal agricultural practices were carried out without any insecticidal treatment throughout the whole growing season.

To assess aphid population on the involved cultivars. Samples were collected at random from each plot when tassel start to emerge (in 15th, 25th August and 4th September 1999, respectively). Each sample consists of 10 plants/plot. Counting of aphids was made according to El-Hariry (1979). The mean number of aphids was calculated on one square inch of terminal, middle and lower leaves of each plant, in addition to tassels.

To estimate the yield loss due to aphid infestation, malathion 57% was applied weekly in half of each cultivars replicates to avoid any aphid infestation. At maturity, ears of each plot were harvested and left to dry to constant weight. The seeds were weighted and the percentage of yield loss was calculated according to Walker (1983):

$$W = \frac{m - y}{m} \times 100$$

Where: W is the percentage of yield loss, m is the yield in the absence of aphid and Y is the yield in the presence of aphid infestation.

RESULTS AND DISCUSSION

1. The population density of aphids on different maize cultivars:

During the course of study, the corn leaf aphid, *Rhopalosiphum maidis* (Fitch) and the bird cherry aphid, *Rhopalosiphum padi* (L) were the most dominant aphid species infesting maize plants. Data shown in Fig. (1) illustrated the population density of aphids on the tested maize cultivars. The results revealed that the tested cultivars were completely free of infestation in the first sampling date (Aug. 15th) except for Giza 2, TWC320 and 322, since the first signs of aphid infestation appeared in low number on the terminal leaf only with a mean number of 1.66, 1 and 1 aphids/inch² respectively. After that, the population appeared in low number in the second sampling date (Aug. 25th) on the cultivars and the terminal leaf received the highest number, while the lowest one appeared on the ear leaves. In the third sampling date (Sept. 4th), the population increased on tassels only and decreased on the other parts of the plant.

Data obtained in Table (1) clear one mean number of aphids on the different parts of the plant throughout the season. It was observed that aphid numbers were more on the terminal leaf than the other parts of the plant for all the tested cultivars. This means that the terminal leaf of the plant represents a good shelter of aphids compared with the other parts.

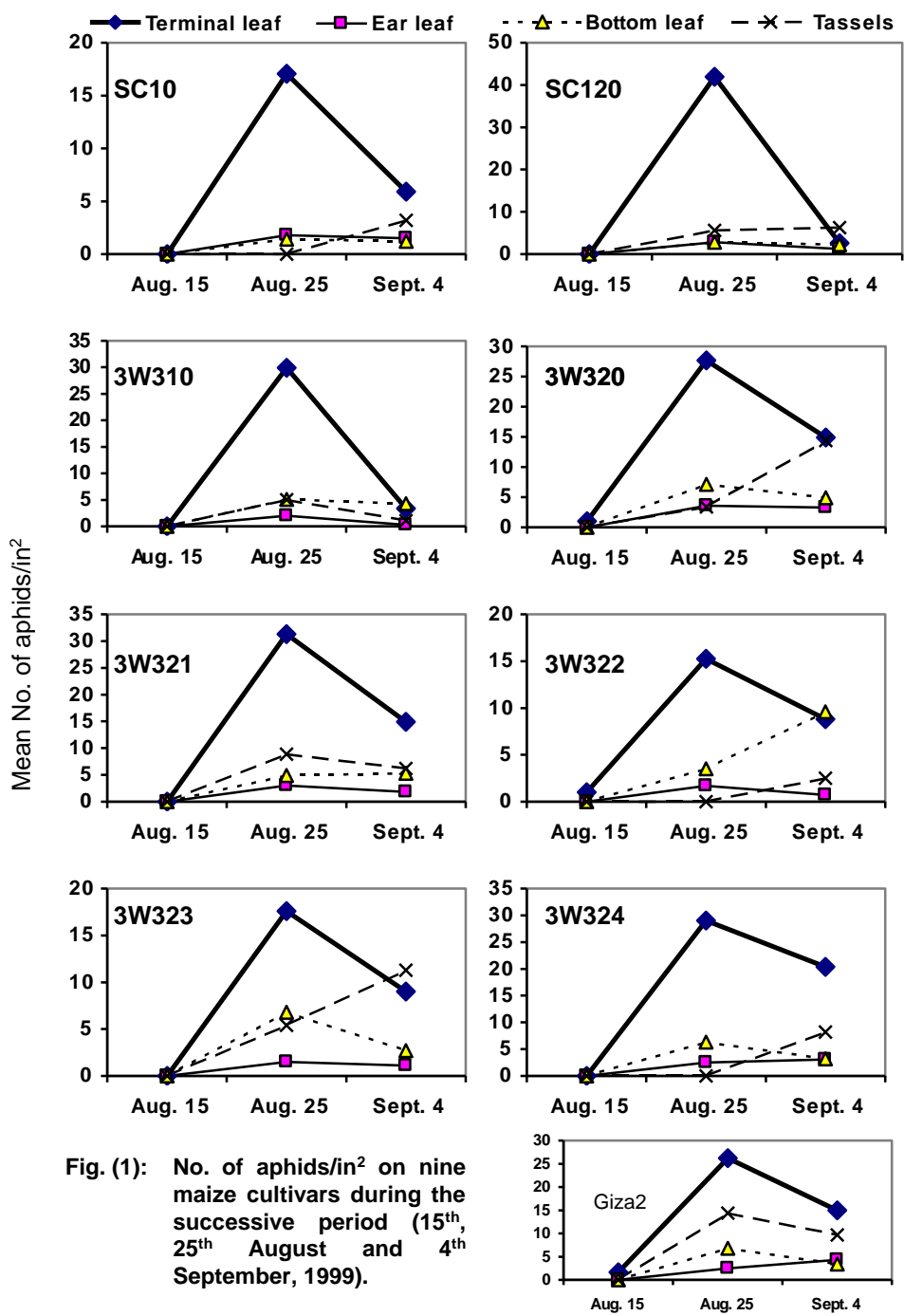


Fig. (1): No. of aphids/in² on nine maize cultivars during the successive period (15th, 25th August and 4th September, 1999).

Table (1): Mean number of aphids/sq. inch. on the different parts of maize cultivars during 1999 season.

Cultivar	Terminal	Ear	Bottom	Tassel	General mean
SC10	7.7 a	1.1 a	0.9 a	1.1 a	2.7 a
SC120	14.8 ab	1.3 a	1.7 a	4.0 a	5.5 a
TWC310	11.1 ab	0.9 a	3.1 a	2.0 a	4.3 a
TWC320	15.5 ab	2.3 a	4.0 ab	5.9 a	6.7 ab
TWC321	15.3 ab	1.6 a	3.4 ab	5.0 a	6.3 ab
TWC322	8.4 a	0.8 a	4.4 ab	0.8 a	3.6 a
TWC323	8.9 a	0.9 a	3.2 a	5.6 a	4.7 a
TWC324	16.5 ab	1.9 a	3.2 a	2.7 a	6.1 a
Giza 2	17.6 ab	2.3 a	3.4 ab	8.0 ab	7.8 ab
L.S.D. (P = 0.05)	8.1	1.6	2.3	5.6	3.4

Means followed by a common letter are not significant different at the 5% level DMRT.

Concerning aphid numbers on the terminal leaf, there were relatively significant variations between the tested cultivars. In case of the bottom and general mean of aphid infestation. Since the highest number was recorded on TWC320 and 322 with mean of 4 and 4.4 aphids/sq./inch, respectively. While SC10 harbored significantly the lowest number of aphids being of 0.9 aphids/sq./inch. The reverse was noticed in case of ear leaf infestation, however, no significant between all tested cultivars. The rest cultivars were moderately infested without significant differences. However, the lowest number of aphids on bottom leaves of SC10 was due to the natural dryness of these leaves before the other cultivars. Within the same habitat different insect species usually show different dispersion Patterns (Kuno, 1963). These differences can arise from several biological causes may be because it reproduces more or only certain parts of the habitat are suitable for it. So, the terminal leaf may be the suitable part of maize plants for aphid reproduction.

Based on the general mean of aphids, Giza 2 harbored significantly the highest number being of 7.8 aphids, while SC10 exhibited the lowest number with a mean of 2.7 aphids. Meanwhile, mean number of the rest cultivars ranged from 3.6 aphids (TWC322) to 6.7 aphids (TWC320) without significant differences. Also, Southwood (1978) recommended that potato aphids could be estimated by pickling three leaves-lower, middle and upper from each plant.

2. Yield losses to aphid infestation on different maize cultivars:

Results summarized in Table (2) clear yield loss caused by aphid infestation in different maize cultivars. The percentage of yield loss due to aphids ranged from 9.84 kg (SC10) to 4.03 kg (TWC310).

From results in Tables 1 and 2, it could be concluded that the relationship between aphid numbers and yield loss was not clear, since the highest yield loss (9.84%) was obtained in case of SC10 in spite of receiving the lowest number of aphids.

On the other hand, Giza 2 that exhibited the highest number of aphids recorded an increase in yield loss (7.83%). The tassel leaf of G2 harboured the highest number of aphids in comparison with the tassel leaves on the

other tested cultivars. So it could be deduced that the tassel infestation had an important effect in yield loss. This emphasizes that the honey dew excreted by aphids accumulates on the pollen grain of the male tassel, consequently reduces pollination affecting greatly the grain yield.

Table (2): Mean yield of different maize cultivars in absence and presence of aphid infestation during 1999 season.

Cultivar	Mean grain yield of plot (kg.)		% of yield loss
	In the presence of aphid	In the absence of aphid	
SC10	43.08	37.80	9.84
SC120	36.60	38.25	4.31
TWC310	35.70	37.20	4.03
TWC320	35.24	37.95	6.88
TWC321	34.31	36.90	7.01
TWC322	34.50	36.75	6.12
TWC323	33.84	36.45	7.16
TWC324	34.68	36.60	2.25
Giza 2	33.18	36.00	7.83

According to the obtained data (Tables 1 and 2), there are a clear correlation between the aphids infestation and yield loss of both TWC320 and TWC321 cultivars.

These results were in agreement with those obtained by Kieckhefer and Kantack, 1986 and Mansour *et al.*, 1994. However, Hammond and Fedigo (1982) mentioned that ability to determine the relationship between yield loss and level of aphid numbers under natural infestation is limited.

Generally, the distribution of the aphid population throughout the habit is of considerable ecological significance. As, it affect the sampling program and the method of analysis of the data. Accordingly to Southwood (1978) the various levels of the plants, upper, middle and lower parts (leaves or other small sampling units) should be treated separately.

REFERENCES

- Abdel Rahim, M.M.; M.I. Abdel Fattah; A.I. Farag and M.A.Z. El-Naggar (1991). Contribution to the study of the corn leaf aphids *Rhopalosiphum maidis* Fitch, on maize plants Bull. Ent. Soc. Egypt., 70: 91-98.
- Dent, D. (1991). Insect pest management. C.A.B. International Wallingfort, U.K. pp. 604.
- El-Hariry, M.A. (1979). Biological studies on aphids attacking corn and wheat in Egypt. M.Sc. Thesis, Fac. Agric., Ain Shams Univ.
- Hammond, R.B. and L.P. Fedigo (1982). Determination of yield-loss relationships for two soybean defoliators by using simulated insect-defoliation techniques. J. Econ. Entomol. 75: 102-107.
- Horber, E. (1972). Plant resistance to insects. Agric. Sci. Rev. 18: 1-10.

- Kieckhefer, R.W. and B.H. Kantack (1986). Yield losses in spring parley caused by cereal aphids (Homoptera: Aphididae) in South Dakota, J. Econ. Entomol. 79: 749-752.
- Kuno, E. (1963). A comparison analysis of the distribution of nymphal populations of some leaf and planthoppers on rice plant. Res. Popul. Ecol., 5: 31-43.
- Mansour, M.H.; N.Y. Salem; E.M. Amr and H.A. Salem (1994). Injury level and yield-loss model for the corn aphid, *Rhopalosiphum maidis* (Fitch) on corn, *Zea mays* (L.) Bull. Ent. Soc. Egypt., 72: 217-224.
- Minks, A.K. and P. Harrewijn (1989). Aphids, their biology, natural enemies and control. Volume C. El Sevier, Amsterdam-Oxford-New York-Tokyo pp. 10.
- Salem, S.A.; F.N. Zaki; M.K. Hamdy and S.M. Moawad (1986). Yield reduction caused by the corn aphid *Rhopalosiphum maidis* Fitch (Homoptera: Aphididae) in corn Bull. Ent. Soc. Egypt. Econ. Ser. 15: 65-71.
- Southwood, T.R.T. (1978). Ecological methods. Great Britain Univ. Printing Houses, Cambridge 524P.
- Walker, P.T. (1983). Crop losses; the need to quantify the effects of pests, diseases and weeds on agricultural production. Agriculture, Ecosystem and Environment. 9: 119-158.

دراسات أولية عن المن لبعض أصناف الذرة الشامية وعلاقته بالمحصول

مصطفى عبدالحميد النجار

معهد بحوث وقاية النباتات - مركز البحوث الزراعية - الدقى - الجيزة

أن المن هو واحد من أهم الآفات الحشرية التي تهاجم نباتات الذرة فى الحقل مسببة نقصا واضحا فى المحصول. ولهذا أجريت تجربة حقلية بمحطة بحوث سخا موسم ١٩٩٩م لتقييم الكثافة العددية للمن على تسعة أصناف من الذرة هي هجين فردى ١٠ ، هجين فردى ١٢٠ ، هجين ثلاثى ٣١٠ ، هجين ثلاثى ٣٢٠ ، هجين ثلاثى ٣٢١ ، هجين ثلاثى ٣٢٢ ، هجين ثلاثى ٣٢٣ ، هجين ثلاثى ٣٢٤ ، الصنف جيزه ٢ وكذلك شملت الدراسة علاقة الإصابة بالمن بالنقص فى المحصول. أوضحت النتائج المتحصل عليها أن أعداد المن كانت أكبر على الورقة الطرفية (ورقة العلم) للنبات عن الورقة المغلفة للكوز والأوراق السفلية والسنبلة المذكورة فى كل الأصناف المختبرة وكذلك أوضح المتوسط العام لتعداد المن خلال الموسم أن الصنف جيزه ٢ كان أكثر حساسية للإصابة بالمن عن بقية الأصناف بينما كان الصنف هجين فردى ١٠ أقل حساسية للإصابة وأيضا أتضح أن العلاقة بين أعداد المن ونقص المحصول كانت غير واضحة حيث وجد أن أعلى نقص فى المحصول فى حالة الصنف هجين فردى ١٠ على الرغم من تواجد أقل تعداد للمن عليه وعلى الجانب الآخر فإن الصنف جيزه ٢ والذى أحتوى على أكبر تعداد للمن فإنه سجل زيادة فى نقص المحصول ولكن الصنف هجين ثلاثى ٣٢٠ ، هجين ثلاثى ٣٢١ ، هجين ثلاثى ٣٢٣ فإن نقص المحصول كان مرتبطا بزيادة تعداد المن على السنبلة المذكورة Tassel بينما أظهر الصنفان هجين فردى ١٢٠ وهجين ثلاثى ٣١٠ أكثر تمحلا للإصابة بالمن وكذلك سجلت أقل فقد فى المحصول.