SOWING DATES OF WHEAT IN RELATION TO CEREAL APHID INFESTATION AND DAMAGE IN UPPER EGYPT

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ABSTRACT

The wheat variety Sids 1 was cultivated in three different sowing dates (Early, 1 November, Recommended, 15 November and Late, 1 December) in order to determine the relationship between the plant growth stages of wheat and the population of cereal aphids *Rhopalosiphum padi* L., *R. maidis* (F.) and *Schizaphis graminum* (Rondani) during two successive wheat growing seasons, 2004 and 2005. Also, damage to wheat plants caused by cereal aphids was determined under these sowing dates. It was found that cereal aphid complex started to infest the early sowing date (1 November) in the first week of January (ZGS 30) whereas, the recommended (15 November) and late (1 December) sowing dates were infested two (ZGS 28) and third weeks later (ZGS 26). The population of cereal aphids on all plots increased gradually and reached their peaks at the end of February and beginning of March. The maximum population of cereal aphid complex on the plants in the first sowing date occurred when these plants were in the mature stage (ZGS 60). Contrary to that, the peak of cereal aphids was recorded on the plants of the second and third sowing dates when these plants were at the earlier growth stage (ZGS 45 & 39, respectively). Statistical analysis generally, showed that the wheat plants in the first sowing date had the lowest number of aphids with an average 436.66 aphids / tiller followed by the late sowing date, 1 December (598.93). The average number of aphids in the recommended (15 November) sowing date had higher number with an average of 884.74. The reductions due to aphid infestation in the yield were 15.02, 20.28 and 21.96% in the three planting dates, respectively. It is clear that plants in the early sowing date (first of November) produced the higher yield and exhibited lower reduction of the grain yield due to aphid infestation comparing with those of the other two planting dates.

INTRODUCTION

Cereal aphids are the serious insect pests attacking wheat plants especially at Upper Egypt. Fifty years ago, before the introduction of pesticides to control the common pests in Egypt. They were almost exclusively controlled using cultural, mechanical and biological techniques. It is necessary to make an attempt to control cereal aphids by other methods not depending on pesticides. Several studies have reported that integrated control of cereal aphids involves modifying for the wheat-growing environment in ways that make it less favourable for pest reproduction and survival. Sowing dates were found to be a simplest form of cultural practices that has considerable influence on the level of aphid infestation on wheat (Ba-Angood and Stewart, 1980 McGrath *et al.*, 1987 and Mahmoud, 2005). The present studies were oriented to study the relationship between sowing dates of wheat and population of cereal aphids infesting wheat at Upper Egypt. Also, reduction of wheat yield due to cereal aphid infestation was determined.

MATERIAL AND METHODS

This work was carried out at the Experimental Farm of Assiut University during 2004 and 2005 wheat growing seasons. Wheat variety Sids 1 was planted in three sowing dates, i.e. early (1 November), recommended (15 November) and late (1 December). Normal other cultural practices were preformed and no insecticides wee used. Weeds were removed by hand.

The experiments were undertaken in split plot design in four replicates each of (1/100 feddan). Two sets of experiments in an equal size (24 plots) were applied. In the first experiment, plants were kept free from aphid infestation by spraying aphicides (Aphox 50% DG) with the rate of 50 gm / 100 L. In the second experiment, (naturally infested plants), sampling procedures began soon after seedlings emergence by taking weekly samples which consisted of counting different aphid morphs on 10 wheat mean tillers picked out randomly out of ten plants from each plot. At the end of the season, samples of wheat plants from an area of one m^2 from each plot were harvested separately either from treated or untreated experiments to evaluate the grain yield. Data were statistically analyzed using analysis of variance and means were compared according to Duncan's multiple range test.

Determination of the growth stages of wheat plants according to Zadoks *et al.* (1974) had been practiced at the same dates in the sampling.

RESULTS AND DISCUSSION

1- Effect of sowing dates on aphid populations

Data presented in Tables 1 & 2 show the population changes of cereal aphids (the bird-cherry aphid, *R. padi*; corn leaf aphid, *R. maidis* and the greenbug, *S. graminum)* during 2004 and 2005 wheat growing seasons. Growth stages of wheat plants, according to Zadoks Growth Stage (ZGS), Zadoks, *et al.* (1974) were correlated with aphid populations.

Data show that the average numbrs of aphids were 300.28, 833.38 and 605.95 aphids / tiller; 573.04, 935.95 and 591.91 aphids / tiller on the wheat planted in 1 November, 15 November and 1 December during 2004 and 2005, respectively. Statistical analysis showed generally that the wheat plants in the first sowing date had the lowest number of aphids with an average 436.66 aphids / tiller followed by the late sowing date, 1 December (598.93). The average number of aphids in the recommended (15 November) sowing date had higher number with an average of 884.74. Alternating the sowing date of crops has been a recognized method of cultural control for many pests. The present results are in agreement with those obtained by Ali and Rizik, 1979; Ba-Angood and Stewart, 1980; McGrath *et al.*, 1987; Mahmoud 2005 and El-Fatih, 2006), who concluded briefly that the aphid number was correlated with the progressive of plant growth stages, and also found that the plants of the early sowing date were much less infested with aphids than those of the later successive dates.

According to seasonal abundance of aphids in relation to these sowing dates, data in Tables 1 & 2 shows that cereal aphid complex started to infest the early sowing date (1 November) in the first week of January (ZGS 30) whereas, the recommended (15 November) and late (1 December) sowing dates were infested two (ZGS 28) and third weeks later (ZGS 26). The population of cereal aphids on all plots increased gradually and reached their peaks at the end of February and beginning of March. Figure 1 show that the maximum population of cereal aphid complex on the plants in the first sowing date occurred when these plants were in the mature stage (ZGS 60). Contrary to that, the peak of cereal aphids was recorded on the plants of the second and third sowing dates when these plants were at the earlier growth stage(ZGS 45 & 39, respectively). Mean while, the aphids infestation on the plants of all sowing dates drastically droped down, although some of these plants, mainly the late sowing plants, were still vulnerable to the aphids multiplication. Concequently the decrease o the aphids population on the plants of the early sowing date may be due to the migration of the aphids from the mature

plants in which food supply was reduced. These resultus support the data obtained by Greene (1973); Ali and Rizk 1979. On the other hand the meterological data indicate that by the end of March, the maximum temperature and RH were 35C and 42%, respectively which are not in faour of the aphid multiplication.

TABLE (I)

Seasonal abundance of cereal aphid complex on wheat plants (variety Sids 1) at three different sowing dates during 2004.

Sampling Date	No. aphids / tiller and growth stages					
	Sowing dates					
	1 November		15 November		1 December	
	Growth stages (ZGS)*	No. aphids/tiller	Growth Stages (ZGS)	No. aphids/tiller	Growth Stages (ZGS)	No. aphids/tiller
Jan. 1	30	0.05	26	0.00	21	0.00
7	30	0.88	26	0.00	24	0.00
14	31	1.21	28	2.37	26	0.00
21	32	2.98	31	4.51	26	2.51
28	37	3.82	32	21.89	30	10.87
Feb. 4	39	7.93	37	42.24	31	23.87
11	45	35.49	39	85.76	32	38.98
18	50	54.53	39	146.51	37	76.18
25	60	76.04	40	183.11	39	112.20
March 4	62	68.60	45	224.07	39	184.44
11	65	33.13	50	87.16	45	128.27
18	70	11.73	60	24.40	50	26.32
25	71	3.89	61	11.36	52	2.31
Total	-	300.28c	-	833.38a	-	605.95b

* Growth stages of wheat according to Zadoks *et al.* (1974).

Means in a row followed by the same letter are not significantly different at 0.05 level of probability.

The eventual decline of aphid populations at the beginning of March was associated with a rapid drop in the suitability of the crop, accompanied by much alate emigration. However, natural enemies usually achieve their highest population levels during the period of the highest aphid density. Campell and Eikenbary (1990) reported that it is normally after emergence of the ear, that the aphid declines. They added that, this decline occurs regardless of the initial population size and is, in part, likely to be an effect of the aging plant becoming increasingly unsuitable as a food source. Fisher and Macnicol (1986) also reported that the concentration of essential amino acids (arginine, isoleucine, leucine, lysine, phenyl alanine and valine) decreased when wheat plants aged from 25.2% to 13.8%. Thus there is strong evidence to suggest that a decrease in food quality, as an effect of an aging wheat plant, can lead to a decline in the aphid population. However, it was found that changes in the level of intraspecific

competion (crowding) could affect a number of population parameters including fecundity and migration. Wiktelius (1989) reported that analysis of field data for *R. padi* show that although crowding stimulates wing formation during early growth stages in cereals, almost 100% of the fourth instar nymphs become alatiform after ear emergence has began regardless of aphid density. He showed also that the proportion of the aphid population moving on the ground increased rapidly after the population's peak and can reach 50% during the decline phase. This behavior is probably also an effect of changing host plant quality by walking also contributes to population decline. Several authors have pointed out natural enemies may also contribute to population decline. In the present study coccinellids and some hymenopterous parasitoids were existed in association with cereal aphids in relatively high population density particularly during the high aphids density. Ali and Rizk (1980) and Abdel-Rahman (1997) attributed the decline in the cereal aphid's population in wheat field during late March to the predators and parasitoids.

TABLE (II)

Seasonal abundance of cereal aphid complex on wheat (variety Sids 1) plants at three different sowing dates during 2005.

No aphids / tiller and growth stages						
Sampling Date	Sowing dates					
	1 November		15 November		1 December	
	Growth stages (ZGS)*	No. aphids/tiller	Growth Stages (ZGS)	No. aphids/tiller	Growth stages ZGS)	No. aphids/tiller
Jan. 1	30	0.06	26	0.00	21	0.00
7	30	0.36	26	0.00	24	0.00
14	31	1.11	28	0.42	26	0.00
21	32	1.91	31	3.62	26	0.22
28	37	8.69	32	18.69	30	2.07
Feb. 4	39	25.07	37	39.96	31	8.91
11	45	49.02	39	86.69	32	31.11
18	50	95.07	39	157.13	37	65.44
25	60	185.17	40	209.67	39	107.18
March 4	62	116.64	45	268.53	39	151.96
11	65	59.11	50	99.02	45	165.22
18	70	24.67	60	43.6	50	50.47
25	71	6.16	61	8.62	52	9.33
-	-	573.04b	-	935.95a	-	591.91b

* Growth stages of wheat according to Zadoks *et al.* (1974).

Means in a row followed by the same letter are not significantly different at 0.05 level of probability.

2- Grain yield in relation to sowing dates and aphid infestation

Data in Table 3 show the averages grain yield / one m2 in three planting dates (1 November, 15 November and 1 December) in the first experiments (control plants). The averages grain yields were 993.69, 688.38 and 657.49 gm / one m2 during 2004 and 641.32, 434.96 and 340.53 gm / one m2, respectively. In the second experiments, (naturally infested plants), the averages grain yield / one m2 were 853.85, 539.41 and 528.97 during 2004 and 535.59, 356.12 and 249.83, respectively. Statistical analysis show that the plants in the first sowing date either in the check or in the infested plants had the highest yield comparing with the plants in the other two planting dates. The reduction in the grain yield due to aphid infestation were 14.07, 21.64 and 19.54 during 2004 and 16.48, 18.12 and 26.64% during 2005 in the first, middle and later planting dates, respectively.

TABLE (III)

Grain yield (gm / one m2) of wheat plants (Sids 1) as affected by sowing dates in infested and control plants during 2004 – 2005 wheat growing seasons, Assiut.

Sowing dates	Grain yield gm / one m^2 and reduction (%)								
	2004 season			2005 season			Mean		
	Infested	Control	Reduction (%)	Infested	Control	Reduction (%)	Infested	Control	Reduction (%)
1 November	853.85a	993.69a	14.07	535.59a	641.32a	16.48	694.72a	817.51a	15.02
15 November	539.41b	688.38b	21.64	356.12b	434.96b	18.12	447.76b	561.67b	20.28
1 December	528.97b	657.49b	19.54	249.83c	340.53c	26.64	389.40c	499.01c	21.96
Total	1922.23	2339.56	17.83	1141.54	1416.81	19.42	1521.88	1878.18	18.44
Mean	640.74	779.85	17.83	380.51	472.27	19.42	510.63	626.06	18.44

Means in a column followed by the same letter are not significantly different at 0.05 level of probability.

Regardless of the growing season, it can be seen that, in the first experiment (control) the averages of grain yield / one m2 were 817.51, 561.67 and 499.01gm compared with 694.72, 447.76 and 389.40 gm in the naturally infested plants in the first, second and third planting dates, respectively. Rductions due to aphid infestation in the yield were 15.02, 20.28 and 21.96% in the three planting dates, respectively. It is clear that plants in the early sowing date (first of November) produced the higher yield and exhibited lower reduction of the grain yield due to aphid infestation comparing with those of the other two planting dates.

From the above mentioned results, it seems that there were significant differences between the grain yield in the wheat plants exposed to natural aphid infestation and those sprayed with Aphox. The combined analysis between the two experiments concerning the grain yield showed that the reduction in the yield due to aphid infestation reached 17.83 and 19.42% during 2004 and 2005, respectively with an average of 18.44%. Many investigators came to the same conclusion, under natural aphid infestation conditions (Enayat *et al.*, 1984; Papp and Mesterhazy, 1993 Tamam, 1989; Mohamed, 1994 and Abdel-Rahman, 1997).

REFERENCES

ABDEL-RAHMAN, M.A.A. (1997): Biological and ecological studies on cereal aphids and their control in Upper Egypt. *(Unpublished Ph.D. Thesis Fac. Agric. Assiut Univ., 231pp).*

ALI, A. M. and M.M. RIZK (1979): Changes in the population of the cereal aphids in relation to sowing dates of wheat in Upper Egypt. *[Proc. 3rd Pesticide Conf. Tanta Univ., September Vol. (1), 485-489].*

ALI, A. M. and M.M. RIZK (1980): Effect of certain physical factors and natural enemies on the cereal aphids, *Schizaphis graminum* (Rond.) and *Rhopalosiphum maidis* (Fitch.). *(Ass. J. Agric. Sci., 11: 107-115).*

BA-ANGOOD, S.A. and R.K. STEWART (1980): Economic thresholds and economic injury levels of cereal aphids on barley in Southwestern Quebec. *(Can. Entomol. 112: 759-764).*

CAMPBELL, R. K. and R. D. EIKENTLARY (1980): Aphid-Plant genotype interactions. *(Elsevier).*

EL-FATIH, MONIRA M. (2006): Seasonal abundance and certain biological aspects of cereal aphids on barley in Egypt (Giza Region). *(Unpublished Ph.D. Sc. Thesis, Fac. Agric. Cairo Univ., Egypt. 204pp).*

ENAYAT, H. G.; A. M.TANTAWI; A.ABDEL-SHAFI; R. MITKEES and A. F. EL-SAYED (1984): Assessment of losses in wheat grain yield. *(Field Crop Res. Institute, A. R. C., Giza, Egypt: 1-7).*

FISHER, D.B. and P.K. MACNICOI (1986): Amino acid composition along the transport pathway during filling in wheat. *(Plant Physiol., 82: 1019-1023).*

GREENE, E.C. (1973). Field population of three aphid species in Western Oregon. *(J. Econ. Entomol., 59, 1201-1206).*

MAHMOUD, W. A. (2005): Ecological Studies on cereal aphids and their control in Sohag Governorate. *(Unpublished Ph.D. Thesis Fac. Agric., Ain. Shams Univ., 122pp).*

MCGRATH, P.R.; J.S. BALE and S.J. TONES (1987): Effect of sowing date and spray date on the incidence of cereal aphids and BYDV in winter barley. *(Proceeding, Crop Protection in Northern Britain, Dundee University. 15-17 March 1987, 105-110).*

MOHAMED, T. A. (1994): Evaluation of wheat germplasm for aphid resistance and grain yield. *(Unpublished M. Sc. Thesis, Fac. Agric. Assiut Univ., Egypt, 135pp).*

PAPP, M. and A. MESTERHAZY (1993): Resistance to bird-cherry oat aphid (*Rhopalosiphum padi* L.) in winter wheat varieties. *(Euphytica, 67: 49-57).*

TAMAM, A. M. (1989). Inheritance of yield and aphid resistance in some wheat crosses. *(Unpublished M. Sc. Thesis, Fac. Agric. Assiut Univ., Egypt, 135pp).*

WIKTELIUS, S. (1989): Migration of apterous *Rhopalosiphum padi*. *(Bulletin SROP/WPRS).*

ZADOKS, J.C.; T.T. CHANG and C.F. KONZAK (1974): A decimal code for the growth stages of cereals. *(Weed Research, 14: 415-521).*