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The Effect of Wheat Varieties on the Biological Attributes of Corn Leaf Aphid, *Rhopalosiphum maidis* (Fitch) (Hemiptera: Aphididae) under Laboratory Conditions

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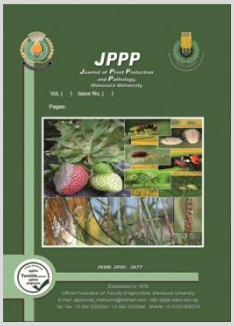

ABSTRACT

Wheat, *Triticum aestivum* L. is an important cereal crops in Egypt. Corn leaf aphid, (*Rhopalosiphum maidis* Fitch) a species of aphid attacks plenty of the Gramineae plants and most cereal crops. The biological attributes of *R. maidis* reared on the nine wheat varieties, namely, Sids-12, Sids-14, Gimmiza-11, Giza-171, Misr-2, Bani suif-5, Bani suif-6, Suhag-4 and Suhag-5 were studied. The wheat varieties differed significantly in the duration of 1st, 2nd, 3rd and 4th nymphal instars. Wheat varieties effect significantly on the total developmental time of nymphal stage. The highest developmental time was recorded on Sids-14 variety with 5.80 days. On the other hand, data showed no significant differences between the nine wheat varieties in reproductive period. Bani suif-5 variety recorded the highest average number 11.90 days. On the other side, the aphids reared on Gimmiza-11 variety recorded the lowest average number 9.25 days. Data showed that the total number of offspring per female and mean number of offspring/day affected significantly by wheat varieties. There are a significant differences in longevity and generation period of *R. miadis* reared on the wheat varieties examined.

Keywords: Wheat, varieties, Rhopalosiphum maidis, biological attributes.

INTRODUCTION

Wheat, *Triticum aestivum* L. is an important cereal crops in Egypt. It used for human food, in addition of animal and poultry feeding. The goal of Egypt government these days is to increase wheat production to reduce the shortage of production to face the highly consumption (Youssif *et al.*, 2017). Wheat came in the first place in importance and it is widely adapted food crop in Egypt. Whereas, Egypt produces less than half of its annual local request of wheat (Salam, 2002). Aphids are important insect pests infesting wheat crop in Egypt, as mentioned by Tantawi (1985) who illustrated that the losses in crop arranged between 7.5 – 18.7% of wheat productivity in Middle and Upper Egypt. Wheat is severely attacked by wheat aphids, which reduces productivity (Hamid, 1983).The wheat plants is attacked by aphids though both vegetative and reproductive stages when both the adults and nymphs feeds on cell sap and effect on the vitality of the plants. Honey dew secreted by the aphids allows fungi to grow on leaf surface which usually associated with aphid infestation which affects the operation of photosynthesis in plants (Deol *et al.*, 1987). Corn leaf aphid, (*Rhopalosiphum maidis* Fitch) a species of aphid attacks plenty of the Gramineae plants and most cereal crops, a polyphagous species from an Asiatic origin, but it now spread out all over the world(Blackman and Eastop, 2000). In Egypt, it feeds on many plants of graminae family i.e. weeds and cereals and it is a an important pest of maize crop (El-Ibrashy *et al.*, 1972). The aphid problems can be solved by the use of insecticides, but the use of pesticides causes a lot of problems on health, environment and it can increase the development of resistance in insects against insecticides. So, it is advisable to determine wheat varieties with resistance against aphids (Devrani *et al.*, 2018). Understanding the biology of *R. maidis* and the effect of wheat varieties on the biological attributes, governing the nymphal development, adult fecundity, generation time, adult longevity and life span can help in the development of effective management of this pest. So, the aim of this work is to illustrates the effects of some wheat varieties on some important life history parameters of *R. maidis* under laboratory conditions.

MATERIALS AND METHODS

Wheat plants:

Nine wheat varieties, namely, Sids-12, Sids-14, Gimmiza-11, Giza-171, Misr-2, Bani suif-5, Bani suif-6, Suhag-4 and Suhag-5 were used for this study. Wheat seedlings were offered for aphids feeding and maintaining using the Punctured Ependorf Tube Technique (PETT) which described by El-Fatih (2014).

Aphids culture:

The insects used in this work were gathered from a wheat field at Shandweel Agricultural Research Station, Sohag Governorate. Aphids were reared on wheat seedlings in a climatic chamber held at 25 ± 1°C, a relative humidity of 65 ± 5% and a light regime of 16 h light: 8 h dark. The progenies had been reared under these conditions before using the aphid individuals in the experiments.

Development, Longevity and fecundity:

To estimate the nymphal development, a fine hair brush were used to transfer the newly-born nymphs from field-collected

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adults separately, to filter paper placed inside clean Petri dishes with wheat seedlings germinated in PETT and were checked daily until death. All replications in which the nymphs died within 24 h after transfer were omitted. To determine molting the presence of discarded exuviae was used. This work were carried out in a climatic cupboard under a constant temperature of 25 ± 1°C, at 65 ± 5% relative humidity and a light: dark photoperiod of 16: 8 h. After the immatures became adults, they were chicked daily for fecundity and survival and all offspring were removed. The developmental time for each insect was recorded and included. Nymphal instar, the duration for adult, pre-reproductive, reproductive and post-reproductive periods, the life span, fecundity and the average number of offspring per day were determined for each adult. These parameters were examined for twenty aphids at 25±1°C on each wheat variety. This work was conducted under completely randomized design.

Data analyses and statistics:

Statistical analysis was conducted by using one-way analysis of variance. To evaluate the differences significance between treatments 'F' test was used. The Duncan's multiple range test at P = 5% was used to separate means (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

Developmental times of immature stage:

The present results arranged in table (1) shows the developmental times of different nymphs of *R. maidis* on nine wheat varieties. The wheat varieties differed significantly in the duration of 1st, 2nd, 3rd and 4th nymphal instars. The longest duration of 1st nymphal instar was recorded in Suhag-5 variety, followed insignificantly by Sids-14 and Bani suif-5, no significant differences between the rest of varieties. However, the longest duration of 2nd nymphal instar was recorded in Giza-171 variety, followed insignificantly by Gimmiza-11, Misr-2, Bani suif-5 and Suhag-5 varieties, no significant differences between the rest of varieties. The longest duration of 3rd nymphal instar was recorded in Suhag-4 variety, followed insignificantly by Giza-171 and Bani suif-6 varieties, while, the shortest duration was recorded in Suhag-5 variety. For the 4th instar nymphal instar, the longest duration was recorded in Sids-14 variety followed insignificantly by Suhag-4 variety, while, the shortest duration was recorded in Misr-2 variety. Also, wheat varieties effect significantly on the total developmental time of nymphal stage. The highest developmental time was recorded on Sids-14 variety with 5.80 days followed insignificantly by Gimmiza-11, Giza-171, Bani suif-6 and Suhag-4 varieties. On the other hand, the lowest developmental time was recorded when aphid reared on Misr-2 variety (4.75 days) followed insignificantly by Suhag-5 variety. Similar trend was recorded for total developmental time of nymphal stage (6.74±0.56 days) of *R. padi* which was reared on wheat at 25 C° by El-Fatih *et al.* (2015). On the other hand, Taheri *et al.* (2010) investigated the nymphal stages durations of *R. padi* on six wheat varieties they indicated that the six examined wheat varieties differed significantly. Also, Razmjou and Golizadeh (2010) studied population growth parameters of *R. maidis* reared on six maize hybrids they found that the maize hybrids differed significantly in the development time of nymphs.

Table 1. Developmental times (days) of immature stages of the corn leaf aphid, *R. maidis* on some wheat varieties.

Varieties	The nymphal instars				Nymphal stage
	1st instar	2nd instar	3rd instar	4th instar	
Sids-12	1.00 b	1.35 bcd	1.30 cde	1.65 bc	5.30 bc
Sids-14	1.20 a	1.20 d	1.40 bcd	2.00 a	5.80 a
Gimmiza-11	1.00 b	1.60 abc	1.40 bcd	1.65 bc	5.65 ab
Giza-171	1.00 b	1.70 a	1.45 abc	1.60 bc	5.75 ab
Misr-2	1.00 b	1.50 abcd	1.25 cde	1.00 d	4.75 d
Bani suif-5	1.15 ab	1.65 ab	1.10 de	1.40 c	5.30 bc
Bani suif-6	1.00 b	1.30 cd	1.65 ab	1.55 bc	5.50 abc
Suhag-4	1.00 b	1.25 d	1.75 a	1.75 ab	5.75 ab
Suhag-5	1.30 a	1.45 abcd	1.00 e	1.40 c	5.15 cd
F value	4.54*	2.86*	5.10*	6.85*	5.68*

Means in each column followed by the same letter are not significantly different at 5% level according to Duncan's multiple range test.

Reproductive period:

Data in Table (2) illustrate the effect of the nine wheat varieties on pre-reproductive, reproductive and post-reproductive periods of *R. maidis*. Data showed that the wheat varieties differed significantly in pre-reproductive and post-reproductive periods. For pre-reproductive period aphid adults reared on Misr-2 variety recorded the highest average number 1.10 days while, aphid adults reared on Gimmiza-11and Bani suif-5 varieties recorded the lowest average numbers 0.55 days for both varieties the rest of varieties arranged between the highest and the lowest. However, for post-reproductive period aphid adults reared on Misr-2 variety recorded the highest average number 1.05 days. Adults reared on Suhag-5 variety recorded the lowest average number 0.35 days. On the other hand, data showed no significant differences between the nine wheat varieties in reproductive period. Bani suif-5 variety recorded the highest average number 11.90 days. On the other side, Gimmiza-11 variety recorded the lowest average number 9.25 . Auad *et al.* (2009) illustrated that the pre-reproductive, reproductive and post-reproductive periods of *R. padi* reared on signal grass were 1.86, 6.75 and 1.40 days, respectively on 24 C°. Also, Salman *et al.* (2017) studied biology of *R. maidis* on five corn hybrids they illustrated that the highest reproductive period 12.13 was recorded when aphids reared on 132 hybrid the lowest reproductive period 9.87 was recorded when aphids reared on 131 hybrid.

Fecundity:

Data in Table (2) showed that the total number of offspring per female affected significantly by wheat varieties. The highest fecundity rate (46.00 progenies/female) was recorded when aphid reared on Bani suif-5 variety with insignificant difference with Suhag-5 variety (40.65 progenies/female) and the lowest fecundity rate (25.00 progenies/female) was recorded when

aphid reared on Gimmiza-11 variety with insignificant difference with Sids-12, Sids-14, Bani suif-6 and Suhag-4 varieties which recorded (28.95, 26.05, 30.90 and 27.80 progenies/female), respectively. For the mean number of offspring/ day, Bani suif-5 and Suhag-5 varieties recorded the highest mean number of offspring/ day (3.92 and 3.70 nymphs/day), respectively. However, Sids-12 variety recorded the lowest mean number of offspring/ day (2.47 nymphs/day) followed insignificantly by Sids-14 and Gimmiza-11 varieties. Akhtar *et al.* (2009) evaluated twelve wheat varieties/ lines they found that *R. padi* reared on PR-83 line was least fecund while, aphid was highly fecund when reared on NR-241 and V-00055 lines. Also, Razmjou and Golizadeh (2013) evaluated the biological parameters of six wheat varieties. They mentioned that the wheat varieties differed significantly in female fecundity. Also, Singh *et al.* (2019) studied fecundity and mean number of offspring of *R. maidis* on barley genotypes they found that the numbers arrange between (31.10 to 42.20) and (2.24 to 3.75), respectively.

Table 2. pre--reproductive, reproductive and post-reproductive periods and fecundity of *R. maidis* on some wheat varieties under laboratory conditions.

Varieties	days			Fecundity	
	Pre- reproductive period	Reproductive period	Post- reproductive period	No. of progeny/ female	Mean No. of offspring/ day
Sids-12	0.90 ab	11.65 a	0.85 a	28.95 cd	2.47 c
Sids-14	0.70 bc	9.30 a	0.80 ab	26.05 d	2.75 bc
Gimmiza-11	0.55 c	9.25 a	0.75 ab	25.00 d	2.68 bc
Giza-171	0.95 ab	11.15 a	0.90 a	34.35 bc	3.01 b
Misr-2	1.10 a	11.50 a	1.05 a	35.15 bc	3.05 b
Bani suif-5	0.55 c	11.90 a	0.75 ab	46.00 a	3.92 a
Bani suif-6	0.85 abc	10.80 a	0.70 abc	30.90 cd	2.85 b
Suhag-4	0.90 ab	9.85 a	0.45 bc	27.80 cd	2.86 b
Suhag-5	0.70 bc	10.90 a	0.35 c	40.65 ab	3.70 a
F value	3.05*	$1.88^{N.S.}$	3.10*	7.39*	17.06*

Means in each column followed by the same letter are not significantly different at 5% level according to Duncan's multiple range test.

Longevity, life span and generation time

Data in Table (3) summarized longevity, life span and generation time of *R. miadis* on nine wheat varieties. Adult longevity of *R. maidis* differed significantly when reared on the wheat varieties studied. The longest female longevity of *R. maidis* recorded on Misr-2 variety (13.65 days) by insignificant differences with Sids-12, Giza-171, Bani suif-5, Bani suif-6 and Suhag-5 varieties which recorded average numbers of (13.40, 13.00, 13.20, 12.35 and 11.95 days), respectively. While, the shortest adult longevity was recorded when aphid reared on Gimmiza-11 variety (10.55 days) by insignificant differences with Sids-14, Bani suif-6, Suhag-4 and Suhag-5 varieties which recorded average numbers of (10.80, 12.35, 11.20 and 11.95 days), respectively. There were insignificant differences in life span of *R. maidis* reared on wheat varieties examined. The longest life span duration was recorded when aphid reared on Giza-171 variety with average number (18.75 days) while the shortest life span duration recorded when *R. maidis* reared on Gimmiza-11 variety with average number (16.20 days). For generation time there were a significant difference between the studied wheat varieties. The nine varieties were arranged in three significant groups. The first and the longest one included Sids-14 (6.50 days), Giza-171 (6.70 days) and Suhag-4 (6.65 days) and the third and the shortest one consisted of Misr-2 (5.85 days), Bani suif-5 (5.85 days) and Suhag-5 (5.85 days). However, the second group which differed insignificantly with previous two groups included Sids-12 (6.20 days), Gimmiza-11 (6.20 days) and Bani suif-6 (6.35 days).

aphid reared on Giza-171 variety (6.70 days) with no significant differences with Sids-12, Sids-14, Gimmiza-11, Bani suif-6 and Suhag-4 varieties with average numbers of (6.20, 6.50, 6.20, 6.35 and 6.65), respectively. While, the duration of the shortest generation time was recorded when aphid reared on Misr-2, Bani suif-5 and Suhag-5 varieties (5.85 days), for all with no significant differences with Sids-12, Gimmiza-11 and Bani suif-6 varieties with average numbers of (6.20, 6.20 and 6.35), respectively. The longevity of *R. maidis* was studied by Kuo *et al.* (2006) on corn. And El-Sheikh *el al.*, 2009 who mentioned that the longevity, life span duration and generation time were 11.9 + 3.4 ,16.9±3.2 and 5.3 + 0.7 at 25 C°. Also, Descamps and Chopa (2011) studied some growth parameters of *R. padi* on some cereal crops.

From the previous results it could be concluded that, wheat varieties have a significant effect on some biological attributes of *R. maidis*.

Table 3. Longevity, life span and generation time of *R. miadis* on some wheat varieties under laboratory conditions.

Varieties	Longevity	Life span	Generation time
Sids-12	13.40 ab	18.70 a	6.20 ab
Sids-14	10.80 cd	16.60 a	6.50 a
Gimmiza-11	10.55 d	16.20 a	6.20 ab
Giza-171	13.00 abc	18.75 a	6.70 a
Misr-2	13.65 a	18.40 a	5.85 b
Bani suif-5	13.20 ab	18.50 a	5.85 b
Bani suif-6	12.35 abcd	17.85 a	6.35 ab
Suhag-4	11.20 bcd	16.95 a	6.65 a
Suhag-5	11.95 abcd	17.10 a	5.85 b
F value	2.41*	$1.62^{N.S.}$	3.63*

Means in each column followed by the same letter are not significantly different at 5% level according to Duncan's multiple range test.

REFERENCES

Akhtar, N. N. Moin, G. Jilani, A. ul Mohsin, S. Y. Tashfeen, M. Goraya and I. Begum 2009. Evaluation of resistance in wheat against *Rhopalosiphum padi* (Homoptera: aphididae) under laboratory conditions. Pakistan J. Agric. Res. 22 (1-2): 67-72.

Auad, A. M., S.O. Alves, C.A. Carvalho, D.M. Silva, T.T. Resende and B.A. Veríssimo 2009. The impact of temperature on biological aspects and life table of *Rhopalosiphum padi* (Hemiptera: Aphididae) fed with signal grass. Florida Entomologist 92: 569–577.

Blackman, R. L. and V. F. Eastop 2000. Aphids on the World's Crops: An Identification and Information Guide. 2nd ed. John Wiley & Sons New York. 466 pp.

Deol, G.S., K.S. Gill and J.S. Brar 1987. Aphid outbreak on wheat and barley in Punjab. News Letter Aphidological Society of India. 6(2):7-9.

Descamps, L. R. and C. S. Chopa 2011. Population growth of *Rhopalosiphum padi*. (Homoptera: aphididae) on different cereal crops from the semiarid pampas of Argentina under laboratory conditions Chilean j. of agric. Res. 71(3).

Devrani, A., R.S. Bisht and N. Rawat 2018. Screening of different wheat varieties against aphids at Pantnagar. J. of Entomol. and Zool. Studies 6(3): 151-155.

El-Fatih, M. M. 2014. Advantages and Application of Punctured Eppendorf Tube Technique (PETT) on the biology of bird cherry-oat aphid *Rhopalosiphum pad*i (Linnaeus). J. plant Prot. And Path., Mansoura Univ., 5 (12): 1111-1120.

El-Fatih, Monira M.; Abeer, M. Mohammad and A. A. Shehawy 2015. Biological aspects and thermal requirements of the bird cherry-oat aphid, *Rhopalosiphum padi* (Linnaeus), reared on wheat seedlings. J. Plant Prot. and Path., Mansoura Univ., 6 (12): 1663– 1670.

El-Ibrashy, M. T., S. El-Ziady and A. A. Riad 1972. Laboratory studies on the biology of the corn leaf aphid, (*Rhopalosiphum maidis*) (Homoptera: Aphididae). Entomol. Exp. Appl. 15: 66–174.

El-Sheikh, M. A. K., S. Elnagar, M. A. El-Hariry and M. M. El-Fatih 2009. Life table- parameters and heat units for the corn leaf aphid, *Rhopalosiphum maidis* (fitch), reared on barley host plant. 4th Conference on Recent Technologies in Agriculture: 101-109.

Gomez, K. A. and A. A. Gomez 1984. Statistical procedures for agricultural research. 2nd Ed. A. John Wiley Intersci. P. 130-240.

Hamid, S. 1983. Natural balance of graminicolous aphids in Pakistan: Survey of population. J. Agron. 3: 665-673.

Kuo, M. H., C. C. Ming and J. J. Perng 2006. Temperature effects on life history traits of the corn leaf aphid, *Rhopalosiphum maidis* (Homoptera: Aphididae) on corn in Taiwan. Appl. Entomol. Zool. 41 (1): 171–177.

Razmjou, J. and A. Golizadeh 2010. Performance of corn leaf aphid, *Rhopalosiphum maidis* (Fitch) (Homoptera: Aphididae) on selected maize hybrids under laboratory conditions. Appl. Entomol. Zool. 45 (2): 267–274.

Razmjou, J. and A. Golizadeh 2013. The Effect of wheat cultivars on biological aAttributes of bird cherry-oat aphid, *Rhopalosiphum padi* (Homoptera: Aphididae). J. Crop Prot. 2 (3): 331-341.

Salam, A. G. 2002. Current status of durum wheat in Egypt and Future prospects. http://www.Fineprint.com.

Salman, A. M. A., A. S. S. Desoky, Saadia A. Abd-El-Samea, M. A. M Youssef 2017. Some Biological aspects of *Rhopalosiphum Maidis* (Fitch), reared on five corn hybrids under laboratory conditions. International J. of Res. in Agric. and Forestry. 4 (11): 20-25.

Singh, S., B. Singh and J. Jindal 2019. Comparative biology and population build-up of corn leaf aphid, *Rhopalosiphum maidis* Fitch. on barley genotypes. J. of Cereal Res. 11(2):147-151.

Taheri, S., J. Razmjou and N. Rastegari 2010. Fecundity and development rate of the bird cherry-oat aphid, Rhopalosiphum padi (L) (Hom.: Aphididae) on six wheat cultivars. Plant Protect. Sci. 46, (2): 72–78.

Tantawi, A. M. 1985. Studies on wheat aphids in Egypt II. Germplasm evaluation and crop loss assessment . Rachis , 4 (2): 26-27.

Youssif , M. A. I.; SH. A. M. Ali and Walaa M. M. Helaly 2017. Cereal aphid species (Homoptera : Aphididae) infesting wheat plants and their aphidophagous insects at El-Khattara District, Sharkia Governorate, Egypt. J. Plant Prot. and Path., Mansoura Univ., 8 (11): 581 – 589.

تأثير أصناف القمح على السمات البيولوجية لمن أوراق الذرة تحت الظروف المعملية

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القمح محصول من أهم محاصيل الحبوب في مصر. من أوراق الذرة *Rhopalosiphum maidis* هو أحد أنواع المن التي تهاجم كثير من محاصيل العائلة النجيلية ومعظم محاصيل الحبوب. تم دراسة السمات البيولوجية لمن أوراق الذرة الذي تم تغذيته على ٩ أصناف قمح وهي سدس١٢ و سدس١٤ و جميزة١١ و جيزة١٧١ و مصر٢ و بني سويف٥ و بني سويف٦ و سوهاج٤ و سوهاج٥. الأصناف المختبرة اختلفت معنوياً في معدل اعمار الحوريات الأول والثاني والثالث والرابع. أظهرت الأصناف تأثير معنوي في زمن التطور الكلي لطور الحورية. سجل أعلى معدل تطور على صنف سدس١٤ بمعدل ٥,٨٠. من ناحية أخرى, أظهرت النتائج عدم وجود فروق معنوية بين التسعة أصناف في فترة التناسل لحشرة المن. سجل صنف بني سويف٥ أعلى متوسط ١١,٩٠ يوم. في الجانب الأخر, سجل صنف جميزة١١ أقل متوسط ٩,٢٥ يوم. أظهرت النتائج أن العدد الكلي للنسل لكل أنثى وكذلك متوسط عدد النسل اليومي تأثرا معنويًا بأصناف القمح. هناك فروق معنوية في طول فترة حياة الحشرة الكاملة وكذلك فترة الجيل لمن أوراق الذرة الذي تم تغذيته على أصناف القمح المختبرة.