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POPULATION TRENDS AND RELATIVE SUSCEPTIBILITY OF CERTAIN BREAD AND DURUM WHEAT CULTIVARS TO CEREAL APHIDS AND RELATION TO THE COCCINELLID PREDATOR COCCINELLA UNDECIMPUNCTATA L.

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ABSTRACT

Population trends of cereal aphids and the associated coccinellid predator Coccinella undecimpunctata L. were evaluated on seven bread and five durum wheat cultivars throughout the two wheat growing seasons (2014 and 2015) in Assiut, northern Upper Egypt. Regardless the wheat cultivar, aphid complex [The green bug, Schizaphis graminum (Rondani), the bird cherry oat aphid, Rhopalosiphum padi L., and the corn leaf aphid, Rhopalosiphum maidis (Fitch)] populations showed one peak at 23rd February in both seasons with an average of 39.08 and 31.13 individuals / tiller. One week later, sharp and sequential decline in aphid populations was recorded until the totally disappearance when wheat became dry. All wheat cultivars were found to be suffering from aphid's infestation with significant variations which leads to identify the most suitable cultivar(s) fit for cultivation in Upper Egypt. Aphid populations on durum wheat cultivars were found to be constituted 1.25 and 1.19 fold of those recorded on bread wheat cultivars during the two seasons. Predator/prey relationship showed negative correlation coefficient. Three (42.65%) amongst bread and four (80%) amongst durum wheat cultivars were appeared as susceptible (S) cultivars. However, three bread wheat cultivars presented some sort of resistance and appeared as low resistance (LR) cultivars. One bread cultivar (Seds1) and one durum cultivar (Beni Suef 1) which gave the highest yield income showed advanced degree of resistance and appeared as moderately resistant (MR) cultivars . Therefore, wheat cultivars that showed some sort of resistance can be included among advanced breeding programs to select new varieties resistance to cereal aphids.

Keywords: *Wheat, Cereal aphid populations, Predator/Prey relationship, Susceptibility degrees.*

INTRODUCTION

Wheat (Triticum aestivum L.) is the most widely grown cereal grain in the world. It is the staple food for 35% of the world's population and is becoming increasingly important in developing world. This cereal is grown on 23 % of global cultivated area and is of the great

importance in bread, diet, pharmaceutics and other industries. It is also important product of international trade on worldwide market (Zeb et al., 2011). Aphids (Aphididae: Homoptera) are important sucking pests of various field crops, fruits and vegetables and commonly called as plant lice. Aphids cause direct damage by feeding deeply within the leaf whorl and inject a toxin which destroys the chloroplast membrane and indirect damage by transmission of several plant viruses (Marzocchi and Nicoli, 1991; Rossing et al., 1994; Bukvayova et al., 2006). The green bug, Schizaphis graminum (Rondani), the bird cherry oat aphid, Rhopalosiphum padi L., and the corn leaf aphid, Rhopalosiphum maidis (Fitch) are commonly attack wheat in Upper Egypt (Abdel-Rahman, 1997; Salem and Mahmoud, 2012). Seasonal occurrence of aphids and their natural enemies associated with wheat at Assiut governorate, northern Upper Egypt (warm area) was evaluated by Salem, (2007) and Salem et al. (2012). In Greece, (temperate area) the influence of different species of aphid prey on the immature survival and development of Coccinella septempunctata L. was evaluated by Papakhristos et al. (2015).They thought that their results may be useful for improving the effectiveness of biological control practice and the production of coccinellids in the insectary. Evaluating cereals for aphid resistance was performed by several authors e.g. Elenin et al. (1989); Shehata, (2013) in Egypt; Mojahed et al. (2013) in Iran; Parvez and Ali, (2000); Aslam et al.(2004) in Pakistan; Alsuhaibani, (1996) in the Kingdom of Saudi Arabia; Hesler et al. (2002); Hesler, (2005) in the United States of America. Therefore, this investigation was conducted to determine the population trend and the relationship between the principal wheat aphids and their associated coccinellid predator C. undecimpunctata on certain bread and durum wheat cultivars in northern Upper Egypt. Also, the susceptibility degrees of these wheat cultivars to these major cereal aphids were evaluated.

MATERIALS AND METHODS

This work was conducted in the experimental farm of the agriculture college, Assiut University during the two successive wheat growing seasons of 2014 and 2015. An area of about 1/4 feddan (1 feddan = 0.42 hectare) was cultivated with 7 bread (Balady, Sakha 93, Giza 168, Mesr 1, Mesr 2, Seds 1, Seds 12) and 5 durum (Beni Suef 1, Beni Suef 4, Beni Suef 5, Beni Suef 6, Sohag 3) wheat cultivars , which were obtained from the Agronomy Institute, Agricultural Research Center. The experiment was carried out in a completely randomized block design, with three replicates (1/400 fed.) per each cultivar. Regular conventional agricultural practices were performed and insecticides were prevented. At harvest time the grain yield of each tested wheat cultivar was determined. Samples of spikelets of 1 m2 / plot (3 replicates) were taken randomly. Grain yield (ton /fed.) was calculated.

1- Population trends of cereal aphids and the associated coccinellid predator

The number of aphid complex (all forms) was counted visually by the direct count method on 10 randomly wheat tillers / replicate (3 replicates / each cultivar) from February 2 until March 30 when wheat aphid density reached to their lowest populations. Numbers of the predatory coccinellid C. undecimpunctata were also recorded. Data were statistically analyzed by using F-test; means were compared according to Duncan's multiple range tests as described by

Steel and Torrie (1982). Correlation coefficient between aphid numbers and the coccinellid predator was calculated.

2- Relative susceptibility of wheat cultivars to aphid species

Numbers of each identified aphid species were counted by the abovementioned method. Mean numbers of each aphid species (all forms) were used to determine the relative susceptibility degrees of the tested cultivars as described by Chiang and Talekar (1980) equation. Relative susceptibility degree was dependent on the general mean number of the pest $\overline{X}$ and the standard deviation (SD).Cultivars that had mean numbers more than $\overline{X}$ +2SD, were considered highly susceptible (HS); between $\overline{X}$ and $\overline{X}$ +2SD, susceptible (S); between $\overline{X}$ and $\overline{X}$ -1SD, low resistant (LR); between $\overline{X}$ -1SD and $\overline{X}$ - 2SD, moderately resistant (MR) and less than $\overline{X}$ -2SD, were considered highly resistant (HR) cultivars.

RESULTS AND DISCUSSION

1- Population trends of cereal aphids and the associated coccinellid predator

Population density of aphid complex [The green bug, Schizaphis graminum (Rondani), the bird cherry oat aphid, Rhopalosiphum padi L., and the corn leaf aphid, Rhopalosiphum maidis (Fitch)] inhabiting all of the tested wheat cultivars during 2014 wheat growing season was established in Table (1). Data revealed that aphids attack wheat throughout the entire wheat growing season (February, 2 until March, 30). Regardless the tested wheat cultivar, the aphid population increased exponentially and reached its peak on 23rd February with an average of 39.08 individuals / tiller. One week later, the pest exhibited less populations (21.55 individuals/ tiller) at 2nd March and followed by sharp decline until the totally disappearance after 30th March when wheat became dry. The durum wheat cultivar Beni Suef 4 harbored the greatest aphid numbers during the entire season with an average of 17.72 individuals/ tiller. However, the bread cultivar Seds 1 harbored the lowest aphid seasonal numbers with an average of 7.44 individuals/ tiller. The pest populations were clearly varied between the tested wheat cultivars (f = 351.0*). Also, it can be note that, infestation level varied amongst each group. Similar results were obtained during the second year of study, 2015 (Table 2). The general mean number of aphids recorded on durum wheat cultivars was found to be constituted 1.25 and 1.19 fold of that recorded on bread wheat cultivars during 2014 and 2015 seasons. This result could be leads to identify the most suitable cultivar(s) fit for cultivation under Upper Egyptian circumstances.

In the same approach, Abdel-Rahman (1997) recorded 472 aphid individuals / tiller on the bread cultivar Sakha 69, however in this manuscript 8-9 aphid individuals/ tiller were recorded on the bread cultivar Sakha 93 in the same area of study. This finding proof that, changes of climatic factors and the wide use of insecticides could leads to changes on the population trends of the examined taxa. In order to determine the population dynamics of aphids, an experiment was conducted by Anayatullah and Khattak (2004) in Pakistan. They reported that attack of aphids started on January 18, 2002 and gradually increased with the growth of plants, however, slow multiplication of aphids was noticed during vegetative growth.

Zeb et al., (2011) study the population trend of cereal aphids on different varieties/ lines of wheat and their effect on the yield. They reported that aphids attack started in first week of January, increased during February and March, peaked on 13rd March, and then declined afterwards till complete disappearance in 6th April.

In respect to the relation between aphid complex and the predatory coccinellid C. undecimpunctata, data presented in Table (3) expressed about the general mean numbers and correlation coefficient (r) between both taxa. Data obtained during the first season of study 2014, revealed that, the bread wheat cultivars harbored (44.45%) of the total aphids inhabiting wheat. However, durum wheat cultivars harbored more percentage (55.55%). Consequently, bread wheat cultivars were found to be harboring high percentage of C. undecimpunctata (59.24%) than durum wheat cultivars (40.76%). Similar results were obtained during the second season of study, 2015. In respect to the predator/prey relationship, it can be note that, negative (r) values were recorded between both taxa (-0.071 and -0.27) during 2014 and 2015 seasons.

Results obtained by Abdel-Rahman (1997) have been confirmed by those obtained in this work. His data showed that coccinellids are considered to be potentially important regulators of cereal aphids in wheat ecosystem. He also, reported that the first generation of coccinellid adults appear to synchronized with the start of aphid populations and they may able to affect the growth of the aphid population. Ten years later, in Pakistan, Khan et al. (2007) recorded C. septumpunctata as the predominant species among four-major coccinellid species associated with cereal aphids. They reported that the peak population of C. septumpunctata was recorded in the middle of March. The numbers then declined and came to an abrupt end by the last week of April. This finding confirmed the truth that the predator populations dependent on its prey populations.

2- Relative susceptibility of wheat cultivars to aphid species

Evaluation of the susceptibility degrees of the tested wheat cultivars against the dominant aforementioned cereal aphids was the main goal of this study. According to the pest mean numbers and the standard deviation, the susceptibility degrees of the tested wheat cultivars were grouped into five categories, Table (4). Data revealed high variations amongst the tested cultivars. Regardless the aphid species, three amongst the seven bread cultivars (42.85%) were appeared as susceptible (S) cultivars. Also, four amongst the five durum cultivars (80%) were appeared as susceptible (S) cultivars. On the other hand, three amongst the seven bread cultivars presented some sort of resistance and appeared as low resistance (LR) cultivars. One bread cultivar (Seds1) and one durum cultivar (Beni Suef 1) only showed advanced degree of resistance and appeared as moderately resistant (MR) cultivars. In addition, these tow cultivars gave the highest yield income as showed in Table (5). Resistant and/or highly resistant cultivars were hoped, but not found.

In a similar study, the seasonal abundance of R. padi and S. graminum on twelve elite wheat lines was investigated by Alsuhaibani (1996) in Saudi Arabia. He reported that all wheat lines were infested by both aphid species. In agreement results, he reported that R. padi was much higher on all tested lines than S. graminum. In the same approach, Akhtar et al. (2008)

evaluated the resistance of twenty wheat varieties to R. padi. According to the damage rate in seedling bulk they grouped the tested varieties into three categories, i.e. resistant, moderately resistant and susceptible. Also, they grouped the tested varieties according to the antixenosis phenomenon into less preferred, moderately preferred and highly preferred varieties. So, the use of resistant lines will remain the most logical and economical way of reducing insect pest damage in cereals. Identification of the factors that confer resistance inheritance in cereal plants would greatly improve breeding strategies resistant lines. Therefore, wheat cultivars that showed some sort of resistance can be included among advanced breeding programs to select new varieties resistance to cereal aphids.

Table1- Weekly mean numbers of cereal aphid complex / wheat tiller during 2014 season in Assiut governorate

Wheat Cultivars		Feb.	Feb.	Feb.	Feb.	Marc	Marc	Marc	Marc	Marc	Mea
Bread Cultivars	Balad	9.22	20.2	14.8	13.5	29.22	1.33	0.44	3.56	0.67	**10.35**
	Sakha	2.00	10.6	7.00	27.2	25.22	2.33	1.00	3.22	0.11	**8.75**
	Giza	4.44	13.1	17.6	30.0	26.11	0.78	2.89	2.78	0.89	**10.96**
	Mesr	2.00	11.2	11.5	26.5	27.55	1.33	1.56	2.00	1.22	**9.44**
	Mesr	3.00	8.67	10.0	32.8	29.33	0.89	1.11	4.44	0.78	**10.12**
	Seds 1	3.00	4.78	15.0	24.5	16.67	0.22	0.67	1.78	0.33	**7.44**
	Seds	5.22	11.3	14.0	32.6	30.44	1.78	0.78	1.33	0.22	**10.86**
Mean		**4.13**	**11.4**	**12.8**	**26.7**	**26.36**	**1.24**	**1.21**	**2.73**	**0.60**	**9.71**
Durum Cultivars	Beni	3.67	7.78	9.22	22.5	22.67	1.33	0.44	1.89	0.11	**7.74**
	Beni	9.56	16.4	33.4	82.3	16.00	0.11	0.11	1.33	0.11	**17.72**
	Beni	10.4	15.7	19.2	63.3	17.33	0.67	0.22	1.00	0.22	**14.25**
	Beni	1.67	12.1	20.0	32.1	17.00	0.78	0.22	0.67	0.11	**9.41**
	Sohag	5.44	9.67	19.2	56.5	10.67	0.55	0.22	0.67	0.11	**11.46**
Mean		**6.16**	**12.3**	**20.2**	**51.3**	**16.73**	**0.69**	**0.24**	**1.11**	**0.13**	**12.11**
Grand Mean		**5.14**	**11.8**	**16.5**	**39.0**	**21.55**	**0.96**	**0.72**	**1.92**	**0.37**	**10.91**
F value		**351.0 ***									

Means followed by the same letter are not significantly different at 0.05 level of probability by Duncan's multiple range tests.

Table 2- Weekly mean numbers of cereal aphid complex / wheat tiller during 2015 season in Assiut governorate

	Wheat Cultivars	Feb. 2	Feb. 9	Feb. 16	Feb. 23	March 2	March 9	March 16	March 23	March30	Mean
Bread Cultivars	Balady	9.44	10.00	15.33	8.11	53.89	2.44	0.22	3.67	0.56	**11.52 C**
	Sakha 93	3.78	14.11	21.33	14.66	20.00	1.45	1.22	4.78	0.22	**9.06 DE**
	Giza 168	7.00	13.11	13.44	20.22	36.67	0.78	2.00	2.56	0.22	**10.67 D**
	Mesr 1	3.67	10.00	12.78	11.89	25.45	1.56	1.00	2.56	0.78	**7.74 F**
	Mesr 2	2.22	8.66	6.22	35.78	23.89	0.67	0.56	4.89	0.44	**9.26 DE**
	Seds 1	2.78	6.33	12.33	22.45	16.89	1.00	0.56	2.22	0.44	**7.22 F**
	Seds 12	2.78	9.89	13.33	41.89	34.78	1.89	0.56	2.44	0.33	**11.99 C**
Mean		**4.52**	**10.30**	**13.54**	**22.14**	**30.22**	**1.40**	**0.87**	**3.30**	**0.43**	**9.64**
Durum Cultivars	Beni Suef 1	3.56	12.67	18.56	23.33	16.00	0.33	0.56	1.44	0.22	**8.52 E**
	Beni Suef 4	3.00	10.22	35.34	28.67	54.00	1.22	0.22	0.44	0.44	**14.84 A**
	Beni Suef 5	9.22	11.89	11.89	42.22	23.67	0.33	0.44	1.11	0.11	**11.21 C**
	Beni Suef 6	7.89	10.22	28.67	54.78	10.56	0.22	0.33	0.78	0.22	**12.63 B**
	Sohag 3	6.67	8.89	14.33	51.56	7.11	0.22	0.22	0.44	0.22	**9.96 DE**
Mean		**6.07**	**10.78**	**21.76**	**40.11**	**22.27**	**0.46**	**0.35**	**0.84**	**0.24**	**11.43**
Grand Mean		**5.30**	**10.54**	**17.65**	**31.13**	**26.25**	**0.93**	**0.61**	**2.07**	**0.33**	**10.53**
F value		**230.0***									

Means followed by the same letter are not significantly different at 0.05 level of probability by Duncan's multiple range tests.

Table 3- Correlation coefficient between the general average of aphids and their coccinellid predator C. undecimpunctata

Wheat cultivars		2014		2015	
		Aphid complex (%)	*C. undecimpunctata* (%)	Aphid complex (%)	*C. undecimpunctata* (%)
Bread cultivars	Balady	10.35 (8.05)	2.59 (8.32)	11.52 (9.24)	2.56 (8.82)
	Sakha 93	8.75 (6.81)	3.19 (10.25)	9.06 (7.27)	2.78 (9.58)
	Giza 168	10.96 (8.53)	3.30 (10.60)	10.67 (8.56)	3.04 (10.48)
	Mesr 1	9.44 (7.35)	2.96 (9.51)	7.74 (6.21)	2.41 (8.30)
	Mesr 2	10.12 (7.88)	2.56 (8.23)	9.26 (7.43)	2.37 (8.17)
	Seds 1	7.44 (5.79)	3.25 (10.44)	7.22 (5.79)	2.04 (7.03)
	Seds 12	10.86 (8.45)	3.00 (9.64)	11.99 (9.62)	2.11 (7.27)
Total		67.92	20.85	67.46	17.31
Mean		9.70 (44.45)	2.98(59.24)	9.64(45.75)	2.47(51.35)
Durum cultivars	Beni Suef 1	7.74 (6.02)	2.19 (7.04)	8.52 (6.84)	2.52 (8.68)
	Beni Suef 4	17.72 (13.79)	1.41 (4.53)	14.84 (11.91)	2.59 (8.93)
	Beni Suef 5	14.25 (11.09)	2.56 (8.23)	11.21 (9.00)	2.67 (9.20)
	Beni Suef 6	9.41 (7.32)	1.67 (5.37)	12.63 (10.13)	1.89 (6.51)
	Sohag 3	11.46 (8.92)	2.44 (7.84)	9.96 (7.99)	2.04 (7.03)
Total		60.58	10.27	57.16	11.71
Mean		12.12 (55.55)	2.05(40.76)	11.43(54.25)	2.34(48.65)
Grand Total		128.50	31.12	124.62	29.02
Grand Mean		10.71	2.59	10.39	2.42
(r)		-0.071		-0.27	

Table 4 - Mean numbers and (susceptibility degrees) to aphid species inhabiting wheat cultivars during 2014 and 2015 seasons

Wheat Cultivars		2014- Mean numbers / tiller and (Susceptibility degrees)				2015- Mean numbers / tiller and (Susceptibility degrees)				Mean 2014&2015 and (Susceptibility degrees)
		S. graminum	*R. padi*	*R. maidis*	Mean	*S. graminum*	*R. padi*	*R. maidis*	Mean	
Bread cultivars	Baladay	5.26 (LR)	23.78 (LR)	2.00 (S)	10.35 (LR)	4.07(LR)	29.00 (S)	1.48 (LR)	11.52 (S)	**10.91 (S)**
	Sakha 93	3.52 (LR)	21.56 (LR)	1.19 (LR)	8.76 (LR)	5.52 (S)	19.67 (LR)	2.00 (S)	9.06 (LR)	**8.91(LR)**
	Giza 168	5.30 (S)	24.96 (LR)	2.63 (S)	10.96 (S)	4.70(LR)	25.33 (S)	1.96 (S)	10.66 (S)	**10.83 (S)**
	Mesr1	2.96 (MR)	24.15 (LR)	1.22 (LR)	9.44 (LR)	2.48 (MR)	19.85 (LR)	0.89 (MR)	7.74 (MR)	**8.59 (LR)**
	Mesr2	3.89 (LR)	25.56 (S)	0.93 (MR)	10.12 (LR)	3.56 (LR)	23.33 (LR)	0.89 (MR)	9.26 (LR)	**9.69 (LR)**
	Seds1	2.85 (MR)	18.15 (MR)	1.33 (LR)	7.44 (MR)	2.85 (MR)	17.56 (MR)	1.26 (LR)	7.22 (MR)	**7.33 (MR)**
	Seds12	4.89 (LR)	26.15 (S)	1.56 (S)	10.86 (S)	3.74 (LR)	30.30 (S)	1.93 (S)	12.00 (S)	**11.45 (S)**
Durum cultivars	Beni Suef 1	3.26 (LR)	18.85 (MR)	1.11 (LR)	7.74 (MR)	5.44 (S)	18.89 (MR)	1.22 (LR)	8.52 (LR)	**8.13 (MR)**
	Beni Suef 4	8.96 (S)	39.93 (HS)	4.26 (HS)	17.72 (HS)	6.30 (S)	36.37 (HS)	1.85 (S)	14.86 (HS)	**16.27 (HS)**
	Beni Suef 5	8.52 (S)	32.30 (S)	1.93 (S)	14.25 (S)	6.30 (S)	26.15 (S)	1.19 (LR)	11.21 (S)	**12.73 (S)**
	Beni Suef 6	5.96 (S)	20.48 (LR)	1.78 (S)	9.41 (LR)	5.93 (S)	29.63 (S)	2.33 (S)	12.63 (S)	**11.02(S)**
	Sohag 3	8.19 (S)	24.00 (LR)	2.19 (S)	11.46 (S)	6.70 (S)	20.93 (LR)	2.26 (S)	9.96 (LR)	**10.73 (S)**
Total		**63.56**	**299.85**	**22.11**	**128.50**	**57.59**	**297.00**	**19.26**	**124.62**	**126.56**
Mean		**5.30**	**24.99**	**1.84**	**10.71**	**4.80**	**24.75**	**1.61**	**10.38**	**10.55**

Susceptibility degrees: HS= Highly Susceptible; S= Susceptible;
LR= Low Resistant; MR= Moderately Resistant ; HS= Highly Resistant

Table 5. Name and yield of the tested wheat cultivars

Bread cultivars	Yield ton/fed. (0.42 hectare)	Durum cultivars	Yield ton /fed. (0.42 hectare)
Balady	2.72E	**Beni Suef 1**	4.93B
Sakha 93	2.35E	**Beni Suef 4**	3.73D
Giza 168	2.99E	**Beni Suef 5**	4.47C
Mesr 1	4.32CD	**Beni Suef 6**	4.54C
Mesr 2	4.29CD	**Sohag 3**	3.87D
Seds 1	5.01A	-	-
Seds 12	4.63C	-	-
F value	**13.995****		

Means followed by the same letter are not significantly different at 0.05 level of probability by Duncan's multiple range tests.

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أتجاه المجموع و الحساسية النسبية لبعض أصناف أقماح الخبز و المكرونة لحشرات من الغلال و علاقتها بالعدو الحيوى أبو العيد ذو الأحدي عشر نقطة

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الملخص :

تم تقييم أتجاه المجموع لحشرات من الغلال و المفترس أبو العيد ذو الأحدي عشر نقطة المصاحب لهاعلي مدار موسمي النمو لمحصول القمح ٢٠١٤ و ٢٠١٥ م بحافظة اسيوط بشمالي صعيد مصرعلي سبعة أصناف من أقماح الخبز و خمسة أصناف من أقماح المكرونة. أوضحت النتائج أن مجموع حشرات من الغلال (من النجيليات الأخضر، من الشوفان و من أوراق الذرة) كان لها قمة واحدة موسمية بتاريخ ٢٣ فبراير بمتوسط قدره ٣٩,٠٨ و ٣١.١٣فرد / خلفة لموسمي الدراسة علي التوالي. بعد أسبوع واحد وجد أن أعداد حشرات المن يحدث لها إنخفاض حاد و متتابع حتى تختفي تماما عندما تصل نباتات القمح إلى مرحلة الجفاف. وجد أن جميع الأصناف تحت الدراسة تعانى من الإصابة بحشرات المن بدرجات معنوية مختلفة، مما يقود الى التعرف على أفضل أصناف القمح التى تجود زراعتها في صعيد مصر. و لقد وجد ان أصناف أقماح المكرونة كانت تأوى ١,٢٥ و ١,١٩ مرة مثل ما يتواجد علي أقماح الخبز خلال موسمي الدراسة. كما أظهرت العلاقة بين كلا من المفترس و الفريسة أرتباط معنوى سالب. أظهرت الدراسة أن ثلاثة أصناف (٤٢.٦٥%) من أقماح الخبزو أربعة أصناف (٨٠%) من أقماح المكرونة بدت كأصناف حساسة. بينما أظهرت ثلاثة أصناف من أصناف أقماح الخبز درجة من المقاومة و بدت كأصناف منخفضة المقاومة . كذلك وجد أن صنف واحد من أصناف قمح الخبز (سدس ١) وصنف واحد من أصناف قمح المكرونة (بنى سويف ١) و الذان أعطيا أعلي محصول أظهرا درجة متقدمة من المقاومة و بديا كصنفين متوسطى المقاومة.