

SEASONAL ABUNDANCE OF CEREAL APHIDS AND THEIR ENDOPARASITOIDS ON WHEAT PLANTS AT EL-FAYOUM GOVERNORATE

[57]

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ABSTRACT

The population densities of the wheat aphids; *Rhopalosiphum padi* L., and *Schizaphis graminum* Rondani, and their rates of parasitism on the wheat plants, *Triticum aestivum* L. in an experimental field at El-Fayoum governorate, had been studied during two successive seasons (2001/02 and 2002/03). The data revealed that aphid infestation started in early January and gradually increased to reach its maximum in February, then decreased gradually towards the end of the season. *Diaeretiella rapae* (McIntosh), *Praon necans* (Mackauer) and *Aphidius colemani* (Viereck) parasitized the wheat aphids. It started at low density in the second week of January and reached the maximum at the end of February, then declined towards the end of the season.

Key words: Egyptian wheat, Aphids, Parasitoid, Biological control

INTRODUCTION

Wheat aphids still and will be the most important pest attacking the wheat plants which cause moderate or sometimes sever losses in the yield. These losses were estimated by 7 – 23 % of total production. The injurious of aphids have been studied by several entomologists (Kindler & Springer, 1989; Gosselke & Freier, 1997; Havlickova, 1996 & 1997; Havlickova & Morovcova, 1998 and Milne & Delves, 1999).

The aphid species surveyed infesting wheat plantation (*Rhopalosiphum padi*

L., *Rhopalosiphum maidis* F. *Schizaphis graminum* Rondani, *Sitobion avenae* Fab. and *Diuraphis noxia* Mordvilko) were found in Egypt (Ghanim, 1984; Tantawi, 1985; Attia and EL-Kady, 1988; EL-Heneidy *et al*, 1991 and Ibrahim and Afifi, 1991), but the most abundant species were *Rhopalosiphum padi* and *Schizaphis graminum* (Ghanim and El-Adl, 1983 a & 1991; Abou-Elhagag & Abdel-Hafez, 1998 and Abdel-Samad, 2002).

Recently the biological control has taken place, since wheat producer countries are planning stopped using insecti-

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cides in wheat fields (Dent, 1999). Therefore, aphid parasitoids were considered one of the most important natural enemies on aphids in wheat fields (Lopez *et al* 1990 and Robinson, 1992).

Much research in Egypt had focused on the relationship between aphids and its parasitoids either in upper and middle Egypt (EL-Heneidy, 1994; Abdel-Rahman *et al* 2000 and Abdel-Samad, 2002) or in delta (Ghanim & El-Adl, 1983b; Hafez, 1994 and Abou-Elhagag & Abdel-Hafez, 1998), but EL-Fayoum governorate had little chance of this focusing.

The present study aimed to throw more light on the population density of wheat aphid species and their parasitoids in EL-Fayoum governorate.

MATERIAL AND METHODS

Survey and population density of wheat aphids and their associated natural enemies, especially parasitoids on the wheat plants (*Triticum aestivum* L) were conducted in wheat fields in experimental area sized one feddan in each of three different locations (Sannouris, EL-Nazla and Toubhar) at EL-Fayoum governorate during the two successive seasons 2001/02 and 2002/03 by adopting the following:-

Survey and population density of wheat aphids

Experimental areas received all regular cultural practices throughout the two growing seasons. No chemical application was used to evaluate the role of natural enemies without any disruption by the insecticides.

Samples of hundred plants were weekly examined by means of the cross – side method under field conditions at each location throughout the different growing stages of wheat plants, starting from early January to the end of March in the two successive seasons. Number of aphids per tiller was counted directly in the field. Infested samples of wheat plants were collected individually, kept in paper bags and transferred to the laboratory for identifying aphid species and determining the ratios of their occurrence.

Survey and population density of parasitoids

Samples of identified aphid species were weekly examined in the laboratory for

- 1- Estimating the rate of parasitism for each species by dissecting 100 randomized living aphid species / location / week.
- 2- Identifying emerged endoparasitoid species by confining infested aphid species separately with seedling in glass jars until emergence of adult parasitoids. Emerged parasitoids were collected, preserved in 70% ethyl alcohol and droplet of glycerine then identified using special key for the genera and species of aphid parasites of the Mediterranean area (Stary, 1976).

RESULTS

Infestation level of aphids

Aphids' infestation started in the two successive seasons 2001/2002 and 2002/2003 in early January (first week)

when the winged aphids began to migrate to the wheat plants but with low numbers per plant Table 1, 2 and Fig 1, with general means of 1.72 ± 0.17 and 1.79 ± 0.32 aphids / plant for 2001/02 and 2002/03 seasons, respectively. Generally the infestation level of aphids / plant increased gradually reaching an average of 5.59 ± 1.38 aphids /plant for 2001/02 season and 8.85 ± 3.56 aphids / plant for 2002/03 season in January.

The highest period of infestation with aphids was recorded during February where the number of aphids / plant reached 32.1 ± 5.67 and 50.30 ± 4.66 aphids/ plant for the two successive seasons, respectively. In March, the number of aphids decreased, it is probably due to the beginning of ripening stage of the wheat plants. Therefore, the mean number of aphids reached an average of 10.32 ± 4.85 and 24.90 ± 7.89 aphids / plant for the two successive seasons, respectively.

The obtained data about the distribution curve of aphid infestation on wheat plants according to its growing stages coincide with those of EL-Heneidy *et al* 1991; Ibrahim & Afifi, 1991; Abou-Elhagag & Abdel-Hafez, 1998 and Abdel-Samad, 2002).

Aphid species

In the two successive seasons of 2001/2002 and 2002/2003 (Tables 1 and 2) the main cereal aphids which found infesting wheat plants at EL-Fayoum governorate were *Rhopalosiphum padi* and *Schizaphis graminum*. *S. graminum* seems to be epistatic than *R. padi* in tillering stage in January where they represent in the first week of January an averages of 1.15 ± 0.32 (66.9 %) and 1.25 ± 0.27 (69.8 %) aphids/plant for the two succes-

sive seasons, respectively, while *R. padi* represent an averages of 0.57 ± 0.09 (33.1%) and 0.54 ± 0.07 (30.2 %) for both seasons, respectively. The percentages of occurrence of *S. graminum* still epistatic in January where its mean number averaged 3.57 ± 0.83 (63.9%) and 5.53 ± 2.34 (62.5%) for both seasons, respectively, while the occurrence of *R. padi* recorded 2.02 ± 0.66 (36.1%) and 3.32 ± 1.47 (37.5%) for both seasons, respectively. This may be due to either fasting migration of winged forms of *S. graminum* to the wheat fields or to the natural enemies specially parasitoids.

In February the situation of occurrence for both species was reverse. Therefore *R. padi* population / plant increased obviously where it reached 20.05 ± 4.08 (62.5%) and 27.54 ± 3.74 (54.7%) aphids/ plant for the two successive seasons, respectively. On the other side the *S. graminum* reached 12.5 ± 1.59 (37.5%) and 22.76 ± 1.17 (45.3%) aphids / plant for the same successive seasons, respectively. The statistical analysis between the two species showed significant differences where ($F = 3.071$ for 2001 /2003 season and $F = 2.433$ for 2002 / 2003).

In March the situation of occurrence for both species still somewhat as the same level in February where the numbers of *R. padi* per plant averaged 7.15 ± 3.60 (69.3%) for 2001/2002 season and 14.24 ± 4.67 (57.2 %) for 2002/2003 seasons, while the number of *S. graminum* per plant averaged 3.17 ± 1.26 (30.7 %) for 2001 /02 season and 10.66 ± 3.21 (42.8%) for 2002 /03 seasons. The statistical difference showed significant differences between both species in 2001/2002 season ($F=2.112$) but in season 2002/2003 there was no significant differences between both species ($F= 1.284$).

Table 1. Mean numbers of aphid species / wheat plant at EL-Fayoum governorate during 2001 / 2002 season.

Inspection date	Replicates									Average \pm S.D.		
	1			2			3			Total	R.p	S.G
	Total	R.p	S.G	Total	R.p	S.G	Total	R.p	S.G	Total	R.p	S.G
Jan 2	1.91	0.50	1.41	1.61	0.54	1.07	1.63	0.68	0.95	1.72 \pm 0.17	0.57 \pm 0.09 (33.1%)	1.15 \pm 0.23 (66.9%)
Jan 9	3.81	0.79	3.02	4.25	1.14	3.84	4.39	1.38	3.01	4.15 \pm 0.30	1.10 \pm 0.29 (26.5%)	3.05 \pm 0.10 (73.5%)
Jan 16	4.78	1.66	3.12	4.07	1.64	2.43	4.86	1.74	3.12	4.57 \pm 0.43	1.68 \pm 0.05 (36.8%)	2.89 \pm 0.40 (63.2%)
Jan 23	8.64	3.53	5.11	8.07	1.05	4.02	8.46	2.62	5.84	8.39 \pm 0.29	2.40 \pm 1.25 (28.6%)	5.99 \pm 0.92 (71.4%)
Jan 30	10.11	4.88	5.23	10.14	4.47	5.67	7.05	3.73	3.32	9.10 \pm 1.77	4.36 \pm 0.58 (47.9%)	4.74 \pm 1.25 (52.1%)
Meant\pms.e										5.59 \pm 1.38	2.02 \pm 0.66 (36.1%)	3.57 \pm 0.83 (63.9%)
t value										1.19		
Feb. 6	15.56	9.54	6.02	16.92	8.78	8.14	18.0	9.06	8.93	6.83 \pm 1.23	9.13 \pm 0.38 (54.2%)	7.70 \pm 1.50(45.8%)
Feb. 13	29.65	18.3	11.3	33.54	22.0	11.5	29.3	16.8	12.6	30.83 \pm 2.35	19.02 \pm 2.67 (61.7%)	11.81 \pm 0.65(38.3%)
Feb. 20	37.39	23.9	13.5	39.71	24.9	14.9	35.9	23.0	13.0	37.67 \pm 1.92	23.93 \pm 0.95 (63.5%)	13.74 \pm 0.97(36.5%)
Feb. 27	40.58	24.4	16.1	45.34	31.1	14.3	43.3	28.8	14.4	43.07 \pm 2.39	28.10 \pm 3.40 (65.2%)	14.97 \pm 1.04(34.8%)
Meant\pms.e										32.10 \pm 5.67	20.05 \pm 4.08 (62.5%)	12.05 \pm 1.59(37.5%)
t value										3.071**		
Mar. 6	25.86	19.1	6.73	23.08	15.1	8.01	23.1	17.7	5.37	24.01 \pm 1.60	17.30 \pm 2.03 (72.1%)	6.71 \pm 1.32(27.1%)
Mar. 13	11.17	8.12	3.05	9.91	6.10	3.81	9.25	7.06	2.19	10.11 \pm 0.97	7.09 \pm 1.01 (70.1%)	3.02 \pm 0.81(29.9%)
Mar. 20	4.36	3.09	1.27	5.30	3.21	2.09	5.41	2.53	2.88	5.02 \pm 0.58	2.94 \pm 0.36 (58.6%)	2.08 \pm 0.80(41.4%)
Mar. 27	1.95	1.14	3.81	2.70	1.76	0.94	1.76	0.95	0.81	2.14 \pm 0.50	1.28 \pm 0.42 (59.8%)	0.86 \pm 0.22(40.2%)
Meant\pms.e										10.32 \pm 4.85	7.15 \pm 3.60 (69.3%)	3.17 \pm 1.26(30.7%)
t value										2.112*		
General Meant\pms.e										15.20 \pm 3.93	9.15 \pm 2.67 (60.2%)	6.05 \pm 1.32(39.8%)
t value										1.842		

Where : R.p. = *Rhopalosiphum padi* ; S.g. = *Schizaphis graminum*

Table 2. Mean numbers of aphid species / wheat plant at EL-Fayoum governorate during 2002 / 2003 season.

Inspection date	Replicates									Average \pm S.D.		
	1			2			3			Total	R.p	S.G
	Total	R.p	S.G	Total	R.p	S.G	Total	R.p	S.G	Total	R.p	S.G
Jan 2	1.43	0.46+	0.97	2.05	0.54	1.51	1.89	0.61	1.28	1.7 \pm 0.32	0.54 \pm 0.07 (30.2%)	1.25 \pm 0.27 (69.8%)
Jan 9	3.29	1.05	2.24	4.77	1.35	3.42	4.40	1.60	2.80	4.16 \pm 0.76	1.33 \pm 0.27 (32.0%)	2.83 \pm 0.59 (68.0%)
Jan 16	6.12	1.75	4.37	5.94	2.05	3.89	6.01	2.34	3.67	6.02 \pm 0.09	2.05 \pm 0.29 (34.0%)	3.97 \pm 0.36 (66.0%)
Jan 23	9.56	3.55	6.01	10.8	3.95	6.85	10.50	4.21	6.29	10.29 \pm 0.65	3.90 \pm 0.33 (37.9%)	6.39 \pm 0.43 (62.1%)
Jan 30	21.5	8.41	13.10	21.5	8.59	12.91	22.90	9.35	3.50	21.97 \pm 0.81	8.78 \pm 0.50 (40.0%)	13.19 \pm 0.17 (60.0%)
Mean \pm s.e										8.85 \pm 3.56	3.32 \pm 1.47 (37.5%)	5.53 \pm 2.34 (62.5%)
t value											1.611	
Feb. 6	36.9	17.7	19.2	36.9	17.8	19.1	38.5	18.5	20.0	37.43 \pm 0.92	18.00 \pm 0.43 (48.1%)	19.43 \pm 0.49(51.9%)
Feb. 13	50.0	25.6	24.4	49.7	25.8	23.9	52.4	26.3	26.1	50.70 \pm 1.48	25.90 \pm 0.36 (51.1%)	24.80 \pm 1.15(48.9%)
Feb. 20	49.1	27.9	21.2	55.1	31.4	23.7	57.5	32.8	24.7	53.90 \pm 4.33	30.70 \pm 2.52 (56.9%)	23.20 \pm 1.80(43.1%)
Feb. 27	55.7	33.8	21.9	57.0	34.3	22.7	65.1	38.6	26.5	29.27 \pm 5.09	35.57 \pm 2.64 (60.0%)	23.70 \pm 2.46(40.0%)
Mean \pm s.e										50.30 \pm 4.66	27.54 \pm 3.74 (54.7%)	22.76 \pm 1.17(45.3%)
t value											2.433*	
Mar. 6	38.6	21.0	17.6	43.80	25.30	18.50	44.7	28.70	16.00	42.37 \pm 3.29	25.00 \pm 3.86 (59.0%)	17.37 \pm 1.27(41.0%)
Mar. 13	32.1	16.3	15.8	36.10	19.80	16.30	33.1	20.70	12.40	33.77 \pm 2.08	18.93 \pm 2.32 (56.0%)	14.84 \pm 2.12(44.0%)
Mar. 20	13.8	6.89	6.91	15.70	8.49	7.21	14.3	8.63	5.67	14.60 \pm 0.98	8.00 \pm 0.97 (54.8%)	6.60 \pm 0.82(45.2%)
Mar. 27	8.79	4.63	4.16	9.51	5.02	4.49	8.68	5.46	3.22	8.99 \pm 0.45	5.04 \pm 0.41 (56.1%)	3.95 \pm 0.66(43.9%)
Mean \pm s.e										24.90 \pm 7.89	14.24 \pm 4.67(57.2%)	10.66 \pm 3.21(42.8%)
t value											1.284	
General										26.56 \pm 5.72	14.13 \pm 3.37 (53.2%)	12.43 \pm 2.41(46.8%)
Mean \pm s.e												
t value											1.016	

Where: R.p. = *Rhopalosiphum padi* ; S.g. = *Schizaphis graminum*

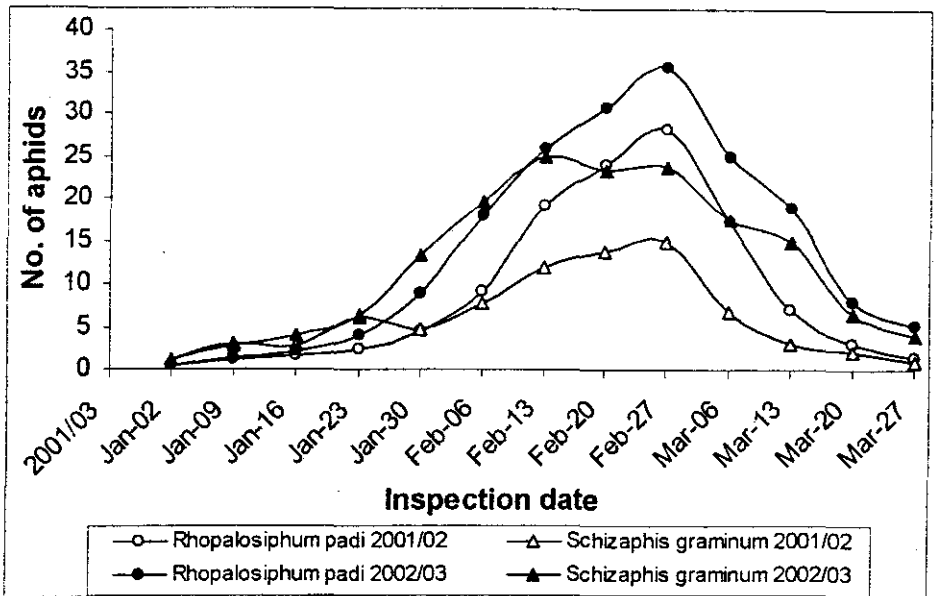


Fig. 1. Mean numbers of both *Rhopalosiphum padi* and *Schizaphis graminum* / wheat Plant at EL-Fayoum governorate during 2001/02 and 2002/03 seasons.

Rate of parasitism

In the present investigation, there parasitoid species were found to attack cereal aphids, they include: *Diaeretiella rapae* (McIntosh), *Praon necans* (Mackauer) and *Aphidius colemani* (Viereck)

The rate of parasitism for both aphid species were recorded in Tables 3 and 4 and figured in Fig.2. The data showed that the parasitoids started to attack the wheat aphids species during the second week of January but in low percentage of parasitism due to the low density of aphids presented. Percentage of parasitism reached the averages 2.2 ± 0.8 and $1.5 \pm 0.7\%$ in 2001/2002 season and 2.6 ± 0.9 and $2 \pm 0.8\%$ in 2002/2003 season on *R. padi* and *S. graminum*, respectively. As the population densities of the aphid species

built up, the percentage of parasitism began to increase to reach an average of $10.4 \pm 2.2\%$ (2001/2002) and $12.5 \pm 2.5\%$ (2002 / 2003) for *R. padi* and $16.2 \pm 3.4\%$ (2001 / 2002) and $16.7 \pm 3.4\%$ (2002/2003) for *S. graminum*. In March the parasitism percentage slightly declined to $7.9 \pm 1.3\%$ (2001/2002) and $10.3 \pm 1.8\%$ (2002/03) on *R. padi* and $15.2 \pm 3.2\%$ (2001/02) and $14.6 \pm 2.8\%$ (2002/03) on *S. graminum*. This results about the distribution curve of parasitism coincide with those of EL-Heneidy, 1994; Hafez, 1994; Abdel-Rahman *et al* 2000 and Abdel-Samad, 2002.

It is noticeable that the percentage of parasitism in January was somewhat higher in *R. padi* than that in *S. graminum* but without significant differences ($F=1.217$ (2001/02) and $F=0.934$ (2002/03)). In February, the situation was re-

verse significantly ($F = 2.539$ (2001 /02) and $F = 2.157$ (2002 / 03)). Also the same manner of parasitism was detected during

March which found signification difference between both species ($F = 3.658$ (2001 / 02 and $F = 2.606$ (2002 /03).

Table 3. Percentages of parasitism on wheat aphid species at El-Fayoum governorate during 2001/2002 season.

Inspection date	<i>Rhopalosiphum padi</i>				<i>Schizaphis graminum</i>			
	Replicates			Averages	Replicates			Averages
	1	2	3	±S.D.	1	2	3	±S.D.
Jan 2	0	0	0	0	0	0	0	0
Jan 9	1	1	0	0.7±0.6	1	0	0	0.3±0.6
Jan 16	2	3	1	2.0±1.0	2	1	1	1.3±0.6
Jan 23	4	5	3	4.0±1.0	2	3	3	2.7±0.5
Jan 30	4	5	4	4.3±0.6	4	3	3	3.3±0.7
mean±S.E				2.2±0.8				1.5±0.7
t value	1.217							
Feb. 6	4	5	6	5.0±1.0	7	8	10	8.3±1.5
Feb. 13	6	9	11	8.7±2.5	10	15	13	12.7±2.5
Feb. 20	10	16	13	13.0±3.0	22	25	17	21.3±4.0
Fe. 27	13	15	17	15.0±2.0	25	23	19	22.3±3.1
mean±S.E				10.4±2.2				16.2±3.4
t value	2.539*							
Mar. 6	11	10	10	10.3±0.6	23	25	18	22.0±3.6
Mar. 13	9	11	9	9.7±1.1	21	20	16	19.0±2.6
Mar. 20	7	6	8	7.0±1.0	11	13	9	11.0±2.0
Mar. 27	5	3	6	4.7±1.5	8	12	6	8.7±3.1
mean±S.E				7.9±1.3				15.2±3.2
t value	3.658**							
General								
mean±S.E				6.2±1.3				10.5±2.3
t value	2.893*							

Where: R.p. = *Rhopalosiphum padi*;

S.g. = *Schizaphis graminum*

t between averages in Jan. = 1.753;

Feb. = 2.749*; March = 3.913**

Table 4. Percentages of parasitism on wheat aphid species at El-Fayoum governorate during 2002/2003 season.

Inspection date	<i>Rhopalosiphum padi</i>				<i>Schizaphis graminum</i>			
	Replicates			Averages	Replicates			Averages
	1	2	3	±S.D.	1	2	3	±S.D.
Jan 2	0	0	0	0	0	0	0	0
Jan 9	1	0	2	1.0±1.0	0	1	1	0.7±0.6
Jan 16	2	3	4	3.0±1.0	1	2	3	2.0±1.0
Jan 23	3	5	3	3.7±1.1	3	3	4	3.3±0.6
Jan 30	4	6	6	5.3±1.1	3	5	4	4.0±1.0
mean±S.E				2.6±0.9				2.0±0.8
t value	0.934							
Feb. 6	5	7	7	6.3±1.2	9	11	7	9.0±2.0
Feb. 13	10	12	10	10.7±1.2	12	15	13	13.3±1.5
Feb. 20	13	16	17	15.3±2.1	18	25	20	21.0±3.6
Feb. 27	16	18	19	17.7±1.5	22	26	23	23.7±2.1
mean±S.E				12.5±2.5				16.7±3.4
t value	2.157*							
Mar. 6	14	13	14	13.7±0.6	16	26	20	20.7±5.0
Mar. 13	13	12	13	12.7±0.6	14	2	17	17.3±3.5
Mar. 20	8	10	9	9.0±1.0	11	15	12	12.7±2.1
Mar. 27	4	8	6	6.0±2.0	5	10	8	7.7±2.5
mean±S.E				10.3±1.8				14.6±2.8
t value	2.606*							
General								
mean±S.E				7.8±1.6				10.6±2.2
t value	1.022							

Where: R.p. = *Rhopalosiphum padi*;
t between averages in Jan. = 0.934

S.g. = *Schizaphis graminum*
Feb. = 0.755; March = 2.593*

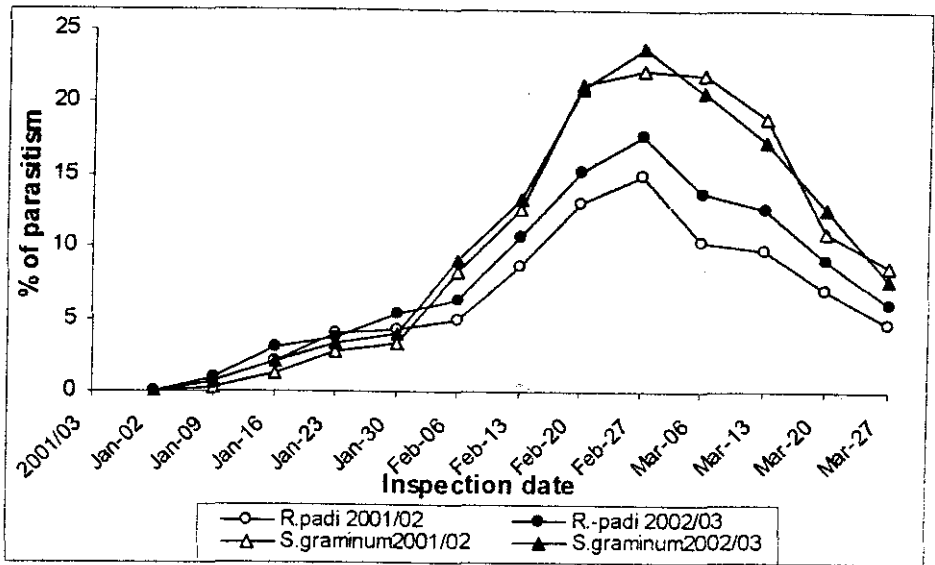


Fig. 2. Rate of parasitism for both *Rhopalosiphum padi* and *Schizaphis graminum* at EL-Fayoum governorate during 2001/02 and 2002/03 seasons.

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الوفرة الموسمية لمن القمح وطفيلياته الداخلية على نبات القمح

في محافظة الفيوم

[٥٧]

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كذلك أظهرت الدراسة وجود ثلاث أنواع من الطفيليات الداخلية على حشرات من القمح هي

Diaeretiella rapae (McIntosh), *Praon necans* (Mackauer) and *Aphidius colemani* (Viereck).

وتتوأكب معدلات التطفل الداخلي على هذين النوعين مع اعدالهما، حيث بدأت بنسب منخفضة في الأسبوع الثاني من شهر يناير ووصلت إلى أقصاها في نهاية شهر فبراير ثم بدأت في الانخفاض تجاة نهاية موسم الزراعة.

أجريت هذه التجارب بهدف دراسة الكثافة العددية لحشرة من القمح على نباتات القمح المنزرعة في الحقل التجريبي بمحافظة الفيوم خلال موسمين متعاقبين هما ٢٠٠٢/٢٠٠٣، ٢٠٠١/٢٠٠٢. وقد أظهرت النتائج المتحصل عليها وجود نوعين من المن تصيب نبات القمح هما *Rhopalosiphum padi* L., *Schizaphis graminum* Rondani. تبدأ الاصابة بهاتين الآفتين في الظهور في الحقل في بداية شهر يناير ثم تزداد نسبة الاصابة تدريجيا الى ان تصل الى أقصاها خلال شهر فبراير. بعدها يبدأ تعداد هاتين الآفتين في الانخفاض تجاة نهاية الموسم.

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