MONITORING OF LEAFHOPPERS POPULATION IN COTTON FIELDS AT KAFR EL-SHEIKH GOVERNORATE

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Abstract

Monitoring of insect population in the field is one of the essential components in the integrated pest management programs. So, an experiment was carried out at Sakha Agric. Res. Station Farm, Kafr El-Sheikh to monitor the population of leafhoppers in cotton fields using two sampling methods (direct count on cotton leaves and sweeping net) as well as effect of some prevailing climatic factors on the population density during two successive growing seasons, 1999 and 2000.

The results obtained indicated that the numbers of leafhopper nymphs found by direct count were more than adults, while the reverse occurred in sweeping net samples. The highest population of leafhoppers occurred during June, July and August and there was insignificant variation in the population density between the two study seasons. The adults of leafhoppers were more affected by the three considered factors (temperature, relative humidity and wind speed) than nymphs in the two seasons and the temperature was the most important factor affecting the population.

Thus, the direct count sampling method should be used for estimating leafhoppers population when the integrated insect management programs are applied in cotton fields.

INTRODUCTION

In recent years, leafhoppers are considered one of the most important sucking insect pests on cotton plants in A. R. of Egypt (Abd El-Wahab 1998, Hendawy & Chiasson, 2001 and Ibraheem, 2001).

Monitoring of pest population in the field is one of the important components of pest management programs (Fenemore, 1984). It can be carried out to follow the progress of population development up to a pre-defined number of insects or action threshold. Field based monitoring involves estimate of pest infestation levels within crop or soil areas and / or aerial population above and around the crop (Dent, 1991). Also, the factors affecting pest numbers such as weather fluctuations and the natural enemies must be involved (Fenemore, 1984).

The gained information can be used to develop a forecasting system and derive the inputs for a working forecasting system. These information then, are used by the farmer to make decisions about the implementation of control measures.

However, the type of sampling techniques used in a monitoring program depends largely on the precise objectives of the proposed program (Dent, 1991) and it must be adapted to suit the different situations (Kumar, 1984).

So, the present study was carried out to monitor leafhoppers population in cotton fields using two sampling methods, sweeping net and direct count on cotton leaves as well as effect of some climatic factors on the population density during 1999 and 2000 seasons .

MATERIALS AND METHODS

The study was carried out at Sakha Agric. Res. Station Farm, Kafr El-Sheikh to monitor the population density of leafhoppers in cotton fields in addition to the effect of some prevailing climatic factors population density during two successive growing seasons, 1999 and 2000. An area of about one feddan was cultivated with cotton variety Giza 86 during the last week of march in the two seasons. The normal agricultural practices were applied throughout the growing season without any pesticidal treatments. Sampling was done weekly from the first week of May to the first week of October. Two sampling methods were used, direct count on the cotton leaves and sweeping net.

Direct count:

Weekly samples of 100 leaves were chosen at random and the leafhoppers were carefully counted directly in the field on the upper and lower surfaces of three cotton leaves per plant, representing the upper, middle and lower level of the cotton plant.

Sweeping net:

Weekly samples of 50 double (100 single) strokes were taken at diagonal directions of the experimental field. The catch was anesthetized using chloroform, emptied in polyethylene bag, then transferred to the laboratory. The leafhoppers were separated from the other insects and counted using a camel's hair brush and a hand glass lens 8x.

To determine the effect of the three climatic factors on the leafhopper population (nymphs and adults), records of mean temperature, relative humidity and wind speed during the two study seasons (1999 and 2000) were obtained from Meteorological Station at Sakha Research Station. Weekly means of these factors during the week preceding the sample date were used to calculate the simple correlation, regression coefficient and explained variance values according to Fisher (1950).

RESULTS AND DISCUSSION

1 –Population density of leafhoppers on cotton plants:

The total number of all leafhopper species occurring on cotton using the two sampling methods , direct count and sweeping net was taken into consideration because of the difficulties of direct identification of leafhopper species in the field.

a- Direct count method:

Data presented in Table (1) clear the mean number of both nymphs and adults of leafhoppers/100 cotton leaves during seasons of 1999 and 2000. In 1999 season,

Table 1. Mean number of leafhoppers / 100 cotton leaves during two successive seasons, 1999 and 2000 season.

Sampling date		Season of 1999			Season of 2000		
Month	Week	nymph	adult	total	nymph	adult	total
May	1st	28	0	28	45	2	47
	2nd	68	2	70	78	5	83
	3rd	171	6	177	167	33	200
	4th	178	33	211	223	50	273
Mean		111.25	10.25	121.50	128.25	22.50	150.75
June	1st	212	145	357	233	156	389
	2nd	167	162	329	145	67	212
	3rd	112	57	169	178	100	278
	4th	212	45	257	100	112	212
Mean		175.75	102.25	278.00	164.00	108.75	272.75
July	1st	45	123	168	67	133	200
	2nd	123	178	301	45	189	234
	3rd	206	128	334	100	145	245
	4th	223	145	368	112	213	325
Mean		149.25	143.50	292.75	81.00	170.00	251.00
Aug.	1st	112	106	218	139	145	284
	2nd	256	56	312	133	100	233
	3rd	223	72	295	223	112	335
	4th	186	103	289	245	112	357
Mean		194.25	84.25	278.50	185.00	117.25	302.25
Sept.	1st	45	17	62	67	6	73
	2nd	67	56	123	112	67	179
	3rd	100	62	162	56	23	79
	4th	106	59	165	45	67	112
Mean		79.50	48.50	128	70.00	40.75	110.75
Oct.	1st	45	33	78	23	45	68
Mean		45.00	33.00	78.00	23.00	45.00	68.00
Seasonal mean± SD*		137.38 ± 71.35	75.62± 54.69	213.00± 104.60	120.76± 68.93	89.62± 60.75	210.38± 102.09

SD*= standard deviation

the population density of leafhoppers on cotton plants was 28 nymphs and 2 adults/100 leaves. Then, the population increased forming the first peak of 357 insects (212 nymphs + 145 adults) in the 1st week of June. After that, the population fluctuated recording four peaks in the 4th week of June, the 4th week of July, the 3rd week of Aug. and the 4th week of Sept. with means of 257 insects (212 nymphs + 45 adults), 368 insects (223 nymphs + 145 adults), 295 insects (223 nymphs + 72 adults) and 165 insects (106 nymphs + 59adults), respectively.

In season of 2000, the leafhopper population started to appear in low numbers (45 nymphs + 2 adults) in the 1st week of May. Also, the population fluctuated during the sampling period forming five peaks of abundance in the 1st week June, the 3rd week of June, the 4th week of July, the 4th week of Aug. and the 2nd week of Sept. with means of 389 insects (233 nymphs + 156 adults), 278 insects (178 nymphs + 100 adults), 325 insects (112 nymphs + 213 adults),357 insects (245 nymphs + 112 adults) and 179 insects (112 nymphs + 67 adults), respectively.

b- sweeping net method:

The number of leafhoppers caught by sweeping net in the two study seasons, 1999 and 2000 was shown in Table (2). In the first season, very low numbers of leafhoppers were caught in the 1st and 2nd week of May with 1 and 3 insects/strokes, respectively. Then, a sudden increase occurred recording the highest peak of 66 insects (3 nymphs + 63 adults) / 100 strokes in the 1st week of June. After that, the population fluctuated recording four peaks in the 3rd week of June, the 4th week of July, the 3rd week of Aug. and the 4th week of Sept. with means of 48 insects (0 nymphs + 48 adults), 49 insects (1 nymphs + 48 adults), 60 insects (2 nymphs + 58 adults) and 31 insects (1 nymph + 30 adults), respectively.

In the second season, the same trend of results was observed ,as very low numbers of population were caught in the 1st week of May. Subsequently, the numbers increased to record the highest peak of 76 insects (3 nymphs + 73 adults) / 100 strokes in the 1st week of June. After that, the population fluctuated till the end of sampling period recording four peaks of abundance in the 3rd week of June, the 4th week of July, the 3rd week of Aug. and the 3rd week of Sept. with means of 59, 48, 63, and 30 insects, respectively.

These results agreed with those of Ibraheem (2001), who reported that the leafhoppers had five peaks of abundance on cotton plants during 1996 season and the highest peak occurred in the 2nd week of June.

Table 2. Mean number of leafhoppers / 100 strokes on cotton plants during two successive seasons, 1999 and 2000 season.

Sampling date		Season of 1999			Season of 2000		
Month	Week	nymph	adult	total	nymph	adult	total
May	1st	0	1	1	0	2	2
	2nd	1	2	3	1	21	22
	3rd	2	20	22	2	28	30
	4th	7	28	35	3	48	51
Mean		2.50	12.75	15.25	1.50	24.75	26.25
June	1st	3	63	66	3	73	76
	2nd	1	28	29	0	53	53
	3rd	0	48	48	1	58	59
	4th	3	25	28	4	35	39
Mean		1.75	41.00	42.75	2.00	54.75	56.75
July	1st	1	34	35	1	31	32
	2nd	0	43	43	1	34	35
	3rd	0	46	46	0	45	45
	4th	1	48	49	0	48	48
Mean		0.50	42.75	43.25	0.50	39.50	40.00
Aug.	1st	0	34	34	1	41	42
	2nd	2	38	40	2	50	52
	3rd	2	58	60	3	60	63
	4th	1	40	41	1	45	46
Mean		1.25	42.50	43.75	1.75	49.00	50.75
Sept.	1st	0	28	28	0	25	25
	2nd	1	29	30	1	26	27
	3rd	0	30	30	2	28	30
	4th	1	30	31	1	29	30
Mean		0.50	29.25	29.75	1.00	27.00	28.00
Oct.	1st	1	9	10	1	10	11
Mean		1.00	9.00	10.00	1.00	10.00	11.00
Seasonal mean ± SD*		1.29 ± 1.62	32.48± 16.15	33.77± 16.34	1.33 ± 1.15	37.62± 17.06	38.95± 17.49

SD*= standard deviation

The data summarized in Table (3) indicated no significant variation in the population density of leafhoppers between the two sampling years, 1999 and 2000. Also, the number of nymphs found by direct count method was more than adults while, the reverse was found in sweeping net samples. This may be due to that the strokes of sweeping net disturb the adults that can fly and therefore enter the sweeping net easily (Ammar *et al.,* 1986).

Table 3. Mean number of leafhoppers (nymphs and adults) on cotton using direct count and sweeping net method during 1999 and 2000 seasons.

Season	Direct count			Sweeping net		
	No./100 leaves			No. / 100 strokes		
	Nymph	Adult	Total	Nymph	Adult	Total
1999	137.38	75.62	213.00	1.29	32.48	33.77
2000	120.76	89.62	210.38	1.33	37.62	38.95
LSD* at 5%	7.608	8.822	10.187	0.706	5.739	6.277

LSD*=Least significant difference

The use of sweeping net in leafhoppers sampling had disadvantages, as it showed extreme variations in catch under varying environmental conditions (Cherry *et al.*, 1977). Also, sweeping net samples captured mainly adults of leafhoppers (Ammar *et al.*, 1986).

Thus, the direct count method was more suitable and precise for counting leafhoppers population than the sweeping net method.

2 – Effect of some climatic factors on the population density of leafhoppers on cotton plants:

Data presented in Table (4) reveal the effect of temperature, relative humidity and wind speed on the population of both nymphs and adults of leafhoppers using two sampling methods, direct count and sweeping net during 1999 and 2000 seasons. In general, temperature was the most important factor affecting the population. In season of 1999, temperature had a significant effect on both nymphs and adults of leafhoppers using the two sampling methods with exception of the effect on nymphs using sweeping net ,as the effect was insignificant. The relative humidity had a significant effect on both nymphs and adults using the two methods with exception of the effect on nymphs using the direct count method, as it was insignificant. Wind speed was within the optimal range for activity of both nymphs and adults, as its effect was insignificant.

During the second season, the effect of temperature was significant on adults and insignificant in nymphs. Both relative humidity and wind speed induced only significant effect on adults and nymphs using direct count method .

Table 4. Effect of temperature (Temp. °C), relative humidity (R.H.%) and wind speed (W.S.)on the population of leafhoppers (nymphs and adults) on cotton plants using direct count and sweeping net during 1999 and 2000 seasons.

Season	Sampling method	Stage	Simple correlation			Regression coefficient			EV*%
			Temp.C°	R.H.%	W.S. Km/h	Temp. C°	R.H. %	W.S. Km/h	
1999	Direct count	Nymph	0.490**	0.346	0.283	13.997	1.401	15.438	35.49
		Adult	0.456**	0.404*	0.269	7.320	2.413	12.054	36.76
		Total	0.573**	0.447**	0.333	21.317	3.814	27.493	52.08
	Sweeping net	Nymph	-0.188	- 0.376*	0.325	0.083	-0.100	0.231	20.65
		Adult	0.661**	0.382*	0.167	5.226	-0.175	2.286	50.23
		Total	0.635**	0.340	0.198	5.308	-0..275	2.517	48.61
2000	Direct count	Nymph	0.135	- 0.253	0.272	14.198	-3.550	19.317	20.46
		Adult	0.717**	0.493**	-0.446**	18.449	0.721	-5.603	52.80
		Total	0.518**	0.122	-0.082	32.648	-2.829	13.714	31.69
	Sweeping net	Nymph	-0.211	-0.306	0.214	-0.033	-0.059	-0.058	9.66
		Adult	0.522**	0.007	0.114	6.486	-0.430	7.421	45.93
		Total	0.495**	-0.013	0.126	6.453	-0.489	7.363	43.23

*= Significant ** = High significant EV*= Explained variance

The results indicate that the nymphs were less affected by the three considered weather factors than adults in the two seasons. In the first season, the combined effect of the three factors (as a percentage of explained variance) on nymphs was 35.49 & 20.65 % using direct count and sweeping net, respectively and it was 36.76 and 50.23 % on adults, respectively. In the second season, the combined effect on nymphs was 20.46 & 9.66 % using direct count and sweeping net, respectively, while it was 52.80 & 45.93 % on adults, respectively.

These results agreed with those of Ammar *et al.* (1986) who reported that temperature had significant effect on leafhoppers in cotton fields in 1982 season. Also, Cherry *et al.* (1977) showed that the temperature was the most important variable affecting sweeping net catches of leafhoppers adults.

Generally, it can be concluded that, the direct count method was more suitable for counting leafhopper nymphs and adults than the sweeping net method on cotton plants. Also, the nymphs of leafhoppers were less affected by the three considered weather factors than adults and the temperature was the most important variable affecting the population.

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مراقبة تعداد نطاطات الأوراق في حقول القطن في محافظة كفر الشيخ

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إن مراقبة الحشرات في الحقل من المكونات الأساسية في برامج المكافحة المتكاملة للآفات – لذا أجريت تجربة في مزرعة محطة البحوث الزراعية بسخا – كفر الشيخ لتقدير تعداد حشرات نطاطات الأوراق في حقول القطن باستخدام طريقتين لأخذ العينات هما طريقة العد المباشر على أوراق القطن وطريقة شبكة الكنس وكذلك تأثير بعض العوامل الجوية السائدة على كثافة التعداد خلال موسمي ١٩٩٩ ، ٢٠٠٠

أوضحت النتائج المتحصل عليها أنه في طريقة العد المباشر كانت أعداد الحوريات أعلى من أعداد الحشرات الكاملة بينما وجد العكس في عينات شبكة الكنس. وكان أعلى تعداد لنطاطات الأوراق على نباتات القطن خلال يونيو ويوليه وأغسطس ولم يكن هناك اختلافاً معنوياً في التعداد في موسمي الدراسة. كانت الحشرات الكاملة لنطاطات الأوراق أكثر تأثراً عن الحوريات بالعوامل الجوية الثلاثة (درجة الحرارة والرطوبة النسبية وسرعة الرياح) خلال الموسمين ، وكانت درجة الحرارة هي أكثر العوامل أهمية في التأثير على التعداد.

وهكذا يجب استخدام طريقة العد المباشر لنطاطات الأوراق على أوراق القطن في برامج المكافحة المتكاملة للحشرات في حقول القطن وذلك للتقدير الشامل لأعداد نطاطات الأوراق.