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THE ROLE OF CERTAIN ENVIRONMENTAL FACTORS ON THE POPULATION ACTIVITY OF RICE LEAF MINER *HYDRELLIA PROSTERNALIS*; DEEMING AND LEAFHOPPER *BALCLUTHA HORTENSIS* LINDB, AT THE NORTHERN PARTS OF DELTA

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Abstract

Rice leafminer *Hydrellia prosternalis* and the leafhopper *Balclutha hortensis* are considered key pest of rice plants in Egypt. Field trails were carried out at El-Serw Experimental Station, Damietta Governorate 1997 and 1998, seasons. Both species were mostly active during August and September of both seasons according to Ali 1978, Bleih (1980) and Isa (1979). The relationship between the changes in the population density of *B. hortensis* and *H. prosternalis* and the prevailing corresponding weather factors in the two tested years revealed a significant positive relationship for the Day Mx. Temp. Insignificant negative effect was obtained for *H. prosternalis* when the mean relative humidity % was considered. The effect of one degree of these factors for *B. hortensis* was about (+7.8, 6.5 and –3.4) for day maximum, minimum temperature and relative humidity and (6.95, 5.4 and – 3.4) for 1997. Similar trend was observed for *H. prosternalis* i.e. (+4.8, +3.0 and –1.4) and (+2.1, +2.9 and –2.1) for 1997 and 1998, respectively. The analysis showed that (28 °C – 31 °C) , (19-22 °C) and 62-72 R.H.%) may be regarded as the optimum day max., min. and relative humidity, respectively.

INTRODUCTION

In Egypt the area cultivated with rice has increased recently rearly that reaching about 1.25 million feddans. Furthermore, rice is the most common crop in newly reclaimed lands where the high salinity prevents the successful growth of many other crops.

Little attention has been given to the leafhoppers which are considered to be of greet effect on rice growth and yield in the Far East, particularly they play a great role in transmission of virus diseases to paddy rice. The rice whorl maggot (R.W.M) *Hydrellia*

prosternalis has recently become common in Egypt. The maggots feed on the mesophyll tissues. Edges of infested leaves are disfigured with whitish or yellowish blotches (Esa *et al.* 1979; Ismail *et al.* 1979; Heinrichichs *et al.* 1982; Tantawi *et al.*, 1989; Bleih 1989; Pantoja 1992) in Colombia. They reported that the damage to rice fields by *H. prosternalis* recovered at early stages of rice plant development. Planting rice early was recommended to avoid high infestation by this insect (Krishnaiah and Ras, 1990). The scope of the present study is to contribute towards better knowledge of the following aspects on rice leafhoppers, *Balclutha hortensis*, and the rice leafminer *H. prosternalis*.

MATERIALS AND METHODS

A field of about one feddan was selected in each season (1997 and 1998). Sampling of both species was done periodically at 10 day intervals by carrying out 100 double strokes using the sweeping net starting from 4th of July until 15th of September i.e., just before harvest. Insect species were collected at each interval and sorted to the different species and their numbers were counted and recorded all over the rice season. The prevailing weather factor figures: Namely Day maximum temperature (X_1), night minimum temperature (X_2) and the mean relative humidity R.H.% (X_3) during 1997 and 1998, rice growing seasons were obtained from Agro-meteorological station at Domietta and the central Meteorological Department at Koubri El-Qubba, Cairo to clarify the effect of these weather factors on the changes in the population density. Correlation values were worked out using C-multipliers method (Fisher, 1950).

This study comprised certain species, which proved to be common or very common in rice fields and conducted on the seasonal abundance of the more dominate.

RESULTS AND DISCUSSION

Tables 1 and 2 show the changes in the population density of insect species surveyed on rice at El Serw locatity Domietta Governorate. It was observed that these species were mostly active during August and September of both 1997 and 1998 rice seasons. Estimates of insect density revealed that leaf hopper species, *B. hortensis* and leaf miner *H. prosternalis* were the highest expressed as total of insects/10 day numbers, therefore, season fluctuatin and abundance were investigated in relation to plant phenology and prevailing weather factors specially environmental temperature and rela-

tive humidity. These species are considered of major importance on rice causing great damage to this crop:

a. The rice leafhopper *Balclutha hortensis* (Lidb)

During the first season (1997), Adult of *B. hortensis* appeared in rice fields by the first week of July with considerable numbers (71.25 adults), after which the population proportionally increased in the subsequent samples and reached it's maximum (184.25 adults), by the third of August. By late August, the density of insect population showed gradual decrease and attained its lowest number (71.75 adults), just before rice harvest. These results infer to the occurrence of one peak of *B. hortensis* adults on rice at El Serw locality. During the second season (1998), *B. hortensis* (Lidb) behaved quite similary to the previous season. However, the density of adults occurrance was somewhat lower. In 1998, the number of adults was started in low (52.25 adults). Insect population steadily increased and showed a distinct summit (147.25 adults) by 3rd of August. Subsequent samples showed considerable decline in insect numbers and reached the least (11.75 adults) by 13th of September. Abu Yaman (1967), Pathak (1968) and Ali (1978) mentioned that first generation adults appear between early April and 3rd week of May, according to climatic factors. The period extending from July to the first week of August was characterized by positive change in insect population towards increase, as a result of which, insect number changed during this period by 2.1-38.5 % in 1997 and 2.3-55.1% in 1998. These results indicated that weather factor and rice plants conditions were in favour of insect reproduction and multiplication. On the other hand, it was observed that a considerable change in population decrease was evident through the second period from 2nd week of August to approximately mid September. In this period, insect number gradually decreased and the population density changed negatively and these changes ranged between (15.3-67.1%) in 1997 and (45.3-164.7%) in 1998.

Population changes towards alrastic decrease during this period may infer to the changes in the corresponding climatic factors and plant which seems to be suitable for insect development and reproduction. Air temperature in rice fields at this period average 27.9 °C in 1997 and 31.5 °C in 1998 which are so higher than 25 °C and 30 °C demonstrate the most favourable conditions for nymphal development, (Pathak,

1968).

b. The rice leafminer *Hydrellia prosternalis*

Flies resting on the top of the rice plants were collected by means of sweeping net, 25 randomized strokes when were performed in each of 4 replicates and the total numbers of collected individuals (from100 double strokes) were recorded.

Adults start to appear in rice fields as early as the 1st week of July in both seasons (1997 and 1998). It was noticed that the insect population in 1997 in the rice field was nearly double the population in 1998, Table 2. The insect tended to show a gradual increase and reached a peak of 570 adults on 23rd of August 1997. This was followed by a gradual decrease until harvest. In 1998, the population of insect proportionally increased and reached a peak of 485.2 adults on 23rd of August. This means that the insect behaviour was similar during the two tested rice seasons.

These results indicate that *H. prosternalis* had only one peak on rice throughout the period extending from July to mid of September and the highest population density usually occurs during the second half of August (peak).

Rice is sown in Egypt during relatively long period; from mid April till early June. However, it is recommended by the Ministry of Agric. that rice should be sown early and the period between mid-April and mid-May is considered optimal. The number of adults decreased considerably until one month before harvest. Klimanova (1971) found that it has 5-8 generations per year, the second of which occurs on rice and on wild grasses which greatly confirmed our results.

H. prosternalis adults' population differ markedly during rice growing seasons of 1997-1998. Flies density changed towards increase which reached maximum in August (41.4-78.2 % in 1998) after which the number of this negatively decreased by 39.7 % in 1997 and 145.5 % in 1998, respectively. Population changes towards decrease in September may ensure again that *H. prosternalis* could not develop on mature rice.

Effect of the mean environmental physical factors on the population activity of tested rice insect pests

a. Rice leafminer *Hydrellia prosternalis*

When the relationship between certain weather factors and tested insects the results showed that positive significant relationship for the day max. tem. and highly significant for minimum temperature. Negative insignificant effect for relative humidity (R.H.)% in both years of study was obtained the unit effect (regression co-efficient) indicate that an increase of 1 °C in the day maximum temperature increase the numbers of insect, (+4.8 and 3.0) and (+2.1 and +2.9), respectively and (-1.4 and 2.1) decreasing in 1997 and 1998 seasons numbers of insects for 1 % relative humidity. The combined effect of the three weather factors during the period of study (2^{nd} of July to 4^{th} of September express as percentage of explained variance E.V.% were significant at 5% level of probability in each 1997 and 1998 (63.76 % and 58.16%), respectively.

b. *Balclutha hortensis* (Lidb)

The relationship between insect population expressed as 10-day intervals of adults caught in net and the prevailing weather factors in the two tested years revealed a significant positive relationship for the day max. tem. Highly positive relationship for the day minimum temperature. Insignificant negative effect was obtained with the mean relative humidity, but in 1998, positive insignificant for both minimum and maximum temperatures and negative for relative humidity. The effect of one degree of these factors (unit effect) as indicated by the regression co-efficient was about (+7.8, +6.5 and 3.4) for the day max. temp., min. temp. and relative humidity (+6.95, +5.4 and 3.4) in 1997 and 198, respectively.

The combined effect of the weather factors expressed as explained variance values were 70.6 and 61.4% of 1997 and 1998 seasons, respectively, Table 4.

Table 1. Mean number of *Balclutha hortensis* (Lidb) adults collected from rice fields at different dates (El Serw 1997 and 1998).

Sampling dates	Season 1997				Season 1998			
	Means of insects	Weather factors			Means of insects	Weather factors		
		Max. tem.	Min. tem.	R.H.%		Max. tem.	Min. tem.	R.H.%
4/7	71.25	28.78	19.64	77.28	52.25	31.51	20.07	69.60
14/7	72.75	29.52	20.61	70.71	53.50	28.02	22.10	64.64
24/7	118.218	28.52	20.21	73.71	66.25	32.58	22.07	62.21
3/8	4.25	28.84	20.00	72.71	147.25	34.02	23.45	62.57
13/8	159.75	27.97	19.64	73.57	64.25	32.84	23.48	6.07
23/8	112.25	27.77	18.99	73.80	39.00	32.45	21.94	52.70
3/9	69.75	27.88	17.94	70.85	31.09	31.65	22.05	63.64
13/9	41.75	27.90	17.58	40.42	11.75	31.50	20.90	61.85
Total	829.95				464.25			
Mean	103.74	28.40	19.33	72.88	58.15	31.83	22.01	62.54

Table 2. Mean number of *Hydrellia prosternalis Deem* flies collected from rice fields at different dates (El Serw 1997 and 1998).

Sampling dates	Season 1997				Season 1998			
	Means of insects	Weather factors			Means of insects	Weather factors		
		Max. tem.	Min. tem.	R.H.%		Max. tem.	Min. tem.	R.H.%
4/7	19.00	28.78	19.64	77.28	13.25	31.51	20.07	69.60
14/7	43.25	29.52	20.61	70.71	31.90	28.02	22.10	64.64
24/7	49.25	28.52	20.21	73.71	34.50	32.58	22.07	62.21
3/8	99.25	28.84	20.00	72.71	76.75	34.02	23.45	62.57
13/8	307.25	27.97	19.64	73.57	130.25	32.84	23.48	6.07
23/8	570.0	27.77	18.99	73.80	485.20	32.45	21.94	52.70
3/9	538.0	27.88	17.94	70.85	454.25	31.65	22.05	63.64
13/9	385.2	27.90	17.58	40.42	185.00	31.50	20.90	61.85
Total	2011.2				1411.1			
Mean	251.4	28.40	19.33	72.88	176.38	31.83	22.01	62.54

Table 3. Simple correlation (r) and partial regression values among the means of maximum, minimum temperature and relative humidity and number of *Hydrellia prosternalis* flies Deem swept by net (1997 and 1998 seasons).

Year	Weather factor	Simple relationship		Partial regression values				F	P	E.V.%
		r	b	b	S.E.	t	p			
1997	Max.t.	+ 0.674*	+4.8	+44.16	21.80	2.01	-	6.14	0.05	63.7%
	Min.t.	+ 0.731**	+3.6	+58.12	61.12	0.95	-			
	R.H.%	-0.352	-1.4	-7.34	6.14	1.12	-			
1998	Max.t.	+ 0.423	+2.1	+32.90	38.26	0.86	-	5.48	0.05	58.16%
	Min.t.	+ 0.612*	+2.9	+41.20	36.46	1.13	-			
	R.H.%	-0.285	-2.1	-5.51	2.90	1.90	-			

Table 4. Simple correlation (r) and partial regression values among the means of maximum, minimum temperature and relative humidity and number of *Balclutha hortensis (Lidb)* adults swept by net (1997 and 1998 seasons).

Year	Weather factor	Simple relationship		Partial regression values				F	P	E.V.%
		r	b	b	S.E.	t	p			
1997	Max.t.	+ 0.538*	+ 0.538*	+ 24.66	17.49	1.41	-	5.94	0.05	71.6%
	Min.t.	+ 0.632*	+ 0.632*	+ 28.15	23.66	1.19	-			
	R.H.%	-0.348	-0.348	- 20.16	15.27	1.32	-			
1998	Max.t.	+ 0.372	+ 6.90	+ 22.14	13.84	1.60	-	5.61	0.05	61.9%
	Min.t.	+ 0.329	+ 5.40	+ 33.18	28.85	1.15	-			
	R.H.%	-0.298	- 3.20	- 25.4	19.54	1.30	-			

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دور عوامل بيئية محددة على النشاط الموسمى لصانعة الأنفاق والنطاط فى أوراق الأرز فى بعض مناطق شمال الدلتا

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تم فى هذه الدراسة عمل حصر الأعداد لكل من صانعة الأنفاق ونطاط الأوراق فى الأرز علاوة على دراسة التغيرات الموسمية لكل منها ودراسة علاقة كل من درجة الحرارة العظمى والصغرى و الرطوبة النسبية وكذلك التأثير المشترك لهذه العوامل مجتمعة على تعداد هذه الآفات فى منطقة شمال الدلتا (محافظة دمياط) بمصر.

فيما يلى أهم هذه النتائج :

- **صانعة الانفاق *H. hortensis***

تتواجد فى الحقل من أوائل شهر يوليو حتى نهاية سبتمبر، يصل التعداد أقصاه فى الأسبوع الأخير من شهر أغسطس ويقل التعداد بعد ذلك حتى نهاية نمو المحصول.

- **نطاط الاوراق *B. hortensis***

تتواجد هذه الحشرة فى الحقل المستديم من أوائل شهر يوليو الى نهاية شهر سبتمبر وتتزايد تعداد هذه الآفة مع بداية تكوين السنابل وحتى وقت الحصاد وتقل الى أقصاها خلال الأسبوع الأول من شهر أغسطس ثم يقل هذا التعداد تدريجيا حتى وقت الحصاد.

علاقة كل من درجة الحرارة العظمى والصغرى والرطوبة النسبية وكذلك التأثير المشترك لهذه العوامل مجتمعة.

أولاً: على صانعة الأنفاق

كان هناك ارتباط موجب لكل من درجة الحرارة العظمى والصغرى خلال عامى ١٩٩٧ ، ١٩٩٨ - معنوى لكل من درجتى الحرارة العظمى والصغرى.

خلال العامين على المعنوية لدرجة الحرارة الصغرى عام ١٩٩٧-أما الرطوبة النسبية فكان الارتباط سالب وغير معنوى فى العامين. وعن تأثير الوحدة والنتائج عن زيادة درجة الحرارة العظمى والصغرى درجة واحدة مئوية - فقد أدى ذلك إلى زيادة أعداد الحشرات (+٤,٨، +٢,١) لدرجة

الحرارة العظمى ، (+٢,١، +٢,٩) لدرجة الحرارة الصغرى عامى ١٩٩٧، ١٩٩٨ .

اما الرطوبة النسبية فزيادتها ١٪ أدى ذلك الى تقصان تعداد الحشرات خلال عامى الدراسة الى (-١,٤، -٢,١) - بينما كان التأثير المشترك للعوامل الثلاث مجتمعة هو ٦٣,٧٪، ٥٨,١٦٪ مع ملاحظة ان هذا التأثير كان قويا خلال عام ١٩٩٧ عن عام ١٩٩٨ .

ثانياً: على نطاط الأوراق

وجد ان الارتباط بين درجة الحرارة العظمى والصغرى موجبا خلال عامى الدراسة معنويا خلال عام ١٩٩٧- وغير معنوى خلال عام ١٩٩٨ اما عن تأثير درجة الرطوبة النسبة فكان سالبا وغير معنوى خلال موسمى ١٩٩٧، ١٩٩٨ .

وبالنسبة للتأثير المشترك للعوامل الثلاث مجتمعة فكان ٧٠,٦٪، ٦١,٤٪ خلال عامى ١٩٩٧، ١٩٩٨ - على الترتيب.

وأمكن من النتائج استخلاص أن درجات (٢٨-٣١ °م) ، (١٦-٢٢ °م) ، (٦٢-٧٢ ٪) لكل من درجات الحرارة العظمى والصغرى والرطوبة النسبية على الترتيب تعتبر مثلى لنشاط هذه الحشرات.