EFFECT OF SIMULATING THE DAMAGE CAUSED BY RICE LEAF MINER, *HYDRELLIA PROSTERNALIS* DEEM. ON RICE GRAIN YIELD.

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Abstract

Ten levels of rice defoliation (0.10,20,30,40,50,60,70,80 and 90%) were done at tillering stage or flowering stage to simulate damage caused by rice leaf miner, *Hydrellia prosternalis* Deem. Grain yield and its components were determined.

Total grain yield and its components were negatively affected by defoliation in both tillering and flowering stages. Defoliation at flowering stage was more negatively effective on grain yield than that at tillering stage. In tillering stage, there was no significant loss in yield before 90% defoliation, and did not occur before 60% in flowering stage.

This study presents data which help determining the economic threshold for insect control through costs of yield loss against insecticidal control which changes from one season to another.

As an important conclusion, insecticidal control may not be urgent against this insect in most cases because 1/5 of leaves in tillering stage or 2/5 in flowering is enoguh to produce yield without significant loss.

INTRODUCTION

Rice is a very important grain crop in Egypt. Rice leaf miner (RLM), Hydrellia prosternalis Deeming is one of the major pests on rice in recent years. Symptoms of infestation appear as transparent mines inside rice leaf, ranging from one mm to about ten cm in length, with one mm in width. This damage occurs allover the plant life, but it is not effective after plant heading. Rice leaf miner causes visually serious leaf damage in rice plant resulting in light grain yield losses. These losses differ according to damage level and stage of plant as well as rice variety.

The present study mainly aims to :

- Clarify the effects of damage on rice yield.

- Find which levels of damage cause significant yield loss.

- Identify which plant stage is more affected by insect damage.

- Determining the economic threshold for insecticidal control.

These were achieved through defoliating rice plant with ten levels at two plant stages simulating the natural insect damage.

MATERIALS AND METHODS

Losses in rice yield, due to infested leaves caused by Rice Leaf Miner (RLM), Hydrellia prosternalis Deeming, was estimated by defoliation. This work was conducted in the greenhouse at Sakha Agric. Res. Sta., Kafr El-Sheikh Governorate in 1994 rice season.

Rice variety "Giza 176" as a susceptible and common variety - was sown in mid May, and transplanted 30 days later into (60 cm diameter x 50 cm deep) plastic containers. Each container had five seedlings. Two experiments, each had 30 containers, were put in randomized block design with three replicates and ten treatments. All normal agricultural practices were normally applied. To avoid the natural infestation with Rice Leaf Miner, Furadan insecticide 10% in the granular form was applied every two weeks after transplanting till grain filling. One experiment was defoliated at tillering stage (40 days after transplanting), and the other at heading stage (60 days after transplanting), being the most dangerous stages affected by the insect infestation. Ten levels of defoliation (cut random leaves) were done using a pair of sharp scissors. This defoliation was done simulating the infestation caused by the Rice Leaf Miner insect which mines through the leaves causing mines ranging between some mm to ten cm in length with about one mm in width. These levels were 0,10,20,30,40,50,60,70,80 and 90 % defoliation. At harvest, the rice grain yield (total, filled and unfilled grains) for each treatment was weighed. The data were subjected to analysis of variance.

RESULTS AND DISCUSSION

Damage caused by the rice leaf miner, Hydrallia prosternalis Deeming has become much more common in Egypt in recent years. Estimating the losses in rice yield due to infestation with this insect is needed to determine the economic threshold for applying the insecticidal control at the suitable time. Simulation of infested

leaves was practised at the tillering and flowering stages.

Table 1 showed grain yield losses caused by simulating the damage of H.prosternalis at tillering stage. Data in this table indicated that the highest rice filled grains (31.2 and 31.8 g) resulted from zero and 10% damage, respectively. While the lowest ones (24.6 and 21.3 g) resulted from the maximum simulated damage (80 and 90 % respectively).

Concerning the unfilled grains, there were slight differences between the effects of different simulated damage levels, and the increases in unfilled grains did not significantly differ. Ten and 20% of infested leaves caused reduction in unfilled grains (20 %), while 80 and 90% caused 60% increasing in unfilled grains. Data in the same table indicated that no significant differences between total grain yield were obtained from 0,10,20,30,40,50,60,70 and 80% simulated damage levels, while the total grain yield, obtained in case of 90%, was significantly lower (22.9 g) than that in control (32.2 g). Sixty and seventy percent of defoliation resulted in 7.1 and 8.1% reduction in total grain yield, respectively. When the simulated damage increased to 80 and 90%, the reduction in total grain yield was 18.6 and 28.9%, respectively.

Table 1 . Effect of rice defoliation at tillering stage on grain yield.

Defoliation level %	Grain yield (g) / 15 panicles					
	Filled grains		Unfilled grains		Total grain yield	
	Yield	% Reduction	Yield	% Reduction	Yield	% Reduction
O Check	31.2ab	-	1.0a	-	32.2a	-
10	31.8a	+1.9	0.8a	-20.0	32.6a	+1.2
20	31.2a	-	0.8a	-20.0	32.0a	0.6
30	30.7a	1.6	1.0a	00.0	31.7a	1.6
40	30.3a	2.9	1.2a	20.0	31.5a	2.2
50	30.0a	3.8	1.3a	30.0	31.3ab	2.8
60	28.6ab	8.3	1.3a	30.0	29.9ab	7.1
70	28.3ab	9.3	1.3a	30.0	29.6ab	8.1
80	24.6	21.2	1.6a	60.0	26.2ab	18.6
90	21.3b	31.7	1.6a	60.0	22.9b	28.9
Mean	28.8	8.5	1.19	21.1	30.0	7.6

Means followed by a common lettter are not significantly different in the 5% level by DMRT.

As for flowering stage, data in table 2 revealed that the rice filled grain yield ranged between 30.4 and 8.1 g in response to zero and 90% simulated damage, respectively, with a significant difference between them. Estimated filled grain slightly decreased from 30.4 to 16.8 g in response to 20 to 60% damge, while sharply decreased from 21.6 to 8.1 g suffering from heavier reduction percentage 44.7, 66.4 and 73.4 in response to 70 to 90% simulated damage, respectively.

In respect to the unfilled grains, increasing damage level from 10 to 30% defoliation did not show any effect on the unfilled grain yield, resulting in 2.3 g as compared with the check (1.8 g). By 30% defoliation, the unfilled grain yield increased as the damage increased. The maximum unfilled grain yield (4.0, 4.2, 4.3 and 4.7 g) was obtained from 60,70,80 and 90% damage levels, respectively, with significant difference between any of them and the other levels. The unfilled grain weight was seriously increased by 60% damage and up.

Table 2 . Effect of rice defoliation at tillering at flowering on grain yield.

Defoliation level %	Grain yield (g) / 15 panicles					
	Filled grains		Unfilled grains		Total grain yield	
	Yield	% Reduction	Yield	% Reduction	Yield	% Reduction
O Check	30.4a	-	1.8a	-	32.2ab	-
10	30.4a	0.0	2.3ab	27.8	32.2ab	0.0
20	30.4a	0.0	2.3ab	27.8	32.2ab	0.0
30	25.4ab	16.4	2.3ab	27.8	27.2bc	15.5
40	24.0ab	21.1	2.5bc	36.7	26.5bc	17.7
50	22.1bc	27.3	2.7bc	50.0	24.8bc	23.0
60	21.6bc	28.9	4.0d	122.2	25.6bc	20.5
70	16.8bc	44.7	4.2d	133.3	21.0cd	34.8
80	10.2d	66.4	4.3d	138.9	14.5de	55.0
90	8.1d	73.4	4.7d	161.1	12.8c	60.2
Mean	21.9	30.9	3.1	80.6	24.9	25.2

Means followed by a common lettter are not significantly different in the 5% level by DMRT.

Data of the usual yield parameter, total grain yield, was shown in table 2. Total grain yield was significantly reduced by the damage at flowering stage more than that in the tillering stage. It is clear that the more increase in damage level, the

higher reduction in total yield. Defoliating leaves up to 60% did not cause any significant decrease in total grain yield, while 70,80 and 90% damage significantly declined it to 21.0, 14.5, and 12.8 g, respectively as compared with the check (32.2 g).

Data in table 3 summarized results of the effect of defoliation at tillering and flowering stages on rice yield and its components. The results indicated that the total grain yield of plants defoliated at flowering stage (25 g) was less than that defoliated at tillering stage (30 g). Also, the filled grain yield (in opposite to unfilled grain) of the flowering stage (21.9 and 3.1 g) was less than those of tillering one (28.8 and 1.2 g, respectively) as affected by different levels of defoliation. These findings indicate that rice leaf miner infestation at flowering stage is more dangerous than tillering stage. This indication can be interpreted that plant in tillering stage is capable to compensate the damaged leaves and tillers more than flowering stage. These findings are in agreement with data of Abdallah and Metwally (1984), Isa *et al.* (1971), Pathak (1967), Khadr et al. (1991) and Sherif *et al.* (1991) who mentioned that simulated damage at flowering stage caused greater yield reduction than did at vegetative stage.

Table 3 . Average effect of defoliation levels at tillering and flowering stages on rice grain yield.

Defoliation stage	Grain yield (g) / 15 panicles					
	Filled grains		Unfilled grains		Total grain yield	
	Yield	% Reduction	Yield	% Reduction	Yield	% Reduction
Tillering stage	28.8	8.5	1.2	21.1	30.0	7.6
Flowering stage	21.9	3.9	3.1	80.6	25.0	25.2
Mean	25.4	6.2	2.2	50.9	27.5	16.4

It can be noticed that defoliation of rice plant at tillering stage did not cause significant losses in total grain or filled grain yield till 80% level, while at flowering stage losses in total grain or filled grain yield were significant after 60 and 40 % damage levels, respectively.

Finally, it is important to mention that yield losses of total grain yield in this

study can be used in determining the economic threshold for insect control. It can be determined as the damage level that results yield loss costs more than the insecticidal control. The economic threshold changes according to yield price, on one hand, and insecticidal control cost, on the other hand, as well as rice variety.

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تأثير محاكاة الإصابة الناتجة من صانعة الانفاق على محصول الأرز

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معهد بحوث وقاية النباتات – مركز البحوث الزراعية – الدقى – الجيزة .

تم محاكاة عشرة مستويات من الاصابة (صفر ، ١٠ ، ٢٠ ، ٣٠ ، ٤٠ ، ٥٠ ، ٦٠ ، ٧٠ ، ٨٠ ، ٩٠ ٪) فى مرحلة التفريخ او الازهار، وقدر المحصول ومكوناته في كل حالة ، وقد وجد الاتى :

- تأثر المحصول ومكوناته بعملية الازالة للاوراق عند اى مستوى او فى اى مرحلة وبدرجات متفاوته وذلك كخسارة فى المحصول.
- كانت الخسارة فى مرحلة الإزهار اكثر منها فى مرحلة التفريع.
- ازالة الاوراق فى مرحلة التفريع لم تود الى فقد معنوى فى المحصول حتى ٨٠٪، بينما فى مرحلة الازهار كانت الخسارة فى المحصول معنوية بعد ازالة اكثر من ٦٠٪ من الاوراق.
- من النتائج يمكن تحديد الحد الاقتصادى للعلاج الكيميائى بالمبيدات بتحديد نسبة الاوراق التى يؤدى ازالتها الى فقد فى المحصول يقدر ثمنه باكثر من تكلفة العلاج الكيميائى. وهذه النسبة تختلف من عام لآخر لخضوعها لثمن المحصول من جهة وتكلفة العلاج من جهة اخرى بالاضافة لنوع الصنف المزروع .

ومن المهم الاشارة الى ان الاصابة بهذه الحشرة رغم خطورتها الظاهرية الا ان الفقد فى المحصول لا يستحق العلاج فى معظم الأحوال – كما دلت النتائج – حيث ان ١/٥ الاوراق فى مرحلة التفريع و ٢/٥ فى مرحلة الازهار تكفى لانتاج محصول بلا خسارة معنوية، كما ان النبات له القدرة على استعواض الاوراق المصابة خاصة فى مرحلة التفريع.