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INFLUENCE OF SOME AGRICULTURAL PRACTICES ON THE INSECT INFESTATIONS OF SORGHUM IN FAYOUM.

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ABSTRACT

A field study was carried out during 2010 and 2011 seasons on sorghum, *Sorghum bicolor* L. to evaluate the effect of some cultural practices (sowing date, plant distance and variety) on infestation with sorghum shoot fly, *Atherigona soccata* Rondani, corn stem borer, *Sesamia cretica* Led. and corn leaf aphid, *Rhopalosiphum maidis* (Fitch), in Fayoum, Egypt. The late sowing date (July 9) and the lowest plant distance (15cm) showed the lowest infestation with the three pest species. All tested varieties or hybrids were insignificantly susceptible to the first two pest species, while was significant for the later one. A significantly negative correlation existed between the plant height of each variety or hybrid and infestation with *R. maidis*.

Key words: *corn leaf aphid, corn stem borer, shoot fly and sorghum.*

1. INTRODUCTION

Grain sorghum, *Sorghum bicolor* L. is a common cereal crop in Egypt, used for human consumption and as a food for poultry and livestock in the form of grain and forage. It is attacked by many insect pests from seedling until maturity. However, only three of them are considered as key pests. These pests are shoot fly, *Atherigona soccata* Rondani, stem borer *Sesamia cretica* Led. and corn leaf aphid, *Rhopalosiphum maidis* (Fitch).

A. soccata is a seedling maggot attacks the crop only in the early stage of growth and the infestation goes up to 80%. The high yielding hybrids are more susceptible to the attack with this fly. The total loss in grain yield of shoot fly damage averaged 5 - 60% (Jotwani, 1983). The larvae crawl to the plant whorl and move downward between the folds of the young leaves until they reach the growing point. When they feed, they cut the growing tip and the result is drying of the central leaf called "dead heart." The economic injury level for *A. soccata* is 3.4 to 5.9 % dead hearts, and 1 % increase may result in a yield loss of 21 to 143 kg / ha (Puri 1983).

The larvae of stem borer, *S. cretica* bore into the stalk and kill the central shoot, causing a dead heart symptoms pre and during head emergence. Twenty percent dead hearts due to stem combine borer results in a significant reduction in grain yield (Taneja and Leuschner 1985).

Corn leaf aphids, *Rhopalosiphum maidis* is the dominant foliar-feeding insects on sorghum. Heavy aphid infestations on sorghum at the booting and heading stages seriously reduce both grain quality and yield.

The present work aimed to study the effect of some agricultural practices *e.g.*, sowing date, plant distance and variety on the infestation by *A. soccata, S. cretica* and *R. maidis* on sorghum crop in Fayoum, Egypt, and also, threw some light on the relation between plant height and the infestation with *R. maidis*.

2. MATERIALS AND METHODS

Three agricultural practices were carried out in sorghum field to clarify their effects on the three insect pest species; *A. soccata, S.cretica* and *R. maidis.* The experiment was done in Fayoum region, during 2010 and 2011 seasons. The experimental area was $^{1}/_{2}$ feddan; divided into three equal plots; each represented one treatment.

2.1. Planting date

The plot of this treatment was divided into three equal subplots each was specialized for a date through four replicates. The first planting date was May 28th while the others were on June 18th and July 9th of the two seasons. All the plots were seeded with Dorado sorghum variety.

2.2. Plant distance

In this treatment, each plot was divided as mentioned above, and planted on June 18th with the same sorghum var. Each subplot was specified for one distance between hills; 15, 25 and 35 cm through four replicates.

2.3. Variety

Three sorghum varieties (Giza 15, Giza 113 and Dorado) and five hybrids (Shandawil 1, Shandawil 2, Shandawil 6, Hybrid 306 and Horus) were used in this treatment. The area, in this case, was divided into 8 equal subplots each was specialized for one of these varieties through four replicates. All these materials were seeded on June 18th, 2010 and 2011 seasons.

The distance between rows and that between hills were 50 and 20 cm, respectively in all experiments except for that of the plant distance treatment. Also, all normal agricultural practices and no insecticides were applied.

Twenty eight days after emergence, a random sample of 50 plants from each replicate was directly inspected in the field; to record the numbers of dead hearts resulted from *A. soccata* infestation (Shekharappa and Bhuti 2007). Also, a similar sample was directly inspected in the field; 58 days after emergence, to record the numbers of dead hearts resulted from *S. cretica* infestation. As for *R. maidis* infestation, a similar sample of 50 plants was also carefully and directly detected in each replicate to record the numbers of the infested plants.

The plant height of each variety or hybrid was measured (58 days after emergence). The differences between the different means were evaluated using the ANOVA test. The simple correlation (r) value was calculated to define the relation between *R. maidis* infestation and sorghum varieties or hybrid heights.

3. RESULTS AND DISCUSSION

The obtained results are shown as follows

3.1. Sowing date

Data in Table (1) revealed that the sowing date affected the infestation with sorghum pests. Dead hearts caused by the shoot fly *A. soccata* was higher in the first sowing date (May, 28), in both seasons (12.0 – 12.5%) than that in the late date (July 9) being 8.0 - 9.0%. The plot of June 18 sowing date showed a moderate infestation; 11 and 9.5 % in 2010 and 2011, respectively. The differences between infestation means were significant only in the second season. In this respect, Salman and Abdel-Moniem (2008) reported that, sorghum plants sowed on April, 20 or July, 9 showed a high percentage of *A. soccata* infestation than that sowed on May, 20. This result is in disagreement with Kumar *et al.* (2008) who reported that, early sowing of sorghum in India escape shoot fly damage.

The dead hearts caused by the stem borer *S. cretica* insignificantly differed in the three sowing dates in both seasons. The percentages were 7.0, 6.0 and 5.5 % in the first season and 6.0, 4.5 and 4.0 % in the second season for the three dates, respectively.

According to Al-Hasnawy (2009), the higher rate of infestation with the previous two pests in the first sowing date may be due to the high activity of emerged adults of the first generation so that, delaying the sowing date of sorghum to the end of July, significantly reduced the infestation of *S. cretica* and seedling dead hearts to 5.03%, 4.74%, respectively.

Infestation percentages with the corn leaf aphid, *R. maidis* were nearly similar in both seasons. At the same time, they were relatively the highest in the second sowing date being 16.0 and 18.0% in 2010

Table (1): Effect of sowing dates on the insect infestations of sorghum during 2010 and 2011 seasons.

Season	Sowing date	% Dead hearts		% Aphids
		A. soccata	*S. cretica*	
2010	May 28	12.5	7.0	14.0
	June 18	11.0	6.0	16.0
	July 9	9.0	5.5	13.5
2011	May 28	12.0 a	6.0	15.5
	June 18	9.5 ab	4.5	18.0
	July 9	8.0 b	4.0	15.0

LSD = 2.61

and 2011 seasons, respectively and that may be as a result of higher RH and temperature. In the USA, Archer *et al*. (1990) found that, the highest densities of *R. maidis* occurred in sorghum planted in May or June.

3.2. Plant distance

As shown in Table (2), the distance between plants, in both seasons significantly affected the infestation with *A. soccata* and *R. maidis*, while insignificant effect was recorded with *S. cretica.* The treatment of the lowest distance (15cm), showed relatively the minimum dead heart percentages caused by *A. soccata* and *S. cretica* being 6 and 4%, respectively in the two seasons. The treatment of the highest distance (35cm), showed high dead heart percentages of 11.5 and 6 % in 2010 season and 10.5 and 5.5 % in 2011 season for the same insect pests, respectively. In the treatment of 25 cm, the plants showing moderate dead heart percentages of 9 and 4.5 % in 2010 season and 8.5 and 4 % in 2011 season. Delobel (1982) in Kenya found that, low sorghum density showed a high infestation of *A. soccata.*

15.5, 13.0 and 10.5 % in 2011 season opposite 15, 25 and 35 cm distances, respectively. This behavior may be as a result of the high humidity found in the crowded plants and easy insect transmission in this case.

3.3. Variety

Data given in Table (3) showed that, the studied varieties and hybrids of sorghum had nearly a similar susceptibility to the infestation with the three aforementioned pests throughout the two seasons. No significant differences were detected between the levels of dead hearts caused by *A. soccata* and *S. cretica.* In the case of *R. maidis* these differences were statistically significant in both seasons.

Regardless of season, all tested varieties and hybrids slightly differed in their ability to be infested with *A. soccata*, 5.5 – 9.0 % dead hearts. Also,*S. cretica* showed a similar result, since the percentage of dead hearts ranged 4 – 7 and 3.5 – 6.5 % in 2010 and 2011 seasons, respectively. These results are in agreement with Dhillon *et al.* (2006) and Berg *et al*. (2005) who stated that sorghum varieties had low to moderate levels of resistance to

Table (2): Effect of plant densities on insect infestations of sorghum during 2010 and 2011 seasons.

Season	Plant distance (cm)	% Dead hearts		% Aphids
		A. soccata	*S. cretica*	
2010	15	6.0 b	4.0	18.5 a
	25	9.0 ab	4.5	16.0 ab
	35	11.5 a	6.0	13.5 b
LSD		3.65	-	3.61
2011	15	6.0 b	4.0	15.5 a
	25	8.5 ab	4.0	13.0 ab
	35	10.5 a	5.5	10.5 b
LSD		3.3	-	3.77

The obtained results revealed that keeping the high density of plants, by delaying plant thinning at a time when plants passed the susceptible stage (plant height exceeds 22 cm) and remove the infested plant was useful in controlling *A. soccata*. On contrary of the previous results, *R. maidis* infestation increased with reducing the densities of plants; 18.5, 16.0 and 13.5 % in 2010 season, and the stem borer and shoot fly.

The results showed also that, these varieties and hybrids had different degrees of infestation with the corn leaf aphid *R. maidis*. While Dorado was the highest infested variety during the two seasons (19.0 and 14.5%), Giza 15 and 113 had the lowest infestation, 4.5 & 5.0 in the first season and 2.5 & 3.0% in the second one. Shandawil 1, Shandawil 2,

Table (3): Susceptibility of sorghum varieties to insect infestations and the effect of their height on aphid infestation during 2010 and 2011 seasons.

Season	Variety & hybrid	Dead hearts/100 plants		% Aphids	Plant height (cm)
		A.soccata	*S. cretica*		
2010	Dorado	9.0	7.0	19.0a	105
	Giza 15	9.0	5.5	4.5c	335
	Giza 113	8.0	5.5	5.0c	300
	Shandawil 1	7.5	6.5	11.5b	140
	Shandawil 2	7.0	7.0	11.0b	144
	Shandawil 6	7.5	4.5	6.0c	160
	Hybrid 306	7.0	5.5	11.0b	145
	Horus	5.5	4.0	7.5c	155
2011	Dorado	9.0	6.5	14.5a	100
	Giza 15	8.0	5.5	2.5b	340
	Giza 113	6.5	6.5	3.0b	295
	Shandawil 1	7.0	4.5	11.5a	138
	Shandawil 2	6.5	4.0	11.0 a	138
	Shandawil 6	9.5	4.0	10.5 a	155
	Hybrid 306	8.5	5.0	11.5 a	133
	Horus	6.5	3.5	6.0b	158

LSD = 3.48, (r) = - 0.74* in 2010 season, LSD = 4.37, (r) = - 0.92* in 2011 season.

Shandawi1 6 and hybrids 306 showed relatively higher infestations in both seasons. Horus hybrid was moderately infested with aphids (7.5 & 6%) during both seasons. In Iraq, Al-Hasnawy (2009) found significant differences between sorghum varieties to aphid infestation.

3.4. Plant height

Data presented in Table (3) revealed that, the varying heights of the different sorghum hybrids or varieties were significantly negative correlated with the infestation of aphids in both seasons. Values of (r) were - 0.74 and - 0.92 in 2010 and 2011 seasons, respectively. Generally, the tall varieties such as Giza 15 and Giza 113 were the least susceptible to the infestation when compared to the short varieties or hybrids as Dorado, Shandawil 1, Shandawil 2 and Hybrid 306. The medium height hybrids as Shandawil 6 and Horus showed also a moderate infestation with aphids.

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تأثير بعض العمليات الزراعية على إصابة محصول الذرة الرفيعة بالآفات الحشرية بمحافظة الفيوم.

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ملخص

أجريت تجربة حقلية على محصول الذرة الرفيعة خلال موسمي 2010 و 2011 لدراسة تأثير موعد الزراعة والمسافة بين النباتات والصنف النباتي على نسب الاصابة بذبابة موت القلب *Atherigona soccata* ودودة القصب الكبيرة *Sesamia cretica* ومن اوراق الذرة *Rhopalosiphum maidis* تحت ظروف محافظة الفيوم.

أوضحت النتائج أن كلا من ذبابة موت القلب ودودة القصب الكبيرة ومَنّ اوراق الذرة تصيب الذرة الرفيعة المزروعة خلال الثلاثة مواعيد المختبرة (28 مايو ، 18 يونية ، 9 يوليو) مع عدم وجود فروق معنوية الا أن تأخير الزراعة خلال أول يوليو يقلل من الإصابة بكل منهما ، كما وجد أن تقليل المسافة بين النباتات تقلل من الإصابة بالآفة الأولى بدرجة معنوية والثانية بدرجة غير معنوية ، بينما أدت الى زيادة الإصابة بال مَنّ بدرجة معنوية خلال موسمي الدراسة. وبدراسة قابلية الاصابة لثلاثة أصناف وخمسة هجن بالآفتين الاولى والثانية وجد انها جميعها قابلة للإصابة مع عدم وجود فروق معنوية وامكن ترتيبها تنازليا حسب شدة اصابتها الى صنف دورادو وجيزة 113 وجيزة 15، هجين شندويل 1 وشندويل 2 وشندويل 6 وهجين 306 وهجين حورس. اما بالنسبة للمَنّ فوجدت فروق معنوية بين قابلية الاصناف والهجن للإصابة خلال موسمي الدراسة وبدراسة العلاقة بين طول النبات ونسبة الإصابة بالمَنّ وجدت علاقة ارتباط معنوية سالبة اي كلما كان الصنف طويلا كان اقل إصابة. ويمكن التوصية بتأخير الزراعة حتى الاسبوع الأول من يوليو وعدم زيادة المسافة بين النباتات وزراعة الأصناف الطويلة لمقاومة الافات سالفة الذكر.

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