

Effect of *Saccharicoccus sacchari* (Cockerell) infestation levels on sugarcane physical and chemical properties

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ABSTRACT

The present investigation was carried out in Sohage Governorate, Egypt on sugarcane infested with *Saccharicoccus sacchari* (Cockerell) (Hemiptera: Pseudococcidae) during growing year 2007/2008. Obtained results indicated that only severe infestation significantly affected sugarcane physical and chemical properties. There were reduction of stalk's weight (5.03, 34.33%), stalk's height (2.16, 6.93%), stalk internodes' number per stalk (8.8, 29.07) and juice weight (2.26, 31.62%) in low and heavy infestation, respectively compared with infestation free. Internodes height increased by 8.59 and 35.45% due to low and severe levels of infestation, respectively. There were losses of brix (4.95, 13.47%), sucrose (6.29, 27.87%), purity (1.41, 16.87%), pol (5.29, 32.6%) and sugar recovery (5.29, 37.08%) and increase of reducing sugar (3.53, 7.68%) and fiber (1.28, 3.85%) due low and heavy levels of infestation, respectively.

Key Words: *Saccharicoccus sacchari*, level of infestation, physical and chemical properties of sugarcane

INTRODUCTION

Sugarcane *Saccharum officinarum* L. is considered the main materials for sugar processing (Darwish, 1979). The sugarcane plantation area in Egypt reached about 350,000 feddans, producing 16 million tons of sugarcane in 2007 (Anonymous, 2008). Sugarcane in Egypt is subject to seven major pests and 24 other minor pests. The major pests are the pyrallid *Chilo agamemnon*, the noctuid *Sesamia cretica*, the coccid *Pulvinaria tenuivalvata*, three scarabids and the pseudococcid *Saccharicoccus sacchari* (Cockerell) (Hemiptera : Pseudococcidae)) (Abd-Rabou and Parker, 2008).

The damage caused by the mealy bug *S. sacchari* occurs partly by sucking the plant sap and so leading to a group of thinner and stunted canes. The most serious loss, however, occurs from the industrial point of view, as the honey dew excreted by the mealy bug on the cane surface, together with the exudation of gums from parts wounded by the piercing mouth parts of the insects seriously interfere with the raw sugar juice leading to a depression in the amount of sugar crystallized during the manufacturing process (Willcocks, 1925).

Atiqi and Murad (1992) assessed sucrose and sugar content (brix, pol and purity) losses as 10.64, 16.44, 6.14 and 12.92 %, respectively as a result of *S. sacchari* infestation. Yield damage caused to sugarcane by *Pulvinaria iceryi* (Signoret) (Hemiptera: Coccidae) and *Aulacaspis tegalensis* (Zhnt.) (Hemiptera: Diapspididae) are cane weight and sucrose content losses (Anonymous, 1987). Saleh (2005) reported significant relationship between five levels infestation of effect *Pulvinaria tenuivalvata* (Newstead) (Hemiptera: Coccidae) on the yield and quality some characters of sugarcane. Goel *et al.*, (1983) indicated that heavily infestation by *Melanaspis glomerata* (Green) (Hemiptera: Diapspididae) on cane caused cane weight,

juice brix, sucrose content of the juice and purity losses of 51.61, 27.69, 39.0 and 13.39 %, respectively.

This work aimed to evaluate damage caused by low and sever levels of infestation of *S. sacchari* on sugarcane quantitative and qualitative characters and juice production.

MATERIAL AND METHODS

The present investigation was carried out at Gerga, Sohage Governorate, Egypt during a single growing year 2007/2008 (*i.e.* from Apr. 2007 to Apr. 2008). The design of experiments was as follows:

An area of about half feddan (*i.e.* 2000 m²) was divided into three parts according to level of infestation as low, sever and free of infestation. Identification of *S. sacchari* was carried out by first and third author, using the insect cutes collection list.

A sample of 25 internodes were chosen at random from each division under investigation and replicated 3 times. The samples were examination, using a magnifying glass at monthly basis. Alive stages found on each sample were recorded as: pre-adult and females.

Assessment of certain physical properties of sugarcane variety C.9/54, was carried out at harvesting time (*i.e.* 12 Apr. 2008). A sample of 10 stalks (replicate 3 times) representing each division was taken as random to determine the following parameters: stalk weight (g.), stalk height (m), high of internodes (cm), internodes number of stalk and juice weight (g).

Chemical analysis of sugarcane juice produced (after one hour from harvesting) from these stalks was conducted. One and half liter juice of them was taken in glass cylinder for calculating the characters according to the formula described by methods of Sugar and Integrated Industries Company (S.I.I.C.) (Mathur, 1981) to determine the following parameters:

*Brix percent (the percent of total soluble solids in 100 ml of juice) was measured by brix hydrometer standardized at 20 °C in the laboratory.

*Sucrose percent which was determined by using Saccarometer according to A.O.A.C. (Anonymous, 1995).

*Purity percent was calculated according to the following equation,

$$\text{Purity \%} = (\text{Sucrose \%} / \text{brix \%}) \times 100.$$

*Pol. = (Sucrose %) × Pol factor.

* Fiber %, and Reducing sugar percent were determined according to the method described in (Mathur, 1981).

*Sugar recovery percent was calculated according to the following equation, Sugar recovery % = Richness % × Purity %.

-Richness = (Sucrose in100mg × factor) /100.

-Factor = 100- (fiber % + physical impurities % + percent water free from sugar).

Statistical analysis as analysis of variance was conducted to clarify the significance between obtained levels of damage.

RESULTS AND DISCUSSION

Data in Table (1) show monthly mean counts of *S. sacchari* recorded on each monthly count as pre-adults and females. Counts mean were 73.5 & 19.1 for low

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infestation and 757.5 & 256.6 for sever infestation. The data indicated low infestation harbored about 10 % of the sever one.

Table (1): Monthly mean number of *S. sacchari* recorded on 25 internodes of infested sugarcane.

Date	Low infestation			Sever infestation		
	Pre-adults	Adult females	Total	Pre-adults	Adult females	Total
Apr. 2007	49.3	7.6	57	483.6	91	534.8
May 2007	112.4	19.3	155.7	1298.1	277.1	1575.3
Jun. 2007	87.2	6.8	94	854.9	81.1	936
Jul. 2007	47.2	8.1	55.3	462.9	96.5	559.4
Aug. 2007	83.4	37.1	140.6	916.1	561	1477.1
Sept. 2007	209.4	68.7	292.1	2092.4	936.9	3029.3
Oct. 2007	132.9	51.5	188.4	1303.1	660.8	1963.9
Nov. 2007	67.6	14.4	92	760.6	171.9	932.5
Dec. 2007	47.8	5.7	53.6	468.9	68.4	537.3
Jan. 2008	8.6	1.5	11.1	94.4	17.6	112
Feb. 2008	14.1	2.1	16.2	138.6	24.8	163.4
Mar. 2008	22.1	6.7	29.8	216.4	91.9	308.3
Total	882	229.5	1185.8	9090	3078.9	12129
Mean	73.5	19.1	98.8	757.5	256.6	1010.8

Results for cane physical properties are presented in Table (2). Results show that weight of stalk was decreased by 5.03 % in the low infestation and 34.33 % of sever infestation compared with free of infestation. This reduction was on significance between low and free of infestation. For height of stalks there was no significance between different tested levels of infestation. Internodes' height increased by 8.59 and 35.45% due to low and sever infestation, respectively. This increase was not significance between low and infestation free. The number of internodes/stalk was reduced at sever infestation by 29.07 % while at low infestation it was 8.80 %. This reduction was not clearly significance between different levels of infestation. Juice weight showed reduction of 2.26 and 31.62 % for low and sever infestation. This indicated significance differences between sever infestation and others.

Table (2): Effect of levels of infestation with *S. sacchari* on physical properties of sugarcane at harvesting time (12 Apr. 2008).

Infestation level	Stalk weight (g.)	Height of stalk (m.)	High of internodes (cm.)	No. internodes/stalk	Juice weight (g.)
Free of infestation	935 a	2.31 a	20.69 a	21.6 a	587 a
Low infestation	888 a	2.26 a	22.47 a	19.70 a	574 a
Sever infestation	614 b	2.15 a	28.03 b	15.32 ab	402 b
L.S.D	63.75	0.4	5.54	3.46	148.81

Results for extracted cane juice properties are presented in Table (3). Results showed the effect of infestation on percentages of brix which was reduced by 4.95 and 13.47 % of low and sever infestation, respectively with on significance between tested levels of infestation. Similar was sucrose percent which was reduced at by 6.29 and 27.87 % for low and sever infestation with on significance between tested levels. Percent of purity was reduced by 1.41 % at low infestation level. This reduction was not significant from free if infestation. Sever infestation resulted in significant reduction of 16.87 % compared with others. Reducing sugar increased insignificantly as infestation level increased as 3.53 % and 35.45 %, respectively. Percent of fiber

also was not affected by differences between the level of infestation. The pol value was reduced significantly as result of sever infestation compared with other levels. It was 32.62 and 5.29 % for sever and low infestation levels respectively. Sugar recovery was not significantly reduced by low of infestation (i.e. 5.29 %) while it was reduced significantly by sever infestation (i.e. 37.08 %).

Table (3): Effect of levels of infestation with *S. sacchari* on certain chemical properties of sugar can juice at harvesting time (12 Apr.2008).

Infestation level	Brix	Sucrose %	Purity %	Reducing Sugar %	Fiber %	Pol	Sugar recovery%
Free of infestation	18.78 a	15.75 a	83.86 a	5.67 a	12.48 a	13.98 a	13.98 a
Low infestation	17.85 a	14.76 a	82.68 a	5.87 a	12.64 a	13.24 a	13.24 a
Sever infestation	16.25 a	11.36 a	69.71 b	7.68 a	12.96 a	9.42 b	7.74 b
L.S.D	5.65	4.8	4.98	2.77	0.59	3.2	4.06

Generally the obtained results indicated that low level of infestation did not significantly affected sugarcane physical and chemical properties while sever one did.

These results are in agreement with Atiqui and Murad (1992) who assessed the loss of sucrose content of sugarcane infestation by *S. sacchari* as decreased of sucrose and sugar content of the cane and its purity (with average losses in sugar brix, pol, purity and available sugar content were 10.64, 16.44, 6.14 and 12.92 %, respectively). Goel *et al.* (1983) indicated that in heavily infestation by *M. glomerata* on cane were the cane weight, juice brix, sucrose content of the juice and purity were reduced by 51.61, 27.69, 39.0 and 13.39 %, respectively. Anonymous (1987) mentioned to yield losses caused to sugarcane by *P. iceryi* and damage level of the 2 components of loss, cane weight and sucrose content. Besheit *et al.* (2002) studied the effect of *P. tenuivalvata* on the yield and quality of sugarcane. The data indicated that under heavy infestation reduction percent recorded 51.24, 32.96, 46.08, 61.51, 73.24 and 31.24 for average stalk weight, juice extraction percentage, brix, (% Richness), % sugar extracted (rendment) and purity. Shalaby (2002) found there was significant reduction in weight of cane to 22.9 % infested cane by *P. tenuivalvata* and reduction in juice extraction and percent sucrose averaged 28.62 % and 4.13 %, respectively. Saleh (2005) reported that there were significant differences between infestation levels by *P. tenuivalvata* and stalk weight, stalk height, stalk of internodes number and juice weight. Percent of brix, purity, sucrose, purity, richness and sugar recovery were decreased by increasing the percent of infestation by *P. tenuivalvata*.

Further studies are required to determine the level of infestation which require introduction of control measurements.

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ARABIC SUMMARY

تأثير مستويات مختلفة من الإصابة بحشرة بق القصب الدقيقى على الصفات الطبيعية و الكيميائية لقصب السكر

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يعد قصب السكر من المحاصيل الإقتصادية الهامة فى العالم، وتعتبر حشرة بق القصب الدقيقى من عائلة البق الدقيقى الكاذب التابع لرتبة نصفية الأجنحة من الأفات الخطيرة التى تصيب محصول قصب السكر فى مصر.

أجريت الدراسة فى محافظة سوهاج خلال عام 2008/2007، بغرض مقارنة تأثير مستويين من الإصابة (إصابه خفيفه وأخرى شديده) بالنباتات السليمة على الصفات الطبيعية لنبات قصب السكر. وكان هناك نقص نتيجة الأصابة فى كل من {متوسط وزن العود (5.03، 34.33%) متوسط طول العود (6.93، 2.16%)، زياده فى متوسط طول السلامية (35.45، 8.59%)، نقص فى متوسط عدد السلاميات (31.62، 2.26%)، وزن العصير الناتج (31.62، 2.26%)}، وكذلك مدى تأثير المحتويات الكيميائية للعصير نتيجة المستويين من الأصابة مقارنة بغير المصاب فكان هناك نقص فى {البركس (13.47، 4.95%)، النسبة المئوية لسكر القصب (27.87، 6.29%)، النقاوة المعدلة (16.87، 1.41%)، الحلاوة المعدلة (32.6، 5.29%)، الناتج النظرى من السكر (37.08، 5.29%)}، وكان هناك زياده نتيجة الأصابة فى {النسبة المئوية للمختزلات فى السكر (7.68، 3.53%)، النسبة المئوية للألياف (3.85، 1.28%)} فى قصب السكر حيث وجد نقص بزيادة مستوى الإصابة بحشرة بق القصب الدقيقى. عامة كان النقص الراجع الى مستوى الاصابه الشديده معنويا بعكس الاصابه الخفيفه.