

Effect of some cultural practices on the infestation level of *Chilo agamemnon* Bles., infesting sugarcane varieties at Luxor Governorate

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ABSTRACT

The present work was carried out at El-Mattana Agricultural Research Station, Luxor Governorate on certain promising sugarcane varieties to study the effect of some agricultural practices on the infestation with the lesser sugarcane borer, *Chilo agamemnon* in spring plantation in late March during two successive seasons 2011/2012 and 2012/2013. Obtained results revealed that, significant differences between sugarcane varieties in all tested measurements in the two studied seasons. G.T.54-9 and G.2003-47 varieties were the most susceptible varieties to infestation incidence (bored stalks %), intensity of infestation (bored joints %) and percentage of girdled stalks. While, G.98-28 variety was the least susceptible in all studied measurements during the two successive seasons of study. The statistical analysis of the data revealed highly significant differences among the three nitrogen fertilization levels, during the two successive seasons. The highest infestation with *C. agamemnon* occurred in the case of sugarcane varieties receiving high rates of fertilizers (280 kg/fed.) compared with other treatments. In addition, increasing level of nitrogen significantly increased the infestation with *C. agamemnon* of sugarcane varieties. Generally, the interaction between sugarcane varieties and rates of Nitrogen fertilization showed significant differences in all tested measurements in the two studied seasons.

Key word: *Chilo agamemnon*, sugarcane varieties, fertilization and infestation.

Introduction

Sugarcane (*Saccharium* spp.) is one of the main field crop for white sugar production in Egypt and about 69 countries in tropical and subtropical regions of the world (Humbert, 1968). For sugar production, sugarcane grows successfully in 325742 feddans in both middle Egypt (EL-Minia governorate) and upper Egypt (Sohag, Qena, Luxor and Aswan governorates), while the acreage in Luxor governorate reaches about 61907 fed. in 2013, with mean yield 47.996 tons/fed. where the total amount of sugar (about 1.013 million tons) produced from sugarcane represented 62.9% of the total annual sugar production and consumption. Lesser sugarcane borer, *Chilo agamemnon* Bles., (Lepidoptera: Pyralidae) showed different symptoms of infestation circular tunnels, infested joints and stalk girdled, this insect causes reduction in sugarcane yield, % brix and % sucrose (Tohamy, 1999). Damage of this type of pathogens is severely depends on the incidence of this pest, as well as on varietal susceptibility. The borer infestation and accompanied diseases complex cause serious deterioration in the quality and quantity of juice extract for sugar production and hence drastic threat to the sugar industry. Borer infestation causes reduction in cane weight due to internodes damage, in addition larval tunnel in the cane cause stalk breakage and lodging. Moreover, the larval entrance and moth holes offer entry points for red rot (Reagan and Flynn, 1985).

Ali *et al.* (2001) found that slight reduction in both seasons and varieties was caused by bored joints less than 5% in JEP, brix, sugar% cane (Richness), sugar% juice (Pol%), extract% sugar (recovery), purity and pH, while, reducing sugar, dextran and ash (slight increase).

Therefore, the present study was conducted to study evaluation promising sugarcane varieties to infestation by sugarcane borer *C. agamemnon* under different nitrogen fertilization levels.

Material and Methods

The present study was carried out in El-Mattana Research Station, Luxor Governorate, Agricultural Research Center Giza Egypt. The work was conducted during the two plant-crop seasons of 2011/2012 and 2012/2013. The spring plantation was achieved in late March in both seasons, and harvested in March in both seasons. This work aimed to study effect of five sugarcane varieties and three nitrogen fertilizer levels on infestation by *C. agamemnon*.

Four promising sugarcane varieties plus commercial variety G.T54-9 and three nitrogen fertilizer levels were applied in both seasons as follows:

1- *Sugarcane varieties*: (G. 84-47, G. 98-28, G. 2003-47 and G. 2003-49). In addition G.T. 54-9 to the major commercial variety, Giza Taiwan G.T.54-9

2- *Nitrogen fertilizer levels*: was applied in the form of urea 46% N with three rates of 180, 230 (recommended dose) and 280 kg / fed. The three rates were distributed at three times, after two, three and four months after planting date. These times in case of the second season.

A fixed dose of phosphorus fertilizer was applied during land preparation at a rate of 60 kg P₂O₅/fed as calcium super phosphate (15.5% P₂O₅) to the permanent field before collecting the needed soil that was used to fill the bags.

The Randomized Complete Block Design was used with four replicates each contained 15 plots. Each replicate is a plot of 21m² (3m rows with 7m length and 1m width). Nitrogen fertilizer levels (Factor A) were distributed in the main plot and sugarcane varieties (Factor B) as a split plot.

The recorded Data:

Evaluation of Four promising sugarcane varieties plus commercial variety G.T54-9 to borer insect pest infestation under different nitrogen fertilizer levels.

1- Stalk Borer or Purple – lined Borer (PLB):

Samples of 20 stalks were taken randomly from the middle row of four replicates for each plot from Aug. 7 and 7 days intervals up to harvest time at March 15, 2012 and 2013 for both plant cane and second season, respectively. Cane stalks were stripped, cleaned and examined for various noticeable sign infestation with *C. agamemnon* using the following formula according to Mendes *et al.* (1980):

- Percentage of bored stalk (infestation incidence) = No. of bored stalks / No. of examined stalks × 100.
- Percentage of bored joints (infestation intensity) = No. of infested joints / No. of examined joints × 100.
- Percentage of girdled stalks = No. of girdled stalks / No. of examined stalks × 100.

Statistical analysis in the present work was carried out with randomized complete block design according to the procedures outlined by Snedecor and Cochran (1981). Means of significant variance were separated using Duncan multiple range test at 5% probability level.

Results and Discussion

1- Effect of sugarcane varieties and rates of nitrogen fertilization on:

1.1. Percentage of bored stalks (infestation incidence):-

Data in Tables (1 and 2) and illustrated in Figs. (1 and 2) demonstrated the effect sugarcane varieties and rates of (N) fertilization on the infestation of percentage of bored stalks by *Chilo agamemnon* during two successive growing seasons of 2011/2012 and 2012/2013. From the results, it is clear that the tested sugarcane varieties differed significantly in their susceptibility to *C. agamemnon* infestation.

In 2011/2012 season, G.98-28 variety was the least susceptible variety as percentage of infestation reached 21.14%, whereas G.T.54-9 was the most susceptible one (40.97%), followed by G.2003-47 variety (39.86 %).

An intermediate infestation was recorded in G.2003-49 (37.86 %) and G.84-47 (33.72 %), moreover, results revealed that percentage of bored stalks infestation increased as rate of nitrogen was increased.

In 2012/2013 seasons, G.2003-47 variety was the most susceptible variety (43.08 %), whereas G.98-28 variety was the least susceptible (21.50 %), meanwhile, an intermediate infestation was observed in the other varieties. Borah (1993) who stated that the percentage of infested stalk (incidence) varied greatly according to sugarcane variety and ranged from 7.4 to 24%. Co.6806 and Co.BLN9104 were comparatively resistant with the lowest incidences of 7.4% and 7.6%. Other cultivars showing low incidence were Co.8014 (9.7%), Co.BLN9102 (10.1%) and Co.BLN9103 (9.9%).

In addition, high nitrogen application rates resulted in a high percentage of bored stalks infestation. Our results are in agreement with Elwan *et al.* (2008) showed that the infestation with *C. agamemnon* was affected greatly by the rate of nitrogen fertilizer, the high dose of nitrogen fertilizer (310 kg/fed.) increases the infestation level more than the recommended dose (230 kg/fed.) because nitrogen encourages the vegetative plant growth which is in favour for this pest.

Concerning, the interaction between sugarcane varieties and rates of Nitrogen fertilization showed significant differences in the two studied seasons. The present results are in agreement with this obtained by Ali

et al. (2001) they mentioned that, the interaction between sugarcane varieties and NP rates had significant effects on borers infestation with *C. agamemnon*.

Table 1: Percentage of the infested sugarcane varieties with *C. agamemnon* as offered by sugarcane varieties and rates of (N) fertilization during the first season, 2011/2012.

Average	Percentage of bored stalks					Rate of Nitrogen fertilization (kg /fed.)
	Sugarcane varieties					
	G.2003-49	G.2003-47	G.84.47	G.98-28	G.T.54-9	
29.62 C	33.33 i	32.33 ijk	28.58 l	16.92 o	36.92 fgh	180
34.47 B	37.50 efg	40.50 cde	32.58 ij	20.75 n	41.00 cd	230
40.05 A	42.75 bc	46.75 a	40.00 c-f	25.75 lm	45.00 ab	280
34.71	37.86 C	39.86 B	33.72 D	21.14 E	40.97 A	Average

Mean followed by similar letters are not significant different according to Duncan multiple range test at 0.05 level of probability.

Table 2: Percentage of the infested sugarcane varieties with *C. agamemnon* as offered by sugarcane varieties and rates of (N) fertilization during the second season, 2012/2013.

Average	Percentage of bored stalks					Rate of Nitrogen fertilization (kg /fed.)
	Sugarcane varieties					
	G.2003-49	G.2003-47	G.84.47	G.98-28	G.T.54-9	
24.87 C	33.17 h	31.25 hij	21.08 mn	10.67 o	28.17 i-l	180
35.17 B	40.83 def	43.92 d	29.00 ijk	21.83 m	40.25 d-g	230
46.55 A	53.00 ab	54.08 a	43.75 de	32.00 hi	49.92 bc	280
35.53	42.33 A	43.08 A	31.28 C	21.50 D	39.44 B	Average

Mean followed by similar letters are not significant different according to Duncan multiple range test at 0.05 level of probability.

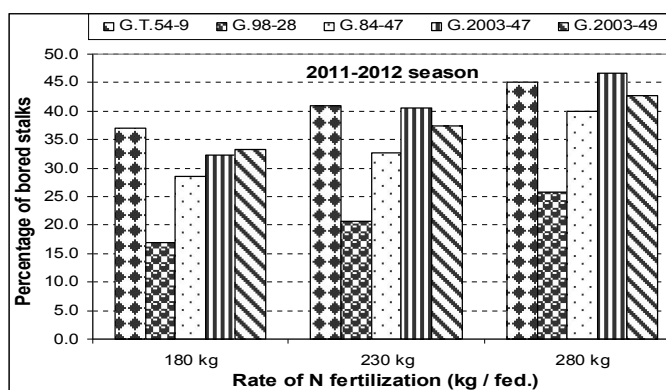


Fig. 1: Percentage of the infested sugarcane varieties with *C. agamemnon* as offered by sugarcane varieties and rates of (N) fertilization during the first season, 2011/2012.

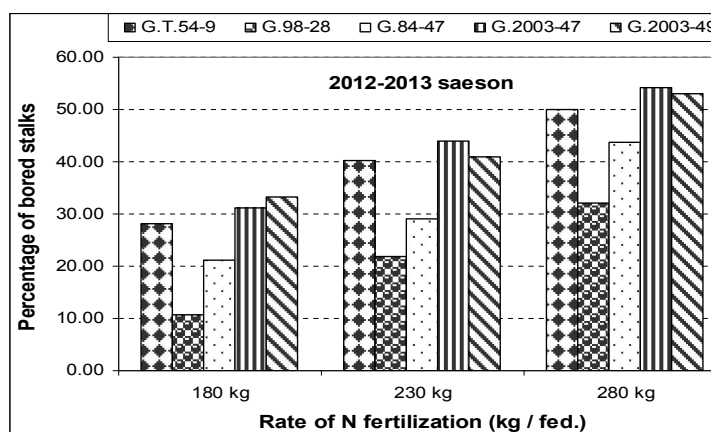


Fig. 2: Percentage of the infested sugarcane varieties with *C. agamemnon* as offered by sugarcane varieties and rates of (N) fertilization during the second season, 2012/2013.

1.2. Percentage of bored joints (infestation intensity):

Data summarized in Tables (3 and 4) and illustrated in Figs. (3 and 4) showed the effect of the tested sugarcane varieties and the different levels of (N) fertilization on the percentage of bored joints with *C. agamemnon* during two successive growing seasons of 2011/2012 and 2012/2013.

In 2011/2012 season, results showed that the sugarcane varieties differed significantly in their susceptibility to *C. agamemnon* infestation. The highest percentage of infestation (4.88%) occurred in G.T.54-9 variety, mean while, the lowest infestation (2.23%) was recorded in G.98-28 variety. Whereas remaining varieties were moderate infestation. Maareg *et al.* (1993) found that percentage of bored stalks and percentage of bored joints are a best measures for *C. agamemnon* damage and for resistance of susceptibility to sugarcane borers. In addition, increasing level of nitrogen significantly increased percentage of bored joints infestation.

In 2012/2013 season, the highest infestation occurred in G.2003-47 (4.75%) and G.2003-49 (4.69 %) meanwhile, the least infestation (2.46 %) was recorded in G.98-28. Remaining varieties were moderate susceptible. In addition, increasing level of nitrogen significantly increased percentage of bored joints.

Table 3: Percentage of bored joints with *C. agamemnon* as offered by sugarcane varieties and rates of (N) fertilization during the first season, 2011/2012.

Average	Percentage of bored joints					Rate of Nitrogen fertilization (kg / fed.)
	Sugarcane varieties					
	G.2003-49	G.2003-47	G.84.47	G.98-28	G.T.54-9	
3.29 C	3.53 f-j	3.77 e-i	3.07 g-l	2.10 l	3.97 c-h	180
3.92 B	4.71 b-e	4.44 c-f	3.30 f-k	2.15 kl	5.00 a-d	230
4.62 A	5.03 abc	5.86 a	4.08 c-g	2.44 jkl	5.67 ab	280
3.94	4.42 B	4.69 AB	3.48 C	2.23 D	4.88 A	Average

Mean followed by similar letters are not significant different according to Duncan multiple range test at 0.05 level of probability.

Table 4: Percentage of bored joints with *C. agamemnon* as offered by sugarcane varieties and rates of (N) fertilization during the second season, 2012/2013.

Average	Percentage of bored joints					Rate of Nitrogen fertilization (kg / fed.)
	Sugarcane varieties					
	G.2003-49	G.2003-47	G.84.47	G.98-28	G.T.54-9	
2.39 C	3.29 hi	2.96 hij	2.02 j-n	1.22 n	2.47 i-m	180
3.76 B	4.49 def	4.45 d-g	2.76 h-k	2.51 i-l	4.58 de	230
5.56 A	6.29 ab	6.83 a	5.37 bcd	3.65 e-h	5.64 bc	280
3.90	4.69 A	4.75 A	3.39 C	2.46 D	4.23 B	Average

Mean followed by similar letters are not significant different according to Duncan multiple range test at 0.05 level of probability.

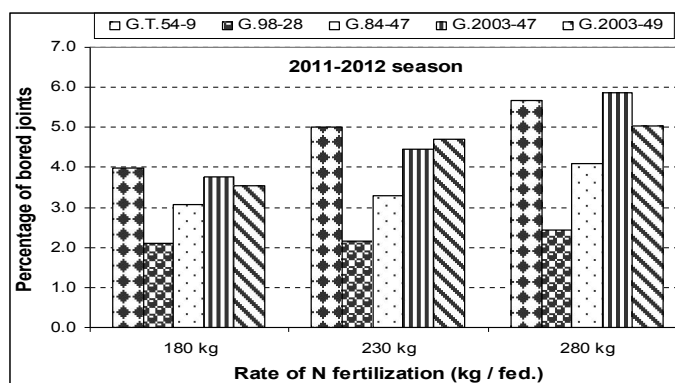


Fig. 3: Percentage of bored joints with *C. agamemnon* as offered by sugarcane varieties and rates of (N) fertilization during the first season, 2011/2012.

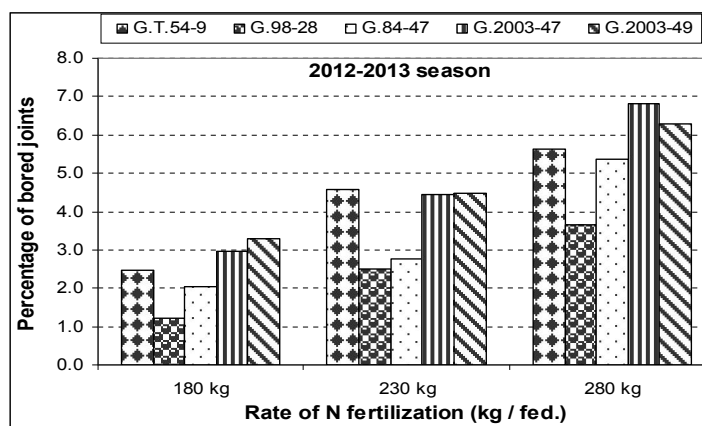


Fig. 4: Percentage of bored joints with *C. agamemnon* as offered by sugarcane varieties and rates of (N) fertilization during the second season, 2012/2013.

1.3. Percentage of girdled stalks:

Data presented in Tables (5 and 6) and illustrated in Figs. (5 and 6) showed the effect of tested sugarcane varieties and different levels of (N) fertilization on the infestation of percentage of girdled stalks with *C. agamemnon*. Throughout two successive growing seasons of 2011/2012 and 2012/2013. In 2011/2012 season, statistical analysis showed that sugarcane varieties varied significantly in their susceptibility to *C. agamemnon*. Among the sugarcane variety G.T.54-9 was the highest infested one as the percentage of infestation reached 40.56 %. G.98-28 variety was the least infestation as percentage reached 21.39 %.

These results are in agreement with Eid *et al.* (2005) showed that, G.T.54-9 had a high susceptible to *C. agamemnon* infestation then Ph 8013 variety.

An intermediate as percentage was recorded in the varieties G.2003-49 (38.39 %) and G.2003-47 (40.17 %) and G.84-47 (34.61 %).

These results are in agreement with those reported by Abu-Dooh (1988) and Maareg *et al.* (1993) who found that the percentage of girdled stalks was the highest for G.74-96, G.T.54-9 and G.84-68, while, G.75-368 was the moderate in the girdled stems infestation. On the other hand, the least infested varieties were G.84-47 and G.85-37.

In addition, the results revealed that percentage of infestation was significantly high in the highest N treatment compared with other treatments. In 2012/2013 season, statistical analysis showed that G.2003-47 was the most susceptible variety in which the percentage of infestation was 21.67 %. On the contrary G.98-28 was the least susceptible one (6.36 %). Remaining varieties were moderate susceptibility to infestation by *C. agamemnon*.

In addition, the results showed that percentage of infestation was significantly high in the highest N treatment compared with other treatments.

Generally, the interaction between sugarcane varieties and rates of Nitrogen fertilization showed significant differences in all tested measurements in the two studied seasons. It could be concluded that, sugarcane varieties significantly differed in their susceptibility to *C. agamemnon* infestation. Infestation of sugarcane varieties increased by increasing the rate of N fertilization. The highest level of infestation were recorded in the case of sugarcane received 280 kg/fed. N fertilizer.

Obtained results are in agreement with those obtained by Ali *et al.* (2001), they mentioned that, the interaction between sugarcane varieties and NP rates had significant effects on borer infestation with *C. agamemnon*.

Table 5: Percentage of girdled stalks with *C. agamemnon* as offered by sugarcane varieties and rates of (N) fertilization during the first season, 2011/2012.

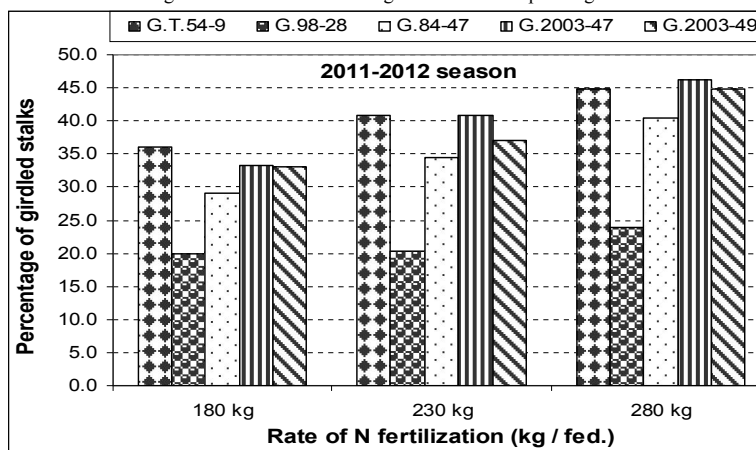
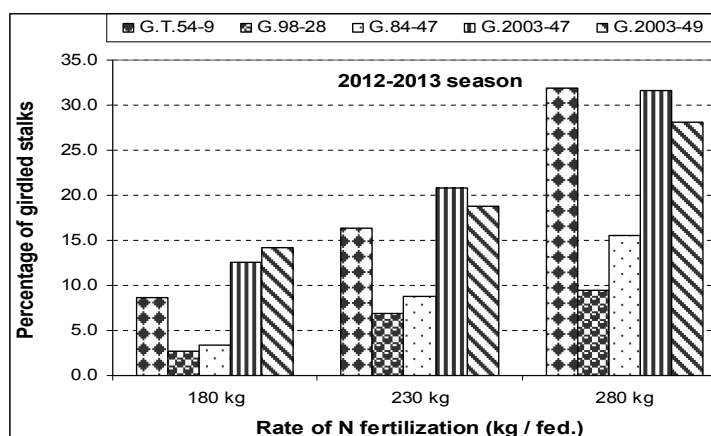
Average	Percentage of girdled stalks					Rate of Nitrogen fertilization (kg /fed.)
	Sugarcane varieties					
	G.2003-49	G.2003-47	G.84.47	G.98-28	G.T.54-9	
30.30 C	33.17 h-k	33.33 hij	29.00 l	20.00 n	36.00 gh	180
34.72 B	37.08 fg	40.92 de	34.42 ghi	20.25 n	40.92 d	230
40.05 A	44.92 ab	46.25 a	40.42 def	23.92 M	44.75 abc	280
35.02	38.39 B	40.17 A	34.61 C	21.39 D	40.56 A	Average

Mean followed by similar letters are not significant different according to Duncan multiple range test at 0.05 level of probability.

Table 6: Percentage of girdled stalks with *C. agamemnon* as offered by sugarcane varieties and rates of (N) fertilization during the second season, 2012/2013.

Average	Percentage of girdled stalks					Rate of Nitrogen fertilization (kg /fed.)
	Sugarcane varieties					
	G.2003-49	G.2003-47	G.84-47	G.98-28	G.T.54-9	
8.28 C	14.25 fgh	12.58 f-i	3.33 mn	2.67 n	8.58 jkl	180
14.32 B	18.75 de	20.83 d	8.75 ijk	6.92 j-m	16.33 ef	230
23.33 A	28.17 bc	31.58 ab	15.58 efg	9.50 ij	31.83 a	280
15.31	20.39 B	21.67 A	9.22 D	6.36 E	18.92 C	Average

Mean followed by similar letters are not significant different according to Duncan multiple range test at 0.05 level of probability.

**Fig. 5:** Percentage of girdled stalks with *C. agamemnon* as offered by sugarcane varieties and rates of (N) fertilization during the first season, 2011/2012.**Fig. 6:** Percentage of girdled stalks with *C. agamemnon* as offered by sugarcane varieties and rates of (N) fertilization during the second season, 2012/2013.

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