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IMPACT OF RELEASING *TRICHOGRAMMA EVANESCENS (WESTWOOD)* AND CHEMICAL INSECTICIDES ON THE INFESTATION BY *CHILO AGAMEMNON* AND *SACCHARICOCCUS SACCHARI (COCKERELL)* IN SUGARCANE FIELD.

BY

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ABSTRACT

Field studies were carried out to determine the effect of of *Trichogramma evanescens* releasingalone or with chemical insecticides (Malathion, Admiral and sulphur) against the purple lined borer, *Chilo agamemnon* Bles. and pink sugarcane mealy bug, *Saccharicoccus sacchari* (Cockerell) at Naga-Hammady, Quena Governorate in 2002 / 2003 and 2003 / 2004 sugarcane (C.9/54 commercial Varity) seasons. The true egg parasitoid, *T. evanescens* was released at rate of 25000 adults / feddan over 5 location (each divided to 6 equal plots) in July 1st. Releasing the parasitoid led to lower damage by *C. agamemnon* (8.64 % infested joints and 0.83 % dead top / 120 plants) in 2003 season and (8.24 % and 0.83 %), in season 2004 showing reduction percentages in the infested joints and dead top than control by 62.61 and 91.96 % in 2003 season and by 65.46 & 94.14 % in 2004 season, respectively. Among the different chemical insecticides treatments, plots received Admiral flowed by Malathion,(30 days between sprays and started after 30 days of parasitoid release) may be fairly considered as highly effective against the two studied pests, it reduced means numbers of mealy bug / plant (two season means 3.63 and 2.51/ plant). Treatments by these two materials caused plants to harbour a total of 26 infested plants/ 120 plants indicating % infestation by 21.67, consequently reduction percentages than control by 45.83 %, in 2003 season, respectively. The corresponding values of subsequent season were 29, 24.17 % and 44.22 %, respectively. Regarding the infested joints recorded on sugarcane plants, it is clear that this treatment was the most effective as plants harbour two season % infestation 3.05 and 3% indicating 86.74 and 87.43 % highest reduction than control, respectively. These percentages showing significant lower than those of control and parasitoids release treatment. The highest reduction percentages of dead top plants (86.74 and 88.21 %) than control were also, observed for this treatment. The lowest means dead top plants (0.33 and 0.33) were recorded from this treatment indicating the lowest % infestation by 1.67 and 1.67 % for the two seasons, respectively.

INTRODUCTION

In Egypt, sugarcane (*Saccharum officinarum* L.) is considered the main materials for sugar processing and it occupied the scored important economic crop (Darwish 1979). According to Anonymous, (2004) sugarcane produced

about 1,05 million tons of sugar, which presented about 73 % of the total amount of sugar production. Unfortunately, sugarcane plants in Egypt, are subjected to infestation by many pests of which the purple lined borer, *Chilo agamemnon* Bles. and the pink sugarcane mealy bug *Saccharicoccus sacchari* (Cockerell) are the most important (Tohamy, 1999).

C. agamemnon infestation to cane plants showed different symptoms of infestation as circular tunnels, infested joints and dead top. Embaby (1996) found that for each 1 % circular tunnels, the loss in cane yield and sugar yield were 0.38 and 0.68 %. Khewa (2001) estimated the losses in sugar yield due to *C. agamemnon* infestation in five different varieties including the commercial one C 9/54. The lowest percentages of increase in monosacharides from plants with infested joints and girdled plants were recorded for the C. 9/54.

The pink sugarcane mealy bug, *S. sacchari* is a common pest of sugarcane in Egypt (Ommer *et al.*, 1986 and Abu-Dooh, 1988). It exists of the stalk and under overlapping leaf-sheaths and below the node and spreads, down the internode and around the stalk to the region of the bud when numbers increase and show peak populations in August – September (Hafez and Salama, 1969). It is responsible for the accumulation of large quantities of wax and honeydew around the buds, the loss of sap and sugar due to heavy infestation by mealy bug during late summer and autumn which led to retardation of growth and reduction in yield. Tohamy (1999) indicated that G.T 54/9 commercial variety was found the highest infested among the studied varieties.

Genus *Trichogramma* attack lepidopterous eggs in varying degrees and they have been assumed to play an important role in regulating biologically the populations of *C. agamemnon* (Abbas, *et al.*, 1996). Several authors discussed the important role which *T. evanescens* play in suppressing the population density of the two corn borers *O. nubilalis* and *C. agamemnon* when the parasitoid released towards these pests (El-Heneidy *et al.*, 1989, Abbas *et al.*, 1991, Ebaid 2001 and Khewa 2001).

The aim of this study was to develop a pest-management system for *C. agamemnon* and *S. sacchari* with minimum adverse effect on the parasitoid.

MATERIAL AND METHODS

The present study was carried out at Naga-Hammady, Qina Governorate throughout two successive seasons (2002/ 2003 and 2003/ 2004). Six different locations of ¼ feddan each were divided to 6 equal plots. All plots were cultivated with the commercial variety C. 9/54 on March, 15th. The research plan aimed to investigate the effect of different treatments on infestation rates by the main sugarcane borer, *Chilo agamemnon* Bles. and the mealy bug as two mean sugarcane pests.

Materials used:

1. *Anagasta kuehniella* eggs parasitized by *Trichogramma evanescens* were supplied from the laboratory of *Trichogramma* mass production, Biological Control Department Mallawi Research Station.
2. Malathion, an organophosphorous chemical insecticide, diethyl [(dimethoxyphosphinothioyl) thio] butanedioate, used at 250 cm^3 / 100 liters of water.
3. Admiral, an I.G.R. compound, 2 [1-methyl-2-(4-phenoxyphenoxy) pyridine. used at 50 cm^3 / 100 liters of water.
4. Sulpher used at rate of 1 liters / 100 liters of water .

Treatments:

1. Location number (1), plots were left free of any application as control.
2. Location number (2), plots received release of *Trichogramma evanescens,* only for control egg masses of *Chilo agamemnon*. Releasing the parasitoid was carried out on July, 1st in both seasons at the rate of 40 cards / feddan, each produced 625 individuals i.e. 25000 adults / feddan.

The remained four locations were treated also with the parasitoid release in addition to chemical insecticides to control the infestation by pink sugarcane mealy bug as follows:

Location number (3), plots received a single application of Malathion after 45 days of parasitoid release.

1. Location number (4), plots received three sprays of Malathion at 30 day intervals between each spray and started after30 days of releasing the parasitoid.
2. Location number (5), plots received a spray by Sulpher followed by Malathion and latter Admiral at 30 day intervals between sprays and started after 30 days of releasing parasitoid application.
3. Location number (6), plots received Admiral application followed by Malathiuon at 30 day intervals between sprays and started after 30 days of releasing parasitoid.

At harvest time (February), samples of 20 stalks each were randomly selected from each replicate and first cleaned, then inspected carefully to estimate total number of joints, bored joints and dead top plants / 120 plants. Total number of infested plants by mealy bug / 120 plants were also counted and mean number of insects / plant were estimated.

Statistical analysis was done to find out L.S.D. values to test the significance between treatments.

RESULTS AND DISCUSSION

1-Releasing *Trichogramma evanescens* for controlling *Chilo agamemnon* eggs:

Data in Table (1) indicated that plants of untreated plots had significantly, more damage than those from plots that received *T. evanescens* release.

Releasing the parasitoid led to lower damage 8.64 % infested joints and 0.83 % dead top / 120 plants) in 2003 season and (8.24 % and 0.83 %), respectively in season 2004. these data indicated reduction percentages in the infested joints and dead top than control by 62.61 % and 91.96 % in 2003 season and by 65.46 % & 94.14 %, in 2004 season, respectively.

From the obtained results, it is thought that the rate of 25000 parasitoids / feddan is enough to achieve high reduction in the rate of infested canes.

The obtained results agree with those of El-Heneidy *et al.*, (1988), they found that release of *T. evanescens* in sugarcane fields at a rate of 60000 adults / feddan resulted in 4.2 % and 48.8 % reduction in rates of infestation in the stalks and joints, respectively. Also Abbas *et al.*, (1991) mentioned that release of *T. evanescens* in sugarcane fields at rate of 20000 adults / feddan resulted in 54.5 and 64.6 % reduction in rates of infestation in the stalks and joints, respectively.

2- Chemical insecticide treatments:

A-Single Malathion application

From data presented in Table (1), it is clear that, in both seasons of study, the single field application of Malathion insecticide that was applied after 45 days of parasitoid release for mealy bug control led to 45 and 43 infested plants / 120 inspected plants, respectively. These counts are, insignificant than those recorded from the control treatment (8 and 8.67 infested plants / 20 plants). This treatment, also, caused 6.25 and 17.3 % reductions in infested plants than control lowered the mean numbers of insects / plant to 4.32 and 3.38 compared to 9.57 and 9.3 insects / control plant, respectively.

The obtained results concerning the effect of this field treatment on *Chilo agamemnon* first season infestation resulted in 104 infested joints / 2249 inspected joints of 120 plants indicated 4.62 % infestation and reduction in infestation than control by 80 %. As for the effect of this treatment on dead top infestation, the total recorded numbers was 6 infested plants / 120 plants showing 5 % infestation and indicating 51.6 % reduction in the infestation than control. Data of second season showed similar trend as in the first season where the % recorded infestation joints was (6.2 % infestation indicating 74.2 % reduction than control, while, those of dead top were 1.67 % infestation and 88.21 % reduction than control, respectively. Such data indicated significant difference between %-infested joints and mean numbers of dead top of this treatment with that of the control while were insignificant compared to the releasing treatment.

It could be, generally, concluded from the obtained data that the delayed used of Malathion till 45 days after parasitoids release, gave the parasitoids enough time to attack and control *C. agamemnon* eggs and subsequently good biotic control can be obtained, but in the same time, this treatment led to achieve low control for mealy bug.

B- Triple Malathion application

In these treatments, each plot received three applications of Malathion insecticide at 30 day intervals between each spray and started after 30 days of releasing *T. evanescens*. Among the different treatments, in the two seasons, triple Malathion applications led to the lowest mean numbers of mealy bug infested plants (3.83 and 3.5 plants / 120 plants). These numbers were insignificantly lower those that recorded from Admiral –Malathion treatments (4.33 and 4.83 plants / 120 plants, respectively), and significantly lower than that resulted from all the remaining four treatments. Among the different treatments, this treatment led to the highest reduction percentages in infested plants than control (52.07 and 59.61%) and lowest mean numbers of insects / plant (3.21 and 2.1 insects / plant in 2003 and 2004, respectively; Table, 1).

As for the effect of this treatment on infestation rate by *C. agamemnon* to sugarcane plants, data tabulated in Table (1) show clearly, that among the different chemical and parasitoid release treatments, the lowest percentages of reduction than control for the infested joints (51.3 and 50.96 %, respectively) and for dead top plants (27.39 and 58.86 %) were recorded from this treatment. The mean numbers of dead top plants (two season averages 1.5 and 1.16) were found insignificantly different than all chemical and parasitoid treatments. While the % of infested joints during the two seasons (11.3 and 11.7) were found, insignificant with those recorded from parasitoid release or Sulphur –Malathion – Admiral treatments but significantly higher than all the three remaining chemical treatments.

From the formerly mentioned results, it could be deduced that this treatment caused an increased in the percentages of infested joints and dead top plants than in all other chemical or parasitoids release treatments and produced the lowest reduction infestation by *C. agamemnon* than control. This may be due to the harmful effect of pesticide on the parasitoid. But, in the same time, this treatment caused the highest reduction in infested plants with mealy bug than control and also minimized the mean numbers of insects / plant to the lowest value among the different treatments.

C- Sulphur – Malathion -Admiral treatments:

After 30 days of parasitoid release, the three materials were applied in the field on plants . The assayed materials were applied successively as Sulphur, Malathion and Admiral at 30 day intervals. At the end of sugarcane seasons (2003 and 2004), 25 and 27.5 % of the inspected plants from this treatment showed infestation by mealy bug. These percentages of infested plants indicated 37.5 and 36.53 % reductions than control, indicating highest efficacy in reducing the numbers of insects / plant to 4.14 and 2.25, for the two seasons, respectively. According to the L.S.D. values, the two season average numbers of infested plants (5 and 5.5) were found insignificantly different than those of Admiral-Malathion treatments.

Table (1): Rates of infestation by *Chilo agamemnon* and *Saccharicoccus sacchari* to C.9/54 sugarcane variety after treatment with *T. evanescens* and chemical insecticides in 2003 and 2004 sugarcane seasons.

Treatments	*Chilo agamemnon*								*Saccharicoccus sacchari*				
	Infested joints				Dead top								
	inspected joints/120 plants	Infested joints	% infestation	Reduction than control	Dead top plants/ 120 plants	Mean	% infestation	Reduction than control	Infested plants / 120 plants	Mean	% infestation	Reduction than control	Mean numbers of insect / plant
	2003												
Control	2199	386	23	0.0	22	3.67	10.33	0.0	48	8	40	0.0	9.57
Parasitoid release	1899	164	8.64	62.61	1	0.17	0.83	91.96	46	7.7	38.33	0.0	9.33
Single Malathion	2249	104	4.62	80.00	6	1.00	5.0	51.6	45	7.5	37.5	6.25	4.32
Triple Malathion	2098	237	11.30	51.3	9	1.5	7.5	27.39	23	3.83	19.17	52.07	3.21
Sulpher-Malathion-Admiral	2308	160	6.93	69.86	5	0.83	4.17	59.63	30	5	25	37.5	4.14
Admiral-Malathion	2491	76	3.05	86.74	2	0.33	1.67	83.83	26	4.33	21.67	45.83	3.63
L.S.D.			4.82			1.5				1.53			
	2004												
Control	2267	541	23.86	0.0	17	2.83	14.17	0.0	52	8.67	43.33	0.0	9.3
Parasitoid release	1990	164	8.24	65.46	1	0.17	0.83	94.14	53	8.83	44.17	0.0	9.85
Single Malathion	2271	141	6.2	74.02	4	0.67	3.33	76.5	43	6.00	35.83	17.31	3.38
Triple Malathion	2050	240	11.7	50.96	7	1.16	5.83	58.86	21	3.5	17.5	59.61	2.1
Sulpher-Malathion-Admiral	2271	159	7	70.66	8	1.33	6.67	52.93	33	5.5	27.5	36.53	2.25
Admiral-Malathion	2280	69	3	87.43	2	0.33	1.67	88.21	29	4.83	24.17	44.22	2.51
L.S.D.			4.47			2.54				1.66			

Statistical analysis of data obtained from this treatment indicated that the percentage of joints infested by *C. Agamemnon* (two season averages 6.93 and 7 %) were insignificantly different than those of Admiral- Malathion treatment. These percentages showed 69.86 and 70.66 % reductions in the infested joints than control for the two seasons of study, respectively. Also, it could be observed that the mean numbers of dead top plants recorded from this treatment (two season averages 0.83 and 1.33 infested plants / 120 plants) were, insignificantly different than those recorded from Admiral- Malathion treatments. This treatment caused reduction in the percentages of dead top plants than control by 59.63 and 52.93 %, for the two seasons of study, respectively.

D-Admiral- Malathion treatments:

In this part of study, sugarcane plants received Admiral application after 30 days of releasing parasitoids while Malathion application came after 30 days from Admiral application. From data in Table (1), this treatment may be fairly considered as highly effective in reducing means numbers of mealy-bug / plant (two season means 3.63 and 2.51/ plant). Treatments by these two materials caused plants to harbour a total of 26 infested plants/ 120 plants indicating % infestation by 21.67, consequently reduction percentages than control by 45.83 %, in 2003 season, respectively. The corresponding values of subsequent season were 29, 24.17 % and 44.22 %, respectively.

Regarding the infested joints recorded on sugarcane plants that received these two latter materials, it is clear from Table (1) that this treatment was the most effective as plants harboured two season % of infested plants 3.05 and 3% indicating 86.74 and 87.43 % reduction than control, respectively. These percentages were significantly lower than those of control and parasitoids release treatment. The highest reduction percentages of dead top plants (83.83 and 88.21 % than control) were also, recorded for this treatment. Among the different chemical insecticide treatments, the lowest means of dead top plants (0.33 and 0.33) were recorded from this treatment indicating the lowest % infestation by (1.67 % for the two seasons).

It could be, generally concluded from the obtained data that Admiral - Malathion treatment gave a good control for the two studied pests. The use of Admiral before Malathion led to serve the parasitoids by saving much enough time for the parasitoid to play its important role in control *C. agamemnon* eggs.

El-Khawas *et al.* (2003) stated that Cascade (I.G.R.) was less harmful to adults of *T. evanescens* than Dursban (chemical insecticide). Ebaid, (2004) stated that Mimic (I.G.R.) proved to be safe compound for adults and full grown larvae of *Bracon brevicornis* parasitoid and also for three tested predacious insects (*P. alfierii, C. undecimpunctata* and *Scymnus spp*).

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تأثير اطلاق طفيل التريكوجراما ايفانسيس وبعض المعاملات الكيمائية على الاصابة بدودة القصب الصغرى وبق القصب الدقيقى فى حقول القصب

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معهد بحوث وقاية النباتات ــ مركز البحوث الزراعية ــ مصر.

اجريت دراسة حقلية لمعرفة تأثير اطلاق طفيل التريكوجراما ايفانسيس منفردا اومع بعض المعاملات الكيماوية (كبريت – ادميرال – ملاثيون) لمكافحة كل من دودة القصب الصغرى وبق القصب الدقيقى بمركز نجع حمادى – محافظة قنا على صنف القصب التجارى س ٥٤/٩ خلال موسمى ٢٠٠٢ / ٢٠٠٣ و٢٠٠٣ / ٢٠٠٤. تم اطلاق الطفيل بمعدل ٢٥٠٠٠ فرد / فدان على خمسة مواقع وتم الاطلاق فى اول يوليوفى كل من موسمي الدراسة. وقد جرى استخدام المواد الكيماوية لمكافحة بق القصب الدقيقى فى أربعة مواقع.

ادى اطلاق الطفيل الى خفض الضرر بدودة القصب الصغرى حيث بلغت النسبة المؤية للعقل المصابة ٨,٦٤ % بينما كانت نسبة القمم المكسورة ٠,٨٣% فى سنة ٢٠٠٣، مقابل ٨,٢٤، ٠,٨٣ % فى عام ٢٠٠٤. اوضحت هذة النسب انخفاضا عن معاملة المقارنة فى العقل المصابة والقمم المكسورة مقدارة ٦٢,٦١ و٩١,٩٦ % لعام ٢٠٠٣، على الترتيب، بينما كانت ٦٥,٤٦، ٩٤,١٤ % لعام ٢٠٠٤.

المعاملة التى استخدم فيها مبيد الملاثيون لمرة واحدة والتى تمت بعد اطلاق الطفيل ب ٤٥ يوم بلغت فيها نسة العقل المصابة بدودة القصب الصغرى لعامى الدراسة ٤,٦٢، ٦,٢ % موضحة انخفاض عن نسبة الإصابة فى معاملة المقارنة بمقدار ٨٠ و٧٤,٠٢ % فى حين بلغت نسبة الاصابة للقمم المكسور فى عامى الدراسة على الترتيب ٥ و٣,٣٣ %وقد أوضحت هذة النسب انخفاضا عن المقارنة بمقدار ٥١,٦، ٧٦,٥ %. اما عن تاثير هذة المعاملة على حشرة بق القصب الدقيقى فقد تبين عدم وجود فرق معنوى فى متوسط عدد النباتات المصابة عن معاملة المقارنة ولكنها خفضت متوسط عدد الحشرات لكل نبات الى ٤,٣٢، ٣,٣٨ حشرة لكل نبات لعامي الدراسة، على الترتيب مقابل ٩,٥٧ و٩,٣ / نبات فى المقارنة.

المعاملة التي تم فيها استخدام مبيد الملاثيون لثلاث مرات بفارق زمني مقدارة ٣٠ يوم بين كل رشتين والتى بدأت بعد اطلاق الطفيل ب ٣٠ يوم أوضحت تأثيرا سيئا على الطفيل حيث سجلت اقل نسب خفض فى العقل المصابة بدودة القصب الصغرى (٥١,٣، ٥٠,٩٦ %) وأعلى تعداد فى عدد النبتات المصابة بالقمة المكسورة (٩ و٧ نباتات / ١٢٠نبات لعامى الدراسة على الترتيب). ولكن من جهة اخرى فقد اظهرت هذة المعاملة كفاءة عالية فى مكافحة بق القصب الدقيقى حيث سجلت اعلى نسبتي خفض عن المقارنة بلغتا (٥٢,٠٧ و٥٩,٦١ %) كما سجلت ايضا اقل متوسط لتعداد الحشرة لكل نبات (٣,٢١ و٢,١).

اما المعاملة التى استخدم فيها الكبريت ثم الملاثيون ثم الادميرال بنفس مواعيد الرش فى المعاملة السابقة – اظهرت نسبة اصابة العقل بدودة القصب الصغرى ٦,٩٣ و٧ % لعامى الدراسة، على الترتيب– موضحة انخفاضا عن معاملة المقارنة

مقدارة ٦٩,٨٦، ٧٠,٦٦ %. لكن من حيث تاثير هذة المعاملة على القمم المكسورة فقد سجلت هذة المعاملة خفضا عن معاملة المقارنة مقدارة ٥٩,٦٣، ٥٢,٩٣ لكل من عا مى الدراسة، على الترتيب- اما من ناحية تأثير هذة المعاملة على حشرة البق الدقيقى فلقد اتضح اصابة ٢٥ و٢٧,٥ % من النباتات التى تم فحصها فى عامى الدراسة على الترتيب. وقد بينت هذة النسب خفضا فى الاصابة عن معاملة المقارنة مقدارة ٣٧,٥، ٣٦,٥٣ % كما بينت اعلى كفاءة فى خفض متوسط عدد الحشرات لكل نبات الى ٤,١٤ و٢,٢٥ لعامي الدراسة على الترتيب.

وبالنسبة للمعاملة التى استخدم فيها الادميرال ثم الملاثيون بفارق زمنى شهر والتى تمت بعد الاطلاق بشهر ربما تكون هي افضل المعاملات فمن حيث التأثير على حشرة البق الدقيقى فقد تبين انخفاض متوسط عدد الحشرات / نبات الى ٣,٦٣، ٢,٥١ كما انخفضت نسبتي الإصابة إلى ٢١,٦٧، ٢٤,١٧ % لعامي الدراسة على الترتيب. ومن ناحية تأثير هذة المعاملة على نسبة الإصابة بحشرة دودة القصب الصغرى بلغت نسبة الإصابة في العقل ٣,٠٥ و٣,٠ مبينة اعلى نسبة خفض بين المعاملات المختلفة عن المقارنة ب ٨٦,٧٤، ٧٨,٤٣ لعامي الدراسة كما سجلت ايضا أعلى نسبة خفض للقمم المكسورة مقدارة ٨٦,٧٤، ٨٨,٢١ %، واقل أعداد للنباتات ذات للقمم المكسورة بين جميع المعاملات إلى نباتين / ١٢٠ نبات في كل من موسمي الدراسة.