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LIST OF ABBREVIATIONS USED IN PRESCRIPTIONS

No	Abbreviation	Meaning
1.	% IS	Per cent. infested stalks.
2.	% IJ	Per cent. infested joints.
3.	% G S	Per cent. girdled stalks.
4.	% B S	Per cent. broken stalks.
5.	H / S	Mean No. of holes/stalk.
6.	V1	G.T.54-9
7.	V2	G. 1999-103
8.	V3	G. 1998-28
9.	V4	E.I.266/2
10.	V5	E.I.264/2
11.	Pc	Plant cane
12.	R1	1 st ratoon
13.	R2	2 nd ratoon
14.	R3	3 rd ratoon

5. Summary

The stalk borer, *Chilo agamemnon* Bles., is one of the main pests of sugarcane and certain other graminaceous crops in Egypt particularly in upper Egypt, the present investigation aimed at throwing light on certain aspects of its ecology and Biological control and assessment losses caused by this pest in El-Mattana Agric. Res. Station, Qena Governorate, upper Egypt. These include using a light trap for monitoring the population fluctuations of moths, the estimated number of field generations and effect of main weather factors on the population fluctuations of moths formed the main ecological studies, the relationship between sugarcane plantation and infestation with *Chilo agamemnon*, the susceptibility of certain sugarcane varieties with this pest, Effect of *C. agamemnon* infestation on juice quality for sugarcane varieties and release *Trichogramma evanescens* against *C. agamemnon* in sugarcane field.

The obtained results of these studies could be summarized as follows:

1- Ecological studies.

1.1. Monitoring the seasonal activity of *C.agamemnon* moths using light trap.

1.1.1. Seasonal activity of *C.agamemnon* moths during its seasonal abundance.

Results indicated that the main period of moth activity of *C.agamemnon* during 2010 and 2011 extended between late July and early November.

This point included two of the largest and most economically important generations. Moths completely disappeared in trap during cold weather (early Jan. until March) as the insect hibernates, as larvae in stalks of hosts. During spring 19.17%, 18.2% of the total catch of moths were observed during 2010 and 2011 seasons, respectively. This increased to (45.5%, 46.6%) in summer 2010, 2011, respectively and (34.8%,35.2%) in autumn 2010 and 2011 respectively.

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1.1.2. Number and duration of annual field generations of *C. agamemnon* moths.

1.1.2.1. First Year of 2010

During the first year *C. agamemnon* passed through four overlapping generations. The first generation was started on the 2nd week of May to the 3rd week of July, 2010 and lasted 70 days. The second generation was started on the 5th week of July to the 2nd week of September, 2010 and lasted 49 days. The third generations was started on the 3rd week of September, to the 2nd week of October, 2010 and lasted 28 days. The fourth generation was started on the 3rd week of October to the 2nd week of November 2010 and lasted 35 days.

1.1.2.2. Second year of 2011

The results followed the same trend as *C. agamemnon* passed through four overlapping generations. The first generation was started on the 2nd week of May to the 2nd week of July, 2011 and lasted 63 days. The second generation was started on the 3rd week of July to the 3rd week of August, 2011 and lasted 42 days. The third generation was started on the 4th week of August to the 1st week of October, 2011 and lasted 42 days. The fourth generation was started on the 3rd week of October to the 1st week of November, 2011 and lasted 28 days.

1.2. Effect of certain main weather factors on the flight activity of *C. agamemnon* moths.

The interrelations between moth catches and the prevailing climatic conditions in both years (2010, 2011) revealed a significant correlation between the weekly catch of moths and either the corresponding reading of maximum, minimum, mean temperatures and relative humidity. The correlation coefficients of these factors were significant positive (+0.744**, +0.785**, +0.816**) for the first season and (+0.792**, +0.823**, +0.813**) for the second season.

Whereas the average relative humidity was insignificant negative (-, .321, -, .262) for two seasons 2010 and 2011, respectively.

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Combined effect of the three weather factors together on the captured moths.

The responsibility of these three factors, combined, expressed as amount of variance explain are 75.5% in the first season 2010, and 74.2% in 2011, This indicates the strong role of these factors in influencing the activity and abundance of *C.agamemnon* moths.

1.3. Effect of different sugarcane plantation on the population dynamic of *C.agamemnon* by using Egg-masses.

1.3.1. Autum plant cane:

Studies on the population of this pest on the different sugarcane plantation by using Egg-masses were carried out at El-Mattana Agric. Res.Station, Qena Governorate, upper Egypt throughout the 2010 and 2011 growing seasons. Number of the collected egg-masses and total number of eggs were considered as an index for the population activity of *C.agamemnon*.

Results obtained revealed that the female moths of the purple lined borer, *C.agamemnon* began activity and laying eggs on sugarcane plants of the planted sugarcane during the third week of June in both 2010 and 2011 growing season.

However, egg deposition lasted intermittently from the third week of June until the first week of December during both growing seasons. The maximum abundant of egg-masses and the total number of eggs were observed in first season 2010 less than the second growing season, 2011. On the other hand, daily mean temperature and relative humidity showed relation significant effect on the number eggs in the 1st year and insignificant. In the 2nd year, mean temperature revealed relation highly significant effect on the number whereas mean relative humidity showed positive significant on the number eggs.

1.3.2.Spring plant cane:

Results showed that the female moths of *C.agamemnon* started activity and laying eggs on sugarcane plants of the planted sugarcane during the third week of August, 2010 during the first season and during the fourth week of

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August 2011 and extended from the third of August until the first week of December during the first season and extended from the fourth week of August until the second week of December 2011. On the other hand it observed four peak activity during two studied years.

1.3.3. The first ratoon:

The results indicated that the female moths of *C. agamenon* began activity and laying eggs on sugarcane plants during the third week of June and extended until the first week of December during the 1st year 2010 and started during second week of June and extended until the first week of December 2011. Number of egg-masses collected and total number of eggs encountered throughout the second season were higher than those encountered on the 1st ratoon during the 2010 season. Four peaks were also estimated during two studied years.

1.3.4.2nd ratoon:

Results indicated that the female moths of *C. agagemnon* began activity and laying eggs on 2nd ratoon during the third week of June during the 1st season and during fourth week of June during the 2nd season. However, egg deposition extended from the third week of June until the end November during the 1st season were extended from the fourth week of June until the first week of November during the 2nd season. Four peaks were also estimated during 2nd ratoon seasons.

1.3.5.3rd ratoon:

Results indicated that the female moths of *C. agagemnon* started activity and laying eggs on 3rd ratoon sugarcane plants during the end of fourth week of June during the 1st season and during the third week of July during the 2nd season. However, egg depositions extended from end the fourth week of June until the second week of December during 1st season and extended from the third week of June until the first week of December during 2nd season. Number of egg-masses collected and total number of eggs encountered throughout the 2nd season 2011 were higher than those encountered on the 3rd ratoon cane

SUMMARY

plants during 1st season, 2010. Four peaks were also observed of *C.agamemnon*.

1.4. Effect of certain weather factors on the seasonal activity of *C.agamemnon* for laying Egg-masses in sugarcane plantation.

1.4.1.Autumn plant cane:

Results showed that the combined effect of these tested weather factors were highly significant effect (F value = 10.85**) on the insect activity during the 1st year (2010) and insignificant effect (F value =2.13) on the insect activity for laying egg-masses in the 2nd year (2011). The combined effect of these factors on the activity for laying egg-masses as indicated by explained variance (E.V.) was 81.3% in 1st year (2010) and 46% in 2nd year (2011). However, the mean relative humidity showed positive relation significant effect.

1.4.2.Spring plant cane

Obtained results revealed that the combined effect of these tested weather factors were significant in the 1st year (F value = 5.7*) and insignificant effect in the 2nd year (F value = 0.77), respectively the amount of variability attributed to the combined effect of these weather factors on this pest population were 79.1%, and 33.9% for the 1st and 2nd years, respectively. The activity of *C.agamemnon* for laying egg-masses on the sugarcane leaves of the spring plant cane referred to the combined effect rather than the single effect.

1.4.3.1st ratoon

Results showed that the combined effect of these tested weather factors were highly significant on the insect activity in both years (F value =15**, 4.6*), respectively. The amount of variability attributed to the combined effect of these tested weather factors on the insect population were 85.70% and 64.6% for the 1st and 2nd years, respectively. The maximum temperature and minimum temperature played the most important role on the population change.

SUMMARY

1.4.4.2nd ratoon

Results indicated that the combined effect of the tested weather factors were highly significant (F value =9.44**) on the insect activity during the 1st season (2010) and significant (F value =4.30*) on the insect activity for laying egg-masses in the 2nd season (2011). The combined effect of these factors on the *C.agamemnon* for laying egg-masses as indicated by explained variance (E.V.) was 79.1% in 1st year and 63.1% one. The relative humidity was responsible for 20.9% (out of 79.1%) and 63.9% (out of 63.1%) during 1st and 2nd years, respectively. Results indicated that the maximum and minimum temperature plays an important role on the number of deposition laying.

1.4.5.3rd ratoon:

Results revealed that the combined effect of the tested weather factors was highly significant (F value = 12.58**) during the 1st year (2010) and significant (F value =2.55*) on the insect activity for laying egg-masses in the 2nd one (2011). The combined effect of these factors as indicated by explained variance (E.V.) was 83.4% in 1st year and 30.3% in 2nd one. On the other hand, the relative humidity was responsible for 16.6% and 69.7%, in the 1st and 2nd year respectively. This means that the relative humidity played the most important role on the egg laying of *C.agamemnon* specially in the 2nd season 2011.

1.5. The relationship between different sugarcane Plantation and infestation with *C.agamemnon*.

Generally, the obtained results indicated that, the relationship between different sugarcane plantation and infestation was varied from season to another and as well as from ratoon to another. The *C.agamemnon* prefers the autumn plant cane for laying egg-masses than the 1st and 2nd ratoon whereas the 3rd ratoon and spring plant cane was less prefers for egg laying.

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1.6. Distribution of egg-masses on sugarcane leaves for plantation

Results indicated that the egg-masses of *C.agamemnon* distributed mainly on the middle parts of sugarcane leaves (plant cane, 1st, 2nd, 3rd) than the basal apical parts which received the lower number of egg-masses. So, the adult moth of *C.agamemnon* prefers the middle parts of sugar cane leaves for laying the egg-masses than the basal and apical ones due to the width of the sugarcane leaf in the middle parts than the basal and terminal ones. On the other hand, the adult female moth prefers the lower surface of sugarcane leaves for laying egg-masses.

1.7. Relative susceptibility of certain new promising sugarcane varieties to infestation by *C.agamemnon*.

Generally, the sensitivity of the used cane varieties differed significantly against *C.agamemnon* attack measured as %IS , %IJ, % GS, %BS and H/S percentage of plant cane and first ratoon during studied years 2010 and 2011.

1.7.1. The first season 2010

1.7.1.1. Percent infested stalks (IS %)

It is evident that sugarcane varieties significantly differed in their susceptibility to *C.agamemnon* infestations in plant cane or 1st ratoon.

In the plant cane the G. 1998 – 28 was the most susceptible, whereas remained varieties were the least susceptible ones. In the 1st ratoon again the variety 1998-28 was the most susceptible, meanwhile the variety E.I. 264/2 was the least susceptible.

1.7.1.2. Percent infested joints (IJ %)

The results indicated that the tested new promising sugarcane varieties varied significantly in their susceptibility to *C.agamemnon*. Among the tested G. 1998-28 was the highest one as the percentage of infestation reached (11.88 and 5.24%) for the plant cane and 1st ratoon, respectively. Meanwhile the variety E.I. 264/2 was the least infestation (3.18%) in the 1st ratoon.

SUMMARY

1.7.1.3. Percent gridled stalks (GS %)

The variety 1998-28 was the most susceptible and the variety E.I. 264/2 was the least susceptible to *C.agamemnon* infestation during plant cane and 1st ratoon.

1.7.1.4. Percent broken stalks (BS %)

Results indicated that the variety E.I. 264/2 was the most susceptible as percentage infestation to *C.agamemnon*. while , the variety G.1998-28 was the least susceptible as percentage infestation to *C.agamemnon*.

1.7.1.5. Mean No.of holes/stalks (H/S)

Results indicated that the G. 1998/28 was the most susceptible while the variety E.I .264/2 was the least infestation.

1.7.2. The second season (2011)

1.7.2.1. Percent infested stalks (IS %)

It is clear that all sugarcane varieties were infested by *C.agamemnon*. the varieties G.T. 54.9, G. 1998-28 and E.I. 264/2 were the most susceptible as percentage infestation to *C.agamemnon* in the plant cane and 1st ratoon.

1.7.2.2. Percent infested joints (IJ %)

Results indicated that the varieties G.T. 54-9 and G. 1999-103 were the most susceptible as percentage of infestation to *C.agamemnon* in the plant cane and 1st ratoon.

1.7.2.3. Percent gridled stalks (GS %)

Statistical analysis showed that there is not different significantly between all varieties in the plant cane. Whereas the variety G. 1999-103 was the least susceptible and the variety G.T.54-9 was the most susceptible as percentage infestation to *C.agamemnon* in the 1st ratoon.

1.7.2.4. Percent broken stalks (BS %)

Results showed the variety G.T. 54-9 was the most susceptible as percentage of infestation to *C.agamemnon* in the plant cane. In the 1st ratoon the variety G.T. 54-9 again was the most susceptible while the variety E.I. 264/2 was the least susceptible as percentage of *C.agamemnon*.

SUMMARY

1.7.2.5. Mean No.of holes/stalks (H/S)

Statistical analysis indicated that the variety G.T-54-9 was the most susceptible infestation whereas the varieties E.I. 266/2 and G. 1999-103 were the least susceptible infestation to *C.agagemnon* in the plant cane. In the 1st ratoon the variety G. 1999-103 was the least infestation.

1.7.3. Distribution of *C.agagemnon* infestation on the sugar cane stalks of some new promising sugar cane varieties.

Results indicated that increase in upper third infestation from 31.2 and 37.6 during the 1st and 2nd season of 2010 and 2011, respectively. Whereas the middle and lower third during two successive seasons, harboured the intermediate infestation. While in the 1st ratoon upper third of the stalk seemed to be the most affected by infestation and suffered the maximum number of infested joints 28 and 37 during the two successive seasons (2010 and 2011). Whereas the middle and lower third of stalk respectively suffered the least infestation.

1.8. Relationship between sugarcane plantation and infestation by *C.agagemnon* .

1.8.1. The 1st season, 2010 (Spring and Autumn)

1.8.1.1. Percent infested stalks (IS %)

Results indicated that the autumn plant cane was the most susceptible plantation and the spring plant cane was the least susceptible plantation to *C.agagemnon* infestation during the 1st season 2010.

1.8.1.1. Percent infested joints (IJ %)

Results indicated the autumn plant cane, 1st ratoon, 2nd ratoon and 3rd ratoon were the most plantation as percentage of infestation to *C.agagemnon*. Meanwhile, the spring plant cane, 1st ,2nd and 3rd ratoon the least susceptible infestation to *C.agagemnon*.

SUMMARY

1.8.1.3. Percent gridled stalks (GS %)

The results showed that the autumn plantation Plant cane, 1st, 2nd and 3rd ratoon were more susceptible than the spring plantation plant cane, 1st, 2nd and 3rd ratoon respectively.

1.8.1.4. Percent broken stalks (BS %)

Statistical analysis indicated that percentage of broken stalks varied markedly from one plantation to another. The highest infestation was recorded in Autumn plant cane (23.33%) meanwhile was (13.33%) in the spring plant cane plantation. Whereas the percentage of broken stalks ranged from 1.66 – 27.50% in the 1st and 2nd ratoon in the spring plantation.

1.8.1.5. Mean number of holes / stalk (H/S)

Statistically analysis showed that there is significant difference between plantation. The maximum number of H/S was observed on spring, 2nd and 1st ratoon (3.01 and 2.3 H/S), respectively.

The maximum number of H/S was observed on Autumn second ratoon (4.05 H/S) and Autumn first ratoon (3.04 H/S).

1.8.2. Second season 2011 (Spring and Autumn)

1.8.2.1. Percent infested stalks (IS %)

Statistical analysis showed that the plantation differ in their relative susceptibility to infestation with *C.agamemnon*. The maximum % was observed in the spring second ratoon with a grand mean (66.87%). Whereas was (94.17%) for autumn cane. This means that the autumn plantation were the most susceptible infestation than the spring plant cane plantation.

1.8.2.2. Percent infested joints (IJ%)

Results indicated that there is difference significant between tested plantation. The highest infestation was observed in the autumn plantation than the spring cane plantation.

1.8.2.3. Percent gridled stalks (GS%).

Results indicated that the percentage of gridled stalks there is difference significant between tested plantation.

SUMMARY

1.8.2.4. Percent broken stalks (BS %)

Results revealed that the autumn plantation were the most infestation than the spring plantation as percentage manifestation ranged between (30.42 – 15.83%) to *C.agamemnon* infestation, respectively.

1.8.2.5. Mean number of holes / stalk (H/S)

Results indicated that the mean number of *C.agamemnon* in the autumn plantation were more infestation by *C.agamemnon* than the spring plantation with grand mean (4.71 – 2.36 H/S), respectively.

1.8.3. Distribution of *C. agamemnon* infestation on the sugarcane plantation cane stalk of the commercial variety (G-T-54-9).

1.8.3.1. In the spring plantation

Results indicated that the second ratoon during the seasons (2010 and 2011) was relatively higher infestation than plant cane, 1st and 3rd ratoon.

1.8.3.2. In the autumn plantation

Results showed that the autumn plant cane and the 3rd ratoon harboured the lowest infestation. Whereas the 1st and 2nd ratoon harboured relatively higher infestation. Results also showed that the upper third was the most infestation one to *C.agamemnon* followed by the middle and lower third for (spring or fall) respectively. This means that the autumn plantation showed the highest infestation by *C.agamemnon* than the spring plantation.

1.9. Effect of *Chilo agamemnon* infestation on juice quality characteristics in sugar cane fields.

1.9.1. Sugarcane varieties 2010

1.9.1.1. Juice Brix poids

In the plant cane 2010, results indicated that the highest losses in juice Brix occurred in variety G.1998-28 and the lowest was in variety G.1999-103 whereas in the first ratoon the highest loss was in variety G.t.54-9 and the lowest was in variety E.I.264/2.

SUMMARY

1.9.1.2. Sucrose in 100 cc

In the plant cane, the percentage of loss in sucrose in 100 cc the highest losses was in variety E.I.266/2 and the least was in G.1999-103 . in the first ratoon the maximum losses was in G.1998-28 and the minimum was in variety E.I.264/2.

1.9.1.3. Sucrose in 100 gm

In the first ratoon the percentage losses of sucrose in 100 gm was highest in variety G.1998-28 and the lowest in variety E.I.264/2 in the plant cane the percentage of loss ranged , according to variety E.I.264/2 (10.34 %) and G.t.54-9 (6.38 %).

1.9.1.4. Juice purity

In the plant cane, the percentage of loss was lower in variety G.1998-28 and the highest was in variety G.1998-28 and the lowest was in variety E.I.266/2.

1.9.1.5. Sugar recovery percentage

Loss in sugar recovery was higher was in variety E.I.266/2 and the lowest was in variety G.T.54-9. In the first ratoon the loss in sugar recovery was maximum in variety G.1998-28 and the least was in variety E.I.264/2.

1.9.2. Sugarcane varieties 2011

1.9.2.1. Juice Brix poids

In the plant cane loss in juice Brix was the highest in variety E.I.266/2 and the least was in variety E.I.264/2. In the first ratoon the maximum losses in juice Brix was in variety E.I.266/2 and the least was in G.1999-103.

1.9.2.2. Sucrose in 100 cc

In the plant cane the highest loss in sucrose in 100 cc occurred in variety E.I.266/2 and the least was in variety E.I.264/2 .In the first ratoon , the maximum loss was in variety E.I.264/2 and the least was variety G.1999.103.

SUMMARY

1.9.2.3. Sucrose in 100 gm

The plant cane the percentage of loss was in higher in variety E.I.266/2 and the lowest was in variety G.1999-103. In the first ratoon , again was in higher in variety E.I.266/2 and the least was in variety G.1999-103.

1.9.2.4. Purity

In the plant cane the loss in juice purity was in variety G.1999-103 and the highest losses was in variety E.I.264/2. In the first ratoon loss in juice purity was least in varieties G.1998-28, G.1999-103 and E.I.264/2.

1.9.2.5. Sugar recovery percentage

In the plant cane the highest losses was in variety E.I.266/2 and the lowest was in variety G.1999-103. In the first ratoon , the maximum losses was in variety G.T.54-9 and the minimum was in variety G.1999-103 .

1.9.3. The spring plantation (2010 & 2011)

1.9.3.1. Juice Brix poids

In the first season the highest percentage of losses occurred in third ratoon and the lowest was in first ratoon. In the second season the percentage of loss in juice Brix was highest in 3rd ratoon and the lowest was in 2nd ratoon.

1.9.3.2. Sucrose in 100 cc

In the first season the percentage of losses was maximum in 3rd ratoon and minimum was in 1st ratoon. In the second season, the lowest losses in sucrose was in 2nd ratoon and the highest was in 3rd ratoon.

1.9.3.3. Sucrose in 100 gm

In the first season, the percentage of losses in sucrose in 100 cc was highest in 3rd ratoon and the least in 1st ratoon. In the second season was in highest in 3rd ratoon and the least in 2nd ratoon.

1.9.3.4. Juice Purity

In the first season the highest losses was in plant cane and the lowest was in 2nd ratoon. In the second season, was maximum in 3rd ratoon and the least in plant cane.

SUMMARY

1.9.3.5. Sugar recovery percentage

In the first season the maximum losses occurred in 3rd ratoon and the least was in the 1st ratoon. In the second season, the highest of losses occurred in 3rd ratoon and the lowest took place in 2nd ratoon.

1.9.4. The Autumn plantation (2010 & 2011)

1.9.4.1. Juice Brix poids

In the first season, 2010 the percentage of loss in juice Brix was comparatively higher in 1st ratoon than 2nd ratoon. Whereas in the second season, 2011 the 3rd ratoon was the highest percentage and the lowest in 2nd ratoon.

1.9.4.2. Sucrose in 100 cc

The highest percentage occurred in 1st, 3rd ratoon in the first season, 2010 and the lowest was in 2nd ratoon. Meanwhile in the second season, 2011 the maximum was in 3rd ratoon and minimum was in 2nd ratoon.

1.9.4.3. Sucrose in 100 gm

In the first season, 2010 the highest percentage was in the 1st ratoon and the least was in 2nd ratoon. In the second season 2011, the 3rd ratoon was the highest percentage of losses and the least was in 2nd ratoon.

1.9.4.4. Juice Purity

In the first season, 2010 the percentage of loss in juice purity means were nearly similar and the least was in plant cane. In the second season, 2011 the highest losses was in 1st ratoon and the least was in 2nd ratoon.

1.9.4.5. Sugar recovery percentage

In the first season, 2010 the highest percentage of losses were in 3rd and 1st ratoon and the least was in 2nd ratoon. In the second season, 2011 the maximum losses was in 3rd and 2nd ratoon, and the minimum was in 2nd ratoon.

2. Control Studies

2.1. Role of the Egg-Parasitoid, *Trichogramma Evanescens* as A biological Agent Against *Chilo agamemnon* infestation in sugar cane fields.

The results indicated that during June, July and August, female moths of *Chilo* tended to deposit their egg-masses on the lower surface of the upper leaves of the sugar cane plants. Parasitized egg-masses started to appear one to three weeks. Results show that maximum abundance of parasitized egg-masses was mostly synchronized with the highest population of the egg-masses. Also number of parasitized egg-masses was always low at the beginning of the season, increased gradually according to the increase of egg-masses deposition till reach a peak mostly in September, October and November and declined thereafter. Results indicated that parasitism percentages in both-egg-masses and eggs of *C.agamemnon* with releasing the egg parasitoid, *T. evanescens* on the autumn plant cane, spring plant cane, 1st, 2nd, and 3rd ratoon in the both years was 68.86 – 71.44% in the treated cane with *T. evanescens* in the 1st season and were 71.74 – 74.24% during the second season. So, must be releasing *T. evanescens* earlier in sugar cane fields is very important to protection sugar cane from *C.agamemnon* infestation.

2.2. Effect of irrigation interval on the efficacy of *T. evanescens* for management of *C.agamemnon* under field conditions.

Results revealed that irrigation interval of bio-control agent release played an efficient role for management of *C.agamemnon*. The mean parasitism percent of the parasitoids was higher in the treatment was given at after irrigation 48 hours as compared to the treatments where releases were made on before irrigation 48 hours, after irrigation 10 days and control.