Evaluating The Insect Growth Regulator Match and Some Plant Extracts in Some Biological Aspects of Callosobruchus Maculatus in Laboratory Conditions

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Abstract

The study was conducted in the laboratories of the college of agriculture/ Tikrit University to study the effect of various concentrations of the insect growth regulator Match and the three plant extracts, \textit{F. foetida}, \textit{A. vera}, and \textit{C. myrrha}, on some biological aspects of \textit{Callosobruchus maculatus}. The study results showed that using 0.7 ml has affected the incubation period from 5.55 days in control treatment to 7.77 days when the seeds are dipped before the eggs were laid on them. Moreover, using 7.0 gm of \textit{A. vera} led to increase the incubation period of the eggs to 7.33 days when the seeds of \textit{Vigna sativum} were dipped after laying the eggs on them as compared to the control treatment that was 5.66 days. The insect growth regulator Match and other plant extracts have a significant effect in decreasing the average larval stage, it reached 12.88 days when the seeds were dipped after laying the eggs on them with the insect growth regulator Match with a concentration of 0.7 ml and 14.10 days when using the \textit{F. foetida} extract with a concentration of 0.7 ml as compared to the control treatment that was 17.33 days. Furthermore, the three plant extracts and the insect growth regulator Match have significantly affected the average virgin stage that was 7.66 days longer when the seeds were dipped in the \textit{F. foetida} extract with a concentration of 7.0 ml before laying the eggs as compared to the control treatment that was 6.33 days.

Keywords: Match, Ferulaassa-foetida, Commiphora .

1. Introduction

The Leguminaceae family has a significant economic value since it is one of the crops that is rich in protein necessary for humans and animals. The dry seed of this family contains 25-30\% of protein as well as a high concentration of iron, calcium, vitamin B1 and B2, and amino acids [1] and [2]. These crops are attacked by different kinds of insects mainly the \textit{Callosobruchus maculatus} Fab. This insect affects these crops in the field and in the storage space. It is widely spread and causes huge losses in the stored seeds of \textit{Vigna sativum} [3]. It is characterized by a wide family range since it can grow and develop on 35 kinds of legumes [4]. Various and many pesticides have been used to reduce the damage of these insects such as chemicals pesticides. However, the unreasonable and frequent use of pesticides led to an immunity against these chemicals by the insects that reached about 460 kinds by 2003 [5]. Thus, in addition to the side effects of using pesticides, researchers and workers in the field of the protection of crops have taken a new and modern strategy to fight insects and get rid of the dangers of using pesticides and replace them with other safer materials and one of the most important elements of this strategy is the use of insect growth regulators in addition to plant extracts , which are considered a good efficacy on the pest ( insect ) and safer on the environment and does not cause any damage to the vital enemies and beneficial insects .

2. Materials and Methods

2.1 Source of the insect and its breading

\textit{C. maculatus} \textit{F. Adults} were obtained from the insect laboratory of the plant protection department of the college of Agriculture/University of Tikrit, to be bred in the laboratory on unharmed seeds free from any infection of \textit{Vigna sativum} in a clean, sterile plastic bottles of 800 ml, and 200 g bottle\textsuperscript{1}. Their nozzles were packed with muslin cloth, tied tightly by rubber laces, and then placed in the incubator at 2 ± 30C\textdegree and 54±70 relative humidity until experimented with [6-8].
2.2 Treatments used in the study

2.2.1 Insects growth regulator Match

Growth regulator Match is a non-systemic insect regulators belonging to the Acylurea Group which containing the active substance Lufenuron (Emulsifiableconcentrate 50%) obtained from Syngenta company, where it was used in concentrations (0.1, 1.3, 0.5, 0.7) ml\(^{-1}\) besides control treatment in which the pure distilled water was used.

2.2.2 Plant Extracts

Three types of plant extracts were selected to study their effect on the life of C. maculatus F., which are (F.foetida extract, A. vera extract, and c.myrrha extract), were used in three concentrations (3, 5, 7) g/liter\(^{-1}\) in addition to the control treatment in which distilled pure water was used, these extracts were prepared using the method [9], taking 40 g of each extract's powder, placing in a 500ml glass beaker, adding 400ml distilled water, putting on the Magnetic Steel Hot Plate for 15 minutes, after that leaving the extract in a dark place for 24 hours, then the extract was nominated by two layers of muslin cloth, after that filtered through filter paper the Wattman No. 1 and put in plastic tubes inside the Centrifuge at 30000 cycle minute\(^{-1}\) for 10 minutes to get clear which was taken to be dried into the dryer undercooling Lepholyzer (ALPHA1-2 LD\(_{chub}\)) for dry matter used in the study, then preserved dry matter in a tight, sterile vessel in the fridge at 4 ° C until use [10,11].

2.3 Treatment methods

Several clean seeds , free from any infestation , were randomly selected from the seeds of the different plant kinds that used in the study (V. unguiculata , P. stivum , and C. arietinum ) and at a rate of 30 seeds per sample for three iterations from each plant treatment and immersed for some seconds in various concentrations from the insect growth regulator Match and the three plant extracts (F. foetida , A. vera , and C. myrrha) before and after laying eggs on them except the two comparison treatments that was immersed with distilled water only, then the following characters were studied ( account of eggs incubation period, the duration of larval stage, and the duration of virgin stage of C. maculates F.

2.4 Statistical Analysis

The experiences have been designed by using the random complete sector block design (R . C. S.B.D) with three iterations to distribute the total treatments and the analysis has been conducted by using ver.12 Gen –Stat program. The results have been compared by using low significant difference criterion at the level of probability 0, 05P< {12}

3. Results and Discussion

3.1 Effect of coefficient method with different concentrations from insect growth regulator Match and some plant extracts and kind of treatment in the average incubation period of the eggs of C. maculates F.

The results of statistical analysis and the test of low significant difference among averages of the character egg incubation period from the table (1) showed a significant difference at the level probability 5% for the most used treatment concentrations in the study compared with control treatment. It was found that the use of the insect growth regulator Match at concentration 0.7 ml/liter extended the incubation period of eggs from 5.55 days in control treatment to 7.77 days, when dipping the seeds before laying eggs and this is the best treatment among the most other treatments. As for the effect of the concentrations of the plant extracts used, it was found that the use of A. vera gave the longest character egg incubation period which reached 7.33 days, when dipping the seeds of three plants treatments after laying the eggs compared with control treatment, which was 5.66 days. The results of the analysis also showed no significant differences of the eggs incubation period character between the two using treatment methods, where the average of egg incubation period reached for each of them 6.31 and 6.48 days respectively, while the effect of the kind of treatment in this character , the results of statistical analysis showed no significant differences among the three kinds of treatment which reached (6.29, 6.42, 6.48 ) days for the three kinds of treatment (Vigna sinensis V. unguiculata L., Pismum sativum P. stivum L., and Cicer arietinum C. arietinum L.) respectively. As for the effect of interference among the concentrations, the two treatment methods, the kind of treatment, the treatment with the growth regulator Match, and some of plant abstracts in the character of the average period of incubation of eggs of the C. maculates F., table (1) showed that there is an inverse proportion between the average period of incubation of eggs and the increase in the concentrations of treatments on the whole of plant treatments used in the study, a significant decrease occurred, where the interference treatment that included dipping seeds of Pismum sativum with the insect growth regulator Match with concentration 0, 7 ml liter before laying the eggs on the other interference treatments
significantly increased, where it led to a prolonged incubation period of eggs of *C. maculates* F. from 5 days in control treatment to 8 days. We also found that using *Commiphora Myrrha* and *F. foetida* with 0.7 g liter concentration for each of them on seeds of *Cicer arietinum*, which had previously been laid eggs, had a significant and clearly effect in prolonging the average incubation period of eggs of *C. maculates* F. from 6.00 days at control treatment to 7.66, 7.33 for each of them respectively. The results came close to what was confirmed by many researchers, The [11], pointed out that the use of insect growth inhibitor Trigard 75% increased the average incubation period of eggs of *C. maculates* F., which was treated by the four plant treatments (*Pisum sativum*, *Cicer arietinum*, *Vigna sisensis* mung bean), therefore the highest average incubation period for the eggs was reached 13.25 days for insect fed on the mung bean treatment and the growth regulator treatment Trigard with two concentration together (3.5) compared with the control treatment that was 9.25 days. The [12], found that the using of seeds of the abstracts of *Eruca sativa* with concentration 2600 PPM has prolonged the incubation period of eggs of *C. maculates* F. from 7 days in control treatment to 9 days, while the treatment that used leaf extract of *Eruca sativa* at a concentration 355 PPM led to prolong the incubation period eggs to 10 days compared to the control treatment, which was 7 days.

**Table 1.** Shows the effect of method treatment with different concentration from the insect growth regulator Match and some of plant abstracts and the kind of treatment in the average of incubation period of eggs of *C. maculates* F.

| Average The averages | Average of the concentrations & averages | *C. arietinum* | *P. sativum* | *V. unguiculata* | Concentrations | Treatments | Treatment method |
|---------------------|------------------------------------------|----------------|--------------|------------------|----------------|------------|------------------|
| 6.319               |                                          | 5.53           | 5.66         | 6                | 5              | 0.0        | Match            |
|                     |                                          | 6.086          | 6            | 6.66             | 5              | 0.1        |                  |
|                     |                                          | 6.876          | 6.33         | 7                | 7.3            | 0.3        |                  |
|                     |                                          | 7.1            | 7            | 7                | 7.3            | 0.5        |                  |
|                     |                                          | 7.73           | 8            | 7.33             | 8              | 0.7        |                  |
|                     |                                          | 7.776          | 5.66         | 6                | 5              | 0.0        |                  |
|                     |                                          | 5.553          | 5.66         | 6                | 5              | 3.0        |                  |
|                     |                                          | 5.886          | 6            | 6.33             | 5.33           | 5.0        | *F. foetida*     |
|                     |                                          | 6.44           | 6.66         | 6.66             | 6              | 7.0        |                  |
|                     |                                          | 5.776          | 5.66         | 6                | 5              | 0.0        |                  |
|                     |                                          | 6.11           | 6            | 6.33             | 6              | 5.0        | Dipping before laying eggs |
|                     |                                          | 6.773          | 6.66         | 7                | 6.66           | 7.0        | *A. vera*        |
| 6.480               |                                          | 5.66           | 6            | 5                | 0.0           |            |                  |
|                     |                                          | 5.773          | 5.66         | 6                | 5.66           | 3.0        |                  |
|                     |                                          | 6.106          | 6            | 6.66             | 5.66           | 5.0        |                  |
|                     |                                          | 5.663          | 6.66         | 7                | 6.33           | 7.0        | *C. myrrha*      |
|                     |                                          | 5.66           | 6            | 5.33             | 5.66           | 0.0        |                  |
|                     |                                          | 6.106          | 6            | 6.66             | 5.66           | 0.1        |                  |
|                     |                                          | 6.663          | 6.33         | 6.66             | 7              | 0.3        |                  |
|                     |                                          | 5.73           | 7            | 7.33             | 7.66           | 0.5        | Match            |
|                     |                                          | 7.443          | 7            | 7.33             | 8              | 0.7        |                  |
|                     |                                          | 6.663          | 6            | 5.33             | 5.66           | 0.0        |                  |
|                     |                                          | 5.773          | 6.66         | 6.66             | 7              | 0.3        | *F. foetida*     |
|                     |                                          | 6.106          | 6.66         | 5.66             | 6              | 5.0        |                  |
|                     |                                          | 6.663          | 7.33         | 6                | 6.66           | 7.0        |                  |
|                     |                                          | 6              | 5.33         | 5.66             | 0.0           |            |                  |
|                     |                                          | 5.773          | 6.33         | 5.33             | 5.66           | 3.0        |                  |
|                     |                                          | 6.106          | 6.66         | 5.66             | 6              | 5.0        |                  |
|                     |                                          | 6.776          | 7            | 6                | 7.33           | 7.0        |                  |
| 0.182               |                                          | 6              | 5.33         | 5.66             | 0.0           |            |                  |
|                     |                                          | 6.22           | 6.33         | 6                | 3.0           |            |                  |
|                     |                                          | 6.886          | 7            | 7                | 6.66           | 5.0        |                  |
|                     |                                          | 7.33           | 7.66         | 7.33             | 7              | 7.0        | *C. myrrha*      |
| 0.373               |                                          | 0.288          |              |                  |                |            |                  |
| 0.400               |                                          | 0.251          |              |                  |                |            |                  |
3.2 The effect of treatment method with different concentrations from insect growth regulator Match, some of plant abstracts, and the kind of treatment on the average larval stage of C. maculates F.

The results of table (2) indicated that the two treatment methods used in dipping before and after laying eggs with different concentrations of the insect growth regulator Match and some plant extracts had no significant effect on the character of the average larval stage of the C. maculates F., while the concentrations of the insect growth regulator Match had a clear significant effect in this character compared to the control treatment, where there was an inverse proportion between the average larval stage and the increase in concentrations of treatments. The average larval stage of C. maculates F. decreased from 17.33 days at control treatment to 12.88 days at dipping the seeds after laying eggs on them with insect growth regulator Match at concentration 0.7 ml/liter. As for the effect of plant abstracts used, we found that dipping the seeds with plant extracts of F. foetida extract at a concentration of 7.0 g/liter after laying eggs on them, gave the lowest average larval life of 14.10 days. Through the same table, we see that there is a disparity in the average larval stage according to the kind of plant treatment used in the study, where the results of the statistical analysis and the least significant difference test confirmed that there was significant differences at a lower probability level of 5% in the average of this character according to the studied plant treatments, where the average larval stage decreased to 15.14 days for larvae raised inside seeds of Cicer arietinum significantly than the larvae raised inside the seeds of Vigna sinensis and Pisum sativum, as the average larval stage in them was 15.61 and 16.33 days respectively.

Referring to the results of the interference between the method treatment and the treatment used, their concentration, and the kind of treatment in the average larval stage of C. maculates F., we find a significant and different decrease in the average larval stage in the concentrations of the insect growth regulator Match and the plant extracts used in the study for the whole used plant treatments, where the interference treatment that included dipping the seeds of Pisum sativum after laying eggs on them with the insect growth regulator Match at a concentration 0.7 ml/liter is got the better on the other most interference treatments that reached 12.66 days except the two interference treatments that included dipping the seeds of Pisum sativum and Cicer arietinum with the abstract of F. foetida at concentration 7.0 g/liter, where the average larval stage for each of them was reached 13.33 days.

We also note from results of the same table that there is an inverse proportional between the average larval stage of the C. maculates F. and the concentrations of the used treatments in the study, especially that the larval stage was considered as a harmful and dangerous stage in this insect, therefore, the decreasing of the average of this stage is considered as good and acceptable results by researchers. The results are different with the findings of [13], who explained that treating the larvae of T. granarium (Everts) with an insect growth regulator Applaud with the two concentrations (0.5, 1.0) g/liter increased the first lifespan of the larvae to (38, 41) days respectively, compared to the control treatment which reached 29 days.

The [14], also found that the period of larval stage of the C. maculates F. reached its climax in 4% concentration of the Alcoholic extract of the seeds of X. strumarium, where it reached 29.66 days compare to the Alcoholic abstract of the seeds of C. colocynthis and C. sativa and that reached (22, 00 –18.33) respectively and with the same concentration.

3.3 The effect of the treatment method with different concentrations from the insect growth regulator Match, some of plant extracts, and the kind of treatment in the average of virgin stage of the C. maculates F.

Table (3) shows that the kind of food treatment has a significant effect in the average of virgin stage of the C. maculates F., where the least proportion reached 6.43 days for the virgins that raised on the seeds of Cicer arietinum, while we note a significant increase for this character on the virgins that raised inside the seeds of Pisum sativum which reached 7.17 days. The same table also shows that there is a direct proportion between the average of virgin stage of the C. maculates F. and the used treatments concentrations with interference with the treatment method as there is an increase in the average of virgin stage with the increasing of the concentrations of growth regulator and the used plant abstracts, where this proportion has a significant effect with different concentrations of the treatments used and the longest average reached 7.66 days when dipping the seeds with the abstracts of F. foetida with concentration 7.0 g/liter after laying eggs and then gradually decreased with decreasing the concentrations to reach 5.99 days when dipping the seeds with the two concentrations (0.1 ml, 3.0 g) from the growth regulator Match and C. myrrha respectively before laying eggs on them, which is not significant difference about comparison treatment that was 5.66 days.

As for the effect of the two used treatment methods, and although there is no significant differences as the results of the statistical analysis pointed out (3).

It has been noted numerical differences with the two methods that included dipping the seeds of the three plant treatments before and after laying eggs on them, which was 6.63, 6.81 respectively.

The interference between the insect growth regulator Match, some plant extracts and their concentration, the two methods of dipping, and the kind of food treatment, has different effects in the average of virgin stage which was reached the highest average 8.33 days when using the insect growth regulator Match with concentration 0.7 ml/liter for virgins raised inside the seeds of Vigna sinensis with dipping method before laying the eggs compared to the control treatment, which was 6.33 days.
, as for the effect of the plant extracts treatment, the treatment in which the extract of *C. myrrha* was used with the concentration 7.0 g/liter gave the highest average that reached 8 days for the virgins raised inside the seeds of *Vigna sinensis* with dipping method before laying the eggs compared to the control treatment, which was 6.33 days.

These results are close to what was mentioned by [15], who explained that the average of virgin stage of the *T. granarium* (Everts) increased to reach (11.13) days when using the insect growth regulator Applaud with the two concentrations (0.5, 0.1) g/liter respectively compared to the control treatment, which was 8 days, while [16], pointed out that using the extract of *Eruca sativa* plant with concentration 3500 PPM prolonged the average of virgin stage of the *C. maculatus* F. from 4.5 days in control treatment to 6 days.

**Table 2.** Shows the effect of treatment method with different concentrations from the insect growth regulator Match, some of plant abstracts, and the kind of treatment in the average larval stage of *C. maculatus* F.

| Treatment method | V. unguiculata Concentrations & averages | V. unguiculata Concentrations & averages | V. unguiculata Concentrations & averages | Kind of treatment | Treatment method |
|------------------|----------------------------------------|----------------------------------------|----------------------------------------|-------------------|-------------------|
| Dipping before laying eggs | 15.870 | 17.663 | 16.33 | 18.33 | 18.33 | 0.0 | Match |
| | 17.776 | 16 | 17 | 17.33 | 3.0 | *F. foetida* |
| | 15.996 | 14.33 | 16.66 | 17 | 5.0 | |
| | 15.44 | 13.33 | 13.66 | 13 | 0.7 | |
| | 15.886 | 15 | 15.66 | 17 | 5.0 | |
| | 14.44 | 14.33 | 14.33 | 14.66 | 7.0 | |
| | 17.66 | 18.33 | 18.33 | 6.65 | 5.0 | |
| | 17.33 | 16.33 | 17 | 16.33 | 5.0 | |
| | 16.553 | 16.33 | 17 | 16.33 | 5.0 | |
| | 15.44 | 17 | 18.33 | 16.66 | 0.0 | |
| | 15.886 | 17 | 16.66 | 15.66 | 0.1 | |
| | 14.44 | 15.66 | 16.33 | 15.66 | 0.3 | |
| | 14.44 | 13.33 | 14.33 | 14.33 | 0.5 | Match |
| | 12.886 | 13 | 12.66 | 13 | 0.7 | |
| | 14.553 | 14 | 16 | 13.66 | 5.0 | |
| | 14.106 | 13.33 | 15.66 | 13.33 | 7.0 | |
| | 15.511 | 17 | 18.33 | 16.66 | 0.0 | |
| | 16.663 | 18.33 | 16.33 | 3.0 | |
| | 15.886 | 14.66 | 17 | 16 | 5.0 | |
| | 14.773 | 17 | 15.66 | 14.66 | 0.0 | |
| | 16.777 | 16.66 | 17 | 16.66 | 3.0 | |
| | 15.883 | 16.66 | 15.66 | 15.33 | 5.0 | *C. myrrha* |
| | 14.996 | 14.66 | 16 | 14.33 | 7.0 | |

| 0.648 | 0.982 | 0.822 | L.S.D 0.05 |
|-------|-------|-------|-----------|
| 15.690 | 15.14 | 16.33 | L.S.D 0.05 |
| 0.425 | | | |
Table 3. Shows the effect of treatment method with different concentrations from the insect growth regulator Match, some of the plant extracts, and the kind of treatment in the average of virgin stage of C. maculates F.

| Treatment method | Concentrations & averages | Kind of | Concentrations | Treatments | Treatment method |
|------------------|---------------------------|---------|----------------|------------|------------------|
| Dipping before laying eggs | Match | 0.0 | 5 | 5 | 5.66 |
| Dipping after laying eggs | Match | 0.0 | 5 | 5 | 5.66 |
| | F. foetida | 0.0 | 5 | 5 | 5.66 |
| | A. vera | 0.1 | 5 | 5 | 5.66 |
| | C. myrrha | 0.0 | 5 | 5 | 5.66 |
| | C. myrrha | 0.0 | 5 | 5 | 5.66 |
| | A. vera | 0.7 | 5 | 5 | 5.66 |
| | F. foetida | 0.7 | 5 | 5 | 5.66 |
| | A. vera | 0.7 | 5 | 5 | 5.66 |
| | C. myrrha | 0.7 | 5 | 5 | 5.66 |
| | L.S.D 0.05 | 0.0 | 5 | 5 | 5.66 |

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