Study of the effect of plant extracts of Myrtus communis and Dodonaea viscosa leaves on the percentage of mortality of adult bean beetle Callosobrachus maculatus in the laboratory.

1Khetam Mohammed Hamzah 2Merzah Hamzah Hadi
AL-Mussaiab Technical college / AL-Furat ALawsat Technical University.
Khk909277@gmail.com
Merza.hamza@atu.edu.iq
07725258101

Abstract

Some laboratory experiments were conducted in the postgraduate insect laboratory / Al-Musayyab Technical College / Al-Furat Al-Awsat University. This study was conducted to test the effect of different concentrations of the aqueous extract of the leaves of the Myrtus and Dodonaea plants on the death of the beetle insect, under laboratory conditions and with three replicates for each extract according to the statistical analysis C.R.D. Which is considered one of the most pests that attack stored grains in the world, the results showed that the extract of the plant Myrtus communis. was superior to the plant Dodonaea viscosa. in the death rate of the bean beetle, as the death rate of adults on grains treated with a concentration of (20) mg/ml of the extract of Myrtus communis. was (13.3, 20.0, 3.33, 50.0)% at the time periods (24, 48, 72, week) days respectively compared to (0.0)% in the control treatment, as for the extract of Dodonia viscosa. The mortality rate of adults on grains treated with a concentration of (20) mg/ml of the extract reached (13.3, 7.16, 26.7, 46.7)% at the time periods (24, 48, 72 weeks) days respectively compared to (0.0)% in the control treatment. The results showed the effectiveness of the aqueous extracts of M. communis. And D.viscosa. and the possibility of their inclusion in integrated management programs in the future to control Callosobrachus maculatus.

Key word : Myrtus communis , Dodonaea viscosa , bean beetle, Callosobrachus maculatus

Introduction

The cowpea beetle Callosobruchus maculates is a widespread insect, and a major pest both in the field and in storage. It may infect many types of legume seeds (Vigna). Its main hosts are cowpea sneninsis, chickpea Cicer arietinum, and mung bean Vigna nilotca. It has received the attention of researchers around the world (11). The adult insect has two forms: the flying form, which has the ability to fly in the field, and the quiescent form, which does not have the ability to fly and is found in storage. This insect may cause weight losses and constitute an annual percentage of about 30-50%, sometimes reaching 62% (6). These insects may be the cause of large losses to crops in terms of quantity and quality, as the percentage sometimes exceeds 90% and may cause complete losses within 3 months (2) (15). The bean beetle may consume 7% of the weight of the infested seed, and a single pair may cause a 61.5% weight loss in mung bean seeds within four weeks. The weight loss due to the insect infestation reaches 22%, and the infested seeds are not suitable for human nutrition (13). The continued use of these chemical insecticides to control stored product insects may pose significant risks to the

ISSN 2072-3857

environment and human and animal health (14). The modern trend in control is to work on finding alternatives to pesticides, including the use of toxic and insect-repellent plants and the application of alternative control methods to manage the Khabra beetle, such as bio-insecticides, essential oils and fungi that cause insect diseases (4). The interest of many researchers in recent years has focused on alternatives in controlling stored material insects, including powders and plant extracts, as they cause a reduction in insect numbers through their impact on various life activities, including the number of eggs laid and dead in adult insects and the impact on their nutrition (9) (18 .(

Black pepper powders (Piper nigrum), harmala (Peganum), harmal (Anethum graveolens) and fenugreek (Triganella) were used against the rusty flour beetle (Foemm Groecum) and the bean beetle (Callosobruchus maculates). Powders and plant extracts were used against storage insects and as safe control methods for humans and animals. The use of powders and plant extracts is one of the easy and effective methods for protecting bean seeds during storage and reducing bean beetle infestation (20.(

Materials and method

Collection of plant samples under study

Plant samples of both Myrtus and Dodonaea were collected from public gardens on 16/7/2024, where they were washed separately to remove impurities. Then, they were dried at room temperature with continuous stirring to prevent rotting. Then, they were ground in an electric grinder for 10 minutes, and the plant powders were placed separately in glass containers with a height of 27 cm and a diameter of 9 cm, which were tightly closed and stored in the refrigerator until use.

Preparation of aqueous extract of M. communis and D. viscosa.

Boiled water extract of each of the plants, Dodonaea,Myrtus was prepared separately according to the method of (5) adapted from (12). 10 g of powder of the plants, Dodonaea and Myrtus, were taken separately and placed in a 500 ml glass flask containing 200 ml of boiled distilled water. Then the plant material was mixed with a magnetic mixer for 15 minutes, then the solution was left for 24 hours (to obtain better extraction) after covering it tightly to avoid the entry of impurities. The solution was filtered with a piece of cloth several times, and the filtrate was taken after that. The foreign materials were precipitated using a centrifuge at a speed of 3000 rpm for ten minutes. The filtrate was concentrated using a rotary evaporator at a temperature of 40-45°C to obtain the dry sludge, which was stored in small, tightly sealed glass bottles after recording their weight when empty and stored in the refrigerator until use.

To estimate the biological effectiveness of the boiled water extract and to prepare the required concentrations (7), (5) grams of dry dregs were taken for each extract separately and dissolved in 100 ml of distilled water, so the concentration of the basic solution (Stuck Solution) became 50 mg/ml or equivalent to 5%, and concentrations (10, 5, 20) mg/ml were prepared from it with the addition of a spreading substance in an amount of one ml (Tween 20) (3.(

Effect of different concentrations of plant extracts on the mortality rate of adult bean beetle Callosobrachus maculatus

Different concentrations of plant extracts were tested (5, 10 and 20 mg/ml). 5 g of sterilized cowpea was taken in each replicate, with three replicates for each concentration (5, 10 and 20

ISSN 2072-3857

mg/ml) for each extract separately. They were placed in plastic boxes, then the grains were soaked with 2 ml of each concentration for 15-20 minutes to saturate the seeds with the extract. Then the seeds were spread on filter paper to dry at laboratory temperature . Then 10 newly emerged adults They can be distinguished from each other in terms of their external appearance. In the female, we notice the presence of black spots on the sheaths and at the end of the abdomen, while the male's body does not contain these spots. The female is larger than the male and its colour is dark brown to black, while the male's colour is light brown (5 males and 5 females) were added to each replicate, while nothing was added to the grains in the control treatment. Then the boxes were incubated in the incubator at a temperature of 1 ± 30 °C, and the mortality rate was calculated after 1, 3, 5 and 7 days of treatment for each concentration and each treatment.

Statistical analysis

The results obtained were statistically analyzed using GenStat Release 2009 V12.1 according to factorial experiments with completely randomized design (C.R.D) for laboratory experiments. The least significant difference (L.S.D) test was used at the probability level to test the significance of the results. Some mortality percentages were corrected for mortality according to the Abbott equation. (1.(

Results and discussions

Testing the effect of different concentrations of the aqueous extract of the plant As M.communis. on the mortality rate of the adult beetle C.maculatus .

The results of the statistical analysis in Table (1) showed that the aqueous extract of the As plant showed high effectiveness in killing the adult beetle beetle in the laboratory, as significant differences were found between the concentrations of the extracts and the comparison treatment, and the percentage of death increased with increasing the concentration of the extract and increasing the time period. The results showed that the highest levels of death were recorded in the treatment (20) mg/ml, as the percentage of death of adults on the grains treated with the Myrtus extract reached (13. 3, 20.0, 33.3, 50.0)% at the time periods (24, 48, 72 weeks) days respectively compared to (0.0)% in the comparison treatment, while the lowest levels of death were recorded in the treatment with a concentration of (5) mg/ml, as the percentage of death of adults on the grains treated with the As extract reached (3.3, 10.0, 23.3, 36.7)% at the time periods (24, 48, 72 weeks) days respectively compared to (0.0)% in comparison transaction.

ISSN 2072-3857

Table (1). Effect of different concentrations of M. communis plant extract on the mortality rate of C. maculatus adults over different time periods.

Concentration Mg/ml	Time periods (in days)				Average
	24	48	72	Week	
0	0.0	0.0	0.0	0.0	0.0
5	3.3	10.0	23.3	36.7	18.3
10	6.7	16.7	26.7	43.3	23.3
20	13.3	20.0	33.3	50.0	29.2
Average	5.8	11.7	20.8	32.5	
		Concentration	Period	Interference	
LSD0.05		57.6	6.57	13.14	

The results of the statistical analysis in Table (2) showed that the aqueous extract of the As plant showed high effectiveness in killing the adult beetle beetle in the laboratory, as significant differences were found between the concentrations of the extracts and the comparison treatment, and the percentage of death increased with increasing the concentration of the extract and increasing the time period. The results showed that the highest levels of death were recorded in the treatment (20) mg/ml, as the percentage of death of adults on the grains treated with the Dodonaea extract reached (13.3, 16.7, 26.7, 46.7)% at the time periods (24, 48, 72 weeks) days respectively compared to (0.0)% in the comparison treatment, while the lowest levels of death were recorded in the treatment with a concentration of (5) mg/ml, as the percentage of death of adults on the grains treated with the Dodonaea extract reached (3.3, 10.0, 20.0, 33.3)% at the time periods (24, 48, 72 weeks) days respectively compared to With (0.0)% in the comparison transaction.

Table (2). Effect of different concentrations of D. viscosa extract on the mortality rate of C. maculatus adults over different time periods.

Concentration Mg/ml	Time periods (in days)				Average
	24	48	72	Week	
0	0.0	0.0	0.0	0.0	0.0
5	3.3	10.0	20.0	33.3	16.7
10	10.0	13.3	23.3	40.0	21.7
20	13.3	16.7	26.7	46.7	25.8
Average	6.7	10.0	17.5	30.0	
		Concentration	Period	Interference	
LSD0.05		75.5	5.75	11.51	

ISSN 2072-3857

The results of this study showed that the plant extracts used had a significant effect on the mortality rate, and this effect increased with increasing concentrations and increasing periods of exposure to the extract. We note that the extract of the Myrtus plant is superior to the extract of the Dodonaea plant, and the method of treating adults by direct spraying is superior to the method of soaking seeds, and this percentage of death is directly proportional to the increase in concentrations and time period. The reason is attributed to the increase in the percentage of death of the adult bean beetle. This reason may be due to the effect of the plant extracts used in the study, as they contain effective chemical compounds and volatile oils that have the ability to spread and penetrate through the insect's tissues in a manner similar to the action of pesticides. These extracts used in the study may affect the surface of the insect's body by contact, as these chemical compounds may penetrate the insect's cuticle through the thin areas, causing paralysis and then death. Or the effect of these extracts may be due to their containing alkaline compounds and toxic substances or effective compounds that affect the absorption of food from the digestive tract, leading to its death(17). This study agrees with what (8). Others act as anti-feeding agents that lead to the death of insects, or the effect of these extracts may be due to their entry through the respiratory openings, affecting the nervous system and the digestive system. This study conducted by (16) also indicated that methanolic extracts of 30 types of aromatic medicinal plants and five essential oils had a significant effect on the mortality rates of adults of the rice weevil (S. oryzae (L.) and the cowpea beetle Callosobruchus chinensis (L.). The mortality rate increased with increasing concentration, as these extracts caused 100% mortality of adults within 4-1 days of treatment. These extracts have been widely used worldwide to control various plant diseases in agriculture (19)(10).

Conclusions

The current study has proven that there is a direct effect between the concentrations and time periods for the effect of the aqueous extract of the two plants (M.communis and D.viscosa). The effectiveness of the plant M.communis was higher in the mortality rate of C. maculatus insect larvae.

References

1)Abbott, W. S. (1925).A method of computing the effectiveness of an insecticide.J.Econ.Ent.,18:265-267.

2)Ahmad , T .; Haile , A .; Ermias , A .; Etbarek , R .; Habteab , Sand Teklai , S. , (2015). Eco - friendly approaches for management of bruchid beetle Callosobruchus chinensis (Coleoptera : Bruchidae) infesting faba bean and cowpea under laboratory conditions . Journal of Stored Products and Postharvest Research . 6 (3) : 25-29 .

3)Al-Amara, Muhammad Sabry Jabr. (2009). The effect of some biological control agents on some aspects of the life of the Khabra grain beetle (Trogoderma granarim Everts). Master's thesis, College of Agriculture, University of Basra. 107 pages.

4)Ali RA, Sagheer M, Sahi ST, Rasul A. (2022). Factors influencing the combined efficacy of microbial insecticides and inert dusts for the control of Trogoderma granarium. Int J Trop Insect Sci 42(1):425–433.

5)Al-Mansour, Nasser Abdul Ali. (1995). Effect of different extracts of Ibicella lutea (Staph.) Van Eslet (Martyniacea) on the

biological performance of the whitefly Bemisia tabaci (Genn.) (Homoptera: Aleyrodidae). PhD thesis. College of Science. University of Basra, 126 pages.

6)AL-Mekhlafi , F. A.; Mashaly , A. M. A.; Mageed , A. A. M. A., Wadaan , M.A., and Al-Mallah, N. M. (2011). Overlap effects of cyromazine concentration, treatment method and rearing temperature on the Southern cowpea weevil (Callosobruchus maculatus F.) reared on cowpea . African Journal of Microbiology Research . 5 (32) : 5848-5853 .

7)Al-Rubaie, Hadi Muzal. (1999). The effect of Datura innoxa extracts on some aspects of the life performance of the house fly Musca domestica. PhD thesis. College of Science / University of Babylon. 126 pages.

8) Al-Taie, Fatima Najm Abdul Ali (2021). Evaluation of the efficiency of some biological factors in controlling the southern cowpea beetle Callosobruchus maculatus (Fab.). Master's thesis / Al-Musayyab Technical College, Middle Euphrates Technical University, 66 pp.

9) Bhalla , S. ; Gupta, K. ; Lal ,B ; Kapur, M. L. and Khetarpal, R. K. (2008). Efficiency of various non – chemical methods against pulse beetle , Callosobruchus maculatus Fab. ENDURE International Conference 2008 Diversifying Crop protection , 12 –15.

10)Dawood ES. (2015). Efficacy of leaf extract of neem (Azadirachta indica) against shoot dieback disease of two species of Ficus in Atabara Town-Sudan. Int. J. Sci. Technol. Res 4(9): 77-83.

11)Edde , P.A. and Bello , M. (2001) . Relative Resistance of some cowpeaVarieties Against Callosobruchus maculates (F.) (Coleoptera:Bruchidae) . Journal of Sustainable Agriculture , 17 :67 – 77.

12)Harborne,J.B.(1984) . Phytochmicals methods . Chapman and Hall . New York . 2nd ed . 288 PP

13)Huis , A.V. and Lentern , J. C. (2003). Biological control of Callosobruchus maculatus , stored product pest in cowpea by means of the West African egg parasitoid Uscana lariophaga.

14)Karanastasi E, Kavallieratos NG, Boukouvala MC, Christodoulopoulou AD, Papadopoulou AA .(2020) .Effect of three entomopathogenic nematode species to Trogoderma granarium Everts (Coleoptera: Dermestidae) larvae on stored-wheat. J Stored Prod Res 88:101641.

15)Khan , A. (2021). Biopesticides : Alternatives for management of Callosobruchus maculatus . Journal of Biopesticides . 14 (1) : 59-78 .

16)Kim, S. I., Roh, J. Y., Kim, D. H., Lee, H. S., and Ahn, Y. J. (2003). Insecticidal activities of aromatic plant extracts and essential oils against Sitophilus oryzae and Callosobruchus chinensis. Journal of Stored Products Research, 39(3), 293-303.

17)Metspalu, L. ; Hiiesaar, K. ; Joudu, J. and Kuusik, A. (2001). The effects of certain toxic plant extracts on the larvae of Colorado Potato beetle Leptinotarsa decemlineala (Say) . Institute of plant protection , Estonian Agriculture University p. 93-100.

18)Phillips T.W.,Throne J.E.(2009).Biorational approaches to managing stored-product insects.Annu. Rev. Entomol. 55: 375-397.

19)Suleiman MN, Emua, SA, Taiga A. (2008). Effect of aqueous extracts on a spot fungus (Fusarium sp.), isolated from cowpea. Am.-Eurasian J. Sustain. Agric 2: 261-263.

20)Tapondjou L. A., Adler C., Bouda H., Fontem D. A.(2002). Efficacy of powder and essential oil from Chenopodium ambrosioides

ISSN 2072-3857

leaves as post-harvest grain protectants against six-stored product beetles. Journal of Stored Products Research. ;38(4):395–402.

ISSN 2072-3857