DF-402
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RESEARCH ARTICLE Agricultural Science Digest, Volume Issue : ()

Seasonal Incidence of Sesame Webworm, *Antigastra catalaunalis* (Dup.) and Evaluation of Selected Cultural Control Practices, on Sesame Crop in Erbil City

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10.18805/ag.DF-402

ABSTRACT

Background: Sesame Webworm, *Antigastra catalaunalis* (Dupunchel) is a principal harmful insect of sesame crop. It infests the all shoot parts and stages of sesame plant growth and responsible for approximately seventy percent seed yield loss, therefore, the present study conducted to investigate the seasonal incidence and evaluate two sets of cultural control practices against the damages of the pest larvae.

Methods: Field experiment was carried out in the Grda Rasha Research Station-College of Agricultural Engineering Sciences-Erbil-Kurdistan region-Iraq, apart from seasonal incidence, first Set was for assessing the effect of three Sowing Dates *viz.* 16-May, 15-June, 15-July-2020. The second set was for evaluating the efficiency of three different crop plants *viz.* corn, cowpea and sunflower plants, intercropped with sesame crop to minimize the capsule infestation damage and seed losses caused by *A. catalaunalis* (Dup.). The experiments were performed using the RCBD design.

Result: The results revealed that the larvae appearance started 2 weeks after sowing and reached its peak 2.31, 2.50 and 2.83 larvae/plant 13 weeks after sowing for all three dates of sowing, the results also showed that the percent capsule infestation and Seed weight loss/25 capsules were 22.27%, 33.85% and 34.16%/25 capsule of sesame plant, for sowing dates mid-May and mid-June and Mid-July respectively. The findings of the intercropping experiment revealed that the least percentages of capsule infestation and losses in seed weight/25 capsules were on sesame plants intercropped with cowpea 18.00% and 21.00% and followed by sesame intercropped with Sunflower and Sesame plants intercropped with corn plants which were 19.40%, 25.60% and 20.20%, 27.60% respectively.

Key words: Antigastra *catalaunalis*, Cultural Control, Intercrop, Seed loss, Sesame.

INTRODUCTION

Sesame (*Sesamum indicum* L.) belongs to the plant family Pedaliaceae (Bedigian, 2003) and is known as the queen of oilseeds due to its high content of oil and delicious flavor (Johnson *et al*., 1979) the percentage protein reaches to over 20 per cent and the per cent of oil to over 50% (Khan *et al*., 2009). Sesame seed is used for a wide array of edible products in both roasted and raw form and also used as animal feed (Bedigian, 2010) and its by-products are utilized as a mixture in Poultry feed (Sulaiman, 2017).

Sesame webworm, *Antigastra catalaunalis* (Duponchel) is a key insect pest of the sesame crop throughout all life stages and is considered as one of the major obstructions of good sesame productivity in terms of quantity and quality (Selvanarayanan and Baskaran, 2000) causing 10-44 percent capsules infestation and resulting in about 70 percent seed yield loss (Ahirwar *et al*., 2010).

Different varieties are cultivated in Iraq, among them, the Variety Rafedeen is the most susceptible one which faces a high percentage of losses on various parts of the plant, The yield loss of sesame crop seeds per plant recorded as 22.2 and 18.1% in rafedeen variety, during 2001 and 2002 respectively (Al-Jorany and Al-Cerrawi, 2009).

Various management tactics have been attempted by previous authors, most of their studies have been focused on using insecticides to control the insect, however, the chemicals cause air and environmental pollution and health problems to humans (Weston *et al*., 2011, Ansari *et al*., 2014).

Worldwide, some research has been done on cultural and other eco-friendly management methods to minimize the damages of this insect pest due to their safeness to the environment, however, to our knowledge very little work has been performed on the cultural methods to manage the sesame webworm on sesame crop in Iraq, So the present

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How to cite this article: Khidher, K.Q., Mohamed, A.M. and Kadir N.B. (2022). Seasonal Incidence of Sesame Webworm, *Antigastra catalaunalis* (Dup.) and Evaluation of Selected Cultural Control Practices, on Sesame Crop in Erbil City. Agricultural Science Digest. DOI: 10.18805/ag.DF-402.

Submitted: 02-09-2021 **Accepted:** 05-02-2022 **Online:** 02-05-2022

study aims to investigate the seasonal incidence of SWW, *A. catalaunalis* (Dup.) and evaluate the impact of three different dates of sowing and three various intercropping practices on the infestation percentage of sesame crop capsules and their role to minimize the losses of seed weight at harvest caused by the insect pest, in Erbil-Iraq.

MATERIALS AND METHODS

Study location and cultivation

The studies were carried out in the Grdarasha research station field belonging to the College of Agricultural Engineering Sciences-Salahaddin University-Erbil-Kurdistan Region-Iraq during sesame growing season, 2020. For this study, sesame crop cultivar Rafedeen was sown in three different periods with a one-month interval between them, using (RCBD) design with 3 replicates, the dates of sowing were 16-5, 15-6 and 15-7-2020. For intercropping experiment, three different crop *viz.*, cowpea, corn and sunflower were selected; the seeds have been sown between rows of sesame plants alternately, the average row number in plots was seven provided that both outer rows were trap crop. The sowing of sesame seeds was taken place on 15-6-2020, while seeds of intercropped plants had been sown previously fifteen days before sowing the main crop (Sesame Variety Rafedeen). The plots size was 1.5 × 2.5 Meters. The plants were sown in rows within plots; the row to row and plant to plant distances were 30 cm and 15 cm respectively.

Observations and sampling

Firstly, for seasonal incidence, sampling was taken place weekly for sesame plants (Variety Rafedeen) cultivated on three different dates of sowing (middle of May, Middle of June and Middle of July), by taking three plants, randomly, at each plot (Replicate) for all three dates of sowing starting from the first appearance of the caterpillars. Second, for evaluation of the effect of sowing dates of Sesame for management of Sesame webworm, *Antigastra catalaunalis* (Dup.), the observation and data of per cent Capsule infestation per plant and seed weight of 25 capsules of Infested and intact ones were recorded at harvest time.

The last experiment, for the intercropping systems, comparison between three different intercropping systems and the sole sesame plant was done by taking three plants (Sample) at harvest, from each treatment and replicate separately, the observations on capsule infestation percent at harvest and the yield (seed weight of 25 capsules) of infested and intact ones were recorded and compared with each other and with that of control (Sole sesame crop, Var. Rafedeen).

For calculating the per cent of capsule damages per plant, the following Formula was used.

$$\text{Percent capsule damages} = \frac{\text{Number of damaged capsules per plant}}{\text{Total number of capsules per plant}} \times 100$$

Statistical analysis

The obtained data were tabulated and subjected to analysis of variance and the Paired T-test has been used to calculate the amount of Seed weight losses then the means were compared with each other according to the (DMRT) Duncan test at 0.05 of significant level.

RESULTS AND DISCUSSION

Seasonal incidence of sesame webworm

The data on larval population indicated that the larval population started after 2nd week of sowing when the plant was at the Leaves stage, which was 0.25,0.25 and 0.42 larvae/plant (22nd, 26th and 30th meteorological week) for the first, second and third sowing dates respectively, the population of the caterpillar increased gradually and reached to its peak *i.e.*, 2.31,2.50 and 2.83 larvae/plant in the 11th week of sampling (32nd, 36th and 40th meteorological week) for 1st, 2nd and 3rd dates of sowing respectively, when the crop was at the flowering and capsule formation stage, in the year 2020. There after, the larval population of sesame webworm started to decrease gradually and the larval population reduced in number to 1.53, 1.67 and 1.94 larvae/plant at the last week of sampling before harvest, when the plants were at the capsule stage (35th, 39th and 43rd SMW) for 1st, 2nd and 3rd DOS respectively on all sesame varieties under the study (Fig 1).

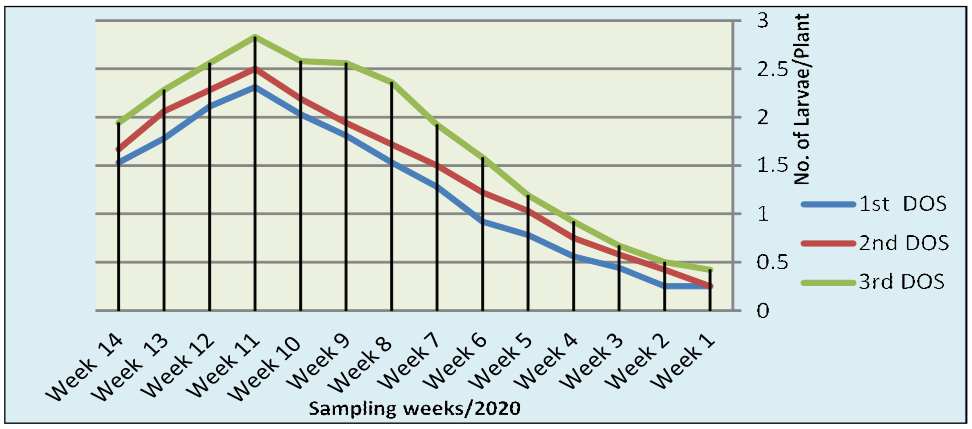

Fig 1: Population of *A. catalaunalis* on sesame plants cultivated at three sowing dates in Grdarasha field-2020.

The findings of this study are more or less similar to that carried out by (Mishra *et al*., 2015) who mentioned that the population density of *Antigastra* caterpillars reached its peak (0.11) larvae/plant in the 35th standard meteorological week and the present study results also supported by Mahadevan and Mohanasundaram (1986)who reported that the incidence of larvae of sesame webworm on flower stage was more than on leaf and capsule stage and the insect caused to just over 50 per cent loss in sesame seeds. However, Talpur *et al.* (2002) reported that the abundance and injuries of SWW larvae on pods were higher than leaf and flowering stage.

Effect of sowing date on capsule infestation at harvest

The data in Table(1) showed that the least capsule infestation percentage recorded on the sesame variety Rafedeen, was in the 1st date of sowing with 16.75% capsules/plant, the highest percentage of capsule infestation at the harvest was in the third date with recording 23.84**%** as infestations/ plant, in comparison to the 1st date**,** it was about 7% higher than the percentage recorded in the 1st date and the 2nd date of seed sowing occupied the middle position in respect of capsule infestation at harvest with recording 22.08% capsule/plant.

Regarding capsule infestation at harvest, the 1st date was differed from both other sowing dates significantly depending on the significant level (0.05) of DMRT. However, there was no significant difference between the 2nd and 3rd dates of sowing. The results of this study are in agreement with that reported by Kudher (1985) in Iraq who demonstrated that the infestation percentage in late sowing dates is higher than earlier dates. The present results are also supported by Gebregergis *et al.* (2018) who reported that the highest level of damage on leaf, flower and capsule due to SWW was recorded on the late sown sesame plants.

Effect of sowing date on seed weight losses at harvest

The data in Table (1) demonstrated that, the least percentage of seed weight loss was recorded on the sesame variety Rafedeen in the 1st date of sowing with 22.27% /25 capsule yield, whilst the highest percentage of Seed weight loss was in the third date with recording 33.85% seed wight/25 capsule yield in comparison with the 1st date**,** it increased just over 10. The 2nd date of seed sowing was ranked in middle regarding the seed weight loss/25 capsules of sesame plant with recording 34.16% seed/25 capsules yield.

As an indication from DMRT at (0.05) significant level, the 1st date was different from the other two dates significantly, however, there was no significant difference between 2nd and 3rd dates.

Overall, it can be concluded that the May month provided the best time for sowing seed of sesame in the present study in comparison with the other two later months (June and July), as an indication to recording the least capsule infestation at harvest and seed weight loss of sesame plant variety rafedeen. The results of the present experiment are in line with those reported by Gebregergis *et al.* (2018) who mentioned that the least infestation of *A. cataluanalis* and better sesame seed yield was obtained in early sowing sesame, while the highest incidence of pest insect reached to 100 per cent and lower grain yield (69.1 kg/ha) were gained in the late sowing date of sesame.

Impact of intercropping on percent damage on capsules at harvest time

According to data in (Table 2), all the trap crops plants reduced the damage percentage on capsules when compared with control plants which was 22.20±0.015% capsules/plant, the highest percentage of capsule infestation at harvest was on the sesame plants that intercropped with corn plants 20.20±0.006 % capsules/plant, hence, providing the least reduction in capsule damage percentage, while the lowest percentage of capsule damages recorded on sesame plants that intercropped with cowpea plants with 18.00±0.004% capsules/plant meaning it gave the highest percentage of damage reduction on capsules at harvest among the trap crops tested and the middle position, in terms of damage reduction capacity, occupied by the sesame plants intercropped with sunflower crop, with capsule damage 19.40±0.01% capsules/plant.

Duncan's test revealed that the treatment with cowpea differed from the other two intercropped crops and the control plants significantly at the significant level (0.05), however, there was no significant difference between sunflower and corn plants with each other as far the capsule damage at harvest concerned. The findings of this study are in agreement with those mentioned by Behera and Jena (2013) who stated that intercropping systems has reduced the incidence of the larvae of *Antigastra* and also reported that among intercropped crops, the impact of Leguminous crop plants is greater than others to reduce the population density of the caterpillars of the pest moth.

Table 1: Percentages of capsule infestation and seed weight loss of sesame plants caused by sesame webworm at three different sowing dates in grdarasha field-erbil-2020.

Treatments (Sowing dates)	Capsule infestation/ plantat harvest		Seed weight loss % / yield of 25 capsules	
	Range	Mean	Range	Mean
(May)	14.77-18.39	16.75b	21.79-22.69	22.27b
(June)	17.98-25.93	22.08a	33.54-34.17	33.85a
(July)	22.66-25.45	23.84a	33.61-34.43	34.16a

Different letters in the same column indicate significantly different from each other at 0.05 SL., Duncan's test.

Table 2: Capsule damage percentages of sesame plants intercropped with different crops at harvest, caused by sesame webworm.

Treatments (Intercropping systems)	Percentages of capsule damages/plant at harvest time (%)	
	Range	Mean±SE
Sunflower intercropped with sesame	17.00-22.00	19.40±0.01ab
Cowpea intercropped with sesame	17.00-19.00	18.00±0.004b
Corn intercropped with sesame	18.00-22.00	20.20±0.006ab
Sole sesame crop	18.00-26.00	22.20±0.015a

Different letters in the same column indicate significantly different from each other at 0.05 SL., Duncan's test.

Table 3: Percentages of seed weight loss caused by sesame webworm on sesame plants intercropped with different crops at harvest time.

Treatments (Intercropping systems)	Percentages of seed weight loss/25 capsule yield at harvest time (%)	
	Range	Mean±SE
Sunflower intercropped + sesame	25.00-26.00	25.60±0.002c
Cowpea intercropped with sesame	20.00-22.00	21.00±0.003d
Corn intercropped with sesame	27.00-28.00	27.60±0.002b
Sole sesame crop	32.00-34.00	33.40±0.004a

Different letters in the same column indicate significantly different from each other at 0.05 SL., Duncan's test.

Impact of intercropping on per cent seed weight losses

The data provided in (Table 3) demonstrated that the minimum reduction in sesame seed weight loss was registered on the treatment of sesame intercropped with corn with the highest per cent of seed weight loss, among the present study treatments, with 27.60±0.002% / 25 capsule yields in comparison with that of sole sesame crop which was 33.40±0.004% seed weight loss/25 capsule yield. However, in the treatment of sesame intercropped with cowpea, the lowest percentage of losses was recorded 21.00±0.003% losses in seed weight/25 capsule yield; it means that the cowpea marked the most effective crop among intercropped plants with sesame as a trap crop and provided the highest percentage of reduction in seed weight losses of sesame seeds/25 capsules yield. Moreover, the sunflower crop provided a middle amount of protection against sesame webworm and recorded the second rank of seed weight losses among intercropped plants with 25.60±0.002% seed weight losses/25 capsule yield.

As an indicative from the Duncan test at a significant level of (0.05), there was a highly significant difference between all treatments and among intercropped trap crops the significant difference also was found high.

The order of crops capacity for the protection of the sesame plant seeds from seed weight losses due to sesame webworm, from highest to least capacity, was (sesame intercropped with cowpea > sesame intercropped with sunflower > sesame intercropped with corn > sole sesame). the results of the present study more or less are in concordance with the findings of the research conducted by Behera and Jena (2013) who reported that the sesame intercropped with cluster bean and black gram both in the family Fabaceae gave the highest yield equivalent in comparison with sorghum (SSG 59-3) and pearl millet (L-74) and provided the highest level of protection against insect damages due to sesame webworm on yield of sesame plants.

CONCLUSION

The present research indicated that the moth larvae started to appear at the leaf stage two weeks after sowings and reached to its peak at flowering and both cultural methods *viz.* sowing date and intercropping system have a great impact on the infestation and damages of sesame webworm, furthermore, the first date of sowing (sowing sesame seeds at May) is the suitable and most effective time to reduce the negative impacts of the insect pest with recording the least percentage of capsule damage and seed weight loss caused by sesame webworm. As for the intercropping system, the study concluded that the sowing cowpea intercropped with sesame seeds provided significantly highest protection against *Antigastra catalaunalis* (Dup.) with recording the least capsule infestation percentage and Seed weight loss/ 25 capsules of sesame caused by the pest insect larvae.

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