Crossref

IJBSM January 2025, 16(1): 01-06 Article AR5834

Research Article Stress Management

DOI: HTTPS://DOI.ORG/10.23910/1.2025.5834

Effect of Intercrops on the Incidence of *Antigastra catalaunalis* (Duponchel) (Crambidae: Lepidoptera) Infesting Sesame

S. B. Kalathiya[1], M. K. Chandaragi[2], Bindu K. Panickar[3] and Manisha S. Shinde[4]

[1]Dept. of Agricultural Entomology, [2]Centre for Oilseeds Research, [3]Pulses Research Station, [4]Polytechnic in Agriculture, S. D. Agricultural University, Sardarkrushinagar, North Gujarat (385 506), India

Open Access

Corresponding mallu3731@gmail.com

0000-0003-1697-0020

ABSTRACT

A field experiment was conducted at Agronomy Instructional Farm, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, North Gujarat, India during July to October, 2023 aimed to evaluate the effect of intercrops on the incidence of *Antigastra catalaunalis* (Duponchel) (Crambidae: Lepidoptera) infesting sesame. The trial was laid out in Randomized Block Design (RBD) with seven treatments *viz.,* sesame (sole crop), sesame+black gram, sesame+pearl millet, sesame+cowpea, sesame+sorghum, sesame+cluster bean and sesame+marigold. The six treatments of these different intercrops were compared with sole sesame on the incidence of *Antigastra catalaunalis* larval population, its web infestation, capsule damage and seed yield. The results of the study revealed that sesame+cowpea treatment was found most effective in terms of reducing the larval population (0.73 larvae plant^{-1}), web infes tation (0.42 webs plant^{-1}) and capsule damage (3.42%) due to leaf webber and capsule borer. It was followed by sesame+pearl millet treatment recorded minimum larval population (0.87 larvae plant^{-1}), web infestation (0.52 webs plant^{-1}) and capsule damage (4.00%). These two treatments are found significantly superior and are at par with each other. The highest sesame equivalent yield was obtained from the treatments sesame+marigold (1467 kg ha^{-1}), sesame+pearl millet (892 kg ha^{-1}) and sesame+cowpea (881 kg ha^{-1}), respectively. These intercrops can be utilized for management of leaf webber and capsule borer, *A. catalaunalis* infesting sesame.

KEYWORDS: Intercrops, *A. catalaunalis*, sesame, incidence, pearl millet, cowpea

Citation* (VANCOUVER)*: Kalathiya et al., Effect of Intercrops on the Incidence of *Antigastra catalaunalis* (Duponchel) (Crambidae: Lepidoptera) Infesting Sesame. *International Journal of Bio-resource and Stress Management,* 2025; 16(1), 01-06. HTTPS://DOI.ORG/10.23910/1.2025.5834.

Data Availability Statement: Legal restrictions are imposed on the public sharing of raw data. However, authors have full right to transfer or share the data in raw form upon request subject to either meeting the conditions of the original consents and the original research study. Further, access of data needs to meet whether the user complies with the ethical and legal obligations as data controllers to allow for secondary use of the data outside of the original study.

Conflict of interests: The authors have declared that no conflict of interest exists.

RECEIVED on 30th September 2024 RECEIVED in revised form on 20th December 2024 ACCEPTED in final form on 05th January 2025 PUBLISHED on 13th January 2025

1. INTRODUCTION

Sesame (*Sesamum indicum* L.) is one of the ancient and important oilseed crops of India, commonly called as Queen of Oilseeds". It belongs to Pedaliaceae and originated in Africa. India produces a wide range of sesame varieties with different grades each peculiar to the region. It is rich in oil containing 38.84% of oleic acid and 46.26% of linoleic acids that are high levels of unsaturated fatty acids (Nzikou et al., 2010). It is extensively preferred for its quality of high drought tolerance and has been commonly utilised for thousands of years as a seed of worldwide significance for edible oil, paste, cake, confectionary purposes and flour due to its highly stable oil contents, nutritious protein and savoury nutty roasted flavour (Anilakumar et al., 2010; Prakash and Naik, 2014; Pathak et al., 2017). In India, sesame is grown in Rajasthan, Gujarat, Uttar Pradesh, Orissa, Maharashtra, Madhya Pradesh, Andhra Pradesh, Karnataka, Tamil Nadu and West Bengal. India contributes the highest sesame acreage of about 15.23 lakh hectares with production of 8.02 lakh tones and productivity of 527 kg ha^{-1}. In Gujarat, sesame was cultivated in 1.96 lakh hectares with a production of 1.43 lakh tones and productivity of 732 kg ha^{-1} (Anonymous, 2023). In Gujarat, major sesame growing areas are Surendranagar, Banaskantha, Bhavnagar, Kachchh, Rajkot, Amreli and Mehsana.

Some studies have been shown that significant loss of sesame yield due to biotic factors (Asekova et al., 2020, Asekova et al., 2021 and Yan et al., 2021) and reportedly sesame is attacked by 29 insect pests (Rai et al., 2001). These are Red hairy caterpillar, *Amsacta moorei* (Butler); Bihar hairy caterpillar, *Spilosoma obliqua* Walker; Sesame leaf webber, *Antigastra catalaunalis* (Duponchel); Hawk moth, *Acherontia styx* (West wood); Gall midge, *Asphondylia sesame* Felt; Mirid bug, *Cyrtopeltis tennius* Reuter; Pentatomid bug, *Nezara viridula* (Linnaeus); Thrips, *Thrips tabaci* (Lindeman); Blister beetle, *Mylabrispustulata* (Thunberg); Yellow mite, *Polyphagotarsonomus latus* Banks; Leaf hopper, *Orosius albicinctus* Distant; Sesame bud fly, *Dasineura sesame* Gennadius. Among these, sesame leaf webber and capsule borer *A. catalaunalis* are the key pests causing extensive damage to foliage and fruiting bodies (Bhadauria et al., 2000). The larvae roll together a few top leaves and feed in the early stage and after pod formation the larvae enter inside the pod and get damaged (Pandey et al., 2019), which leads to 83% yield loss (Gebregergis et al., 2016). Ahirwar et al., 2010 observed that 10–70% infestation of leaves, 34–62% of flower buds or flowers and 10–44% of pods resulting in 72 % yield loss. One to three larvae are sufficient to defoliate a fully-grown plant within 24 to 48 hours. For its control emphasis must be given to adoption of IPM practices and one such practice is the use of intercropping system. It is a non-chemical cultural practice that has the potential to reduce pest infestation because of crop diversity (Sullivan, 2003; Woomer et al., 2004; Degri and Samaila, 2014). Intercropping is mainly for preventing crop yield reduction from pest and disease infestation in different geographical areas and increase biodiversity in the field to encourage environmentally sustainable agriculture production with low inputs of pesticide (Ghaley et al., 2005). Non-host plants in a mixture may emit chemicals or odors that adversely affect the pests, thereby conferring some level of protection to the host plant (Reddy, 2012). Therefore, the present study was conducted to know the effect intercrops on the incidence of sesame leaf webber when sesame was intercropped with sorghum, cluster bean, black gram, cowpea, pearl millet and marigold.

2. MATERIALS AND METHODS

2.1. Study site

A trial on intercropping system was sown during July, 2023 at Agronomy Instructional Farm, C. P. College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar.

2.2. Methodology

The main crop sesame (variety Gujarat Til 3) and intercrops were sown in a gross plot of 4.00×4.05 m^2 with a net plot size of 3.80×3.15 m^2 at spacing of 45cm (R)^2×10 cm (P)^2. The experiment was laid out in Randomized Block Design (RBD) with seven treatments *viz.,* sesame (sole crop), sesame+black gram, sesame+pearl millet, sesame+cowpea, sesame+sorghum, sesame+cluster bean and sesame+marigold. The recommended packages of practices were followed to raise the main crop and intercrop.

2.3. Methods of data collection

From the net plot, ten plants of sesame were selected and tagged. Selected plants were critically observed at weekly intervals for recording the observation till the maturity of the crop. From the selected plants, the number of larvae per plant, number of webs per plant, and healthy and damaged capsules were also counted for computing capsule damage. The capsule damage (%) was calculated by the following formula

Capsule damage (%)=(Total number of damaged capsules/ Total number of capsules)×100

The harvest was made at physiological maturity and the sesame equivalent yield was calculated treatment wise. Sesame equivalent yield (SEY) was calculated by the following formula

SEY (kg ha^{-1})=Sesame yield (kg ha^{-1})+(Seed yield of intercrop kg ha×Price of intercrop(₹ kg^{-1}))/Price of sesame ₹ kg^{-1}

3. RESULTS AND DISCUSSION

3.1. Effect of different intercrops on larval population

The data on the larval population of leaf webber and capsule borer was recorded from 5th to 12th weeks after sowing are presented in Table 1 indicated that sesame+cowpea (0.73 larvae plant^{-1}) was significantly most effective against leaf webber and capsule borer population in sesame and it remained at par with sesame+pearl millet (0.87 larvae plant^{-1}). It was followed by sesame+black gram (1.06 larvae plant^{-1}). The treatments sesame+sorghum (1.32 larvae plant^{-1}) and sesame+cluster bean (1.46 larvae plant^{-1}) were at par with each other and found to be the next best treatments. Sesame intercropped with marigold (1.57 larvae plant^{-1}) was found less effective among all the treatments but significantly superior over the sole crop of sesame (2.49 larvae plant^{-1}). similarly, sesame intercropped with pearl millet (6:3) recorded a lowest larval population of leaf webber and capsule borer (Sathiyaseelan and Balaji 2023), further Manisegaran et al. (2001) revealed that incidence of shoot webber was significantly low (11.2%) in sesame intercropped with pearl millet (4:1). Likewise, sesame intercropped with pearl millet (3:3) recorded lowest larval population of *A. catalaunalis* (Behera and Jena, 2013)

Table 1: Effect of different intercrops on the larval incidence of *A. catalaunalis* infesting sesame

Tr. No.	Treatments	No. of larvae plant^{-1}								
		5 WAS	6 WAS	7 WAS	8 WAS	9 WAS	10 WAS	11 WAS	12 WAS	Pooled over period
T_1	Sesame (Sole crop)	1.48^{a} (1.68)	1.54^{a} (1.87)	1.62^{a} (2.11)	1.70^{a} (2.40)	1.76^{a} (2.60)	1.85^{a} (2.92)	1.93^{a} (3.24)	1.97^{a} (3.38)	1.73^{a} (2.49)
T_2	Sesame+Black gram (2:1)	1.12^{bcd} (0.74)	1.19^{bcd} (0.91)	1.24^{bcd} (1.03)	1.28^{bcd} (1.15)	1.32^{bcd} (1.23)	1.34^{bcd} (1.31)	1.30^{bc} (1.18)	1.19^{bcd} (0.91)	1.25^{d} (1.06)
T_3	Sesame+Pearl millet (2:1)	1.05^{cd} (0.60)	1.09^{cd} (0.69)	1.16^{cd} (0.86)	1.19^{cd} (0.93)	1.26^{cd} (1.08)	1.21^{cd} (0.97)	1.27^{bc} (1.11)	1.15^{cd} (0.83)	1.17^{e} (0.87)
T_4	Sesame+Cowpea (2:1)	0.99^{d} (0.48)	1.07^{d} (0.65)	1.11^{d} (0.74)	1.17^{d} (0.88)	1.19^{d} (0.92)	1.12^{d} (0.76)	1.18^{c} (0.89)	1.08^{d} (0.66)	1.11^{e} (0.73)
T_5	Sesame+Sorghum (2:1)	1.19^{bc} (0.92)	1.27^{bc} (1.12)	1.33^{bc} (1.26)	1.40^{bcd} (1.46)	1.45^{bc} (1.59)	1.39^{bc} (1.44)	1.44^{bc} (1.57)	1.35^{bc} (1.32)	1.35^{c} (1.32)
T_6	Sesame+Cluster bean (2:1)	1.24^{bc} (1.04)	1.30^{b} (1.20)	1.36^{b} (1.34)	1.42^{bc} (1.51)	1.48^{bc} (1.68)	1.51^{b} (1.78)	1.47^{b} (1.65)	1.41^{bc} (1.48)	1.40^{bc} (1.46)
T_7	Sesame+Marigold (2:1)	1.28^{b} (1.15)	1.34^{b} (1.30)	1.40^{b} (1.45)	1.46^{b} (1.64)	1.52^{b} (1.80)	1.54^{b} (1.86)	1.50^{b} (1.74)	1.45^{b} (1.61)	1.44^{b} (1.57)
CD (p=0.05)		0.18	0.18	0.19	0.21	0.21	0.22	0.23	0.23	0.06

WAS: Weeks after sowing, Figures in parentheses are retransformed values of $\sqrt{(X+0.5)}$; Treatment means with the letter(s) in common are not significantly different by DNMRT at 5% level of significance.

3.2. Effect of different intercrops on web infestation

The data on web infestation was recorded from 5th to 12th weeks after sowing are presented in Table 2. The pooled over period data, revealed that the significantly lowest (0.42 webs plant^{-1}) web infestation was observed in sesame intercropped with cowpea and it remained at par with sesame+pearl millet (0.52 webs plant^{-1}). It was followed by sesame+blackgram (0.60 webs plant^{-1}) also found more effective than the remaining treatments. The treatments sesame+sorghum (0.85 webs plant^{-1}) and sesame+cluster bean (0.92 webs plant^{-1}) were at par with each other and found to be the next best treatments. Sesame intercropped with marigold (1.04 webs plant^{-1}) was found less effective among all the treatments but significantly superior over the sole crop of sesame (1.93 webs plant^{-1}). These results are in line with reports of Baskaran et al. (1991) who observed that significantly lowest leaf damage (7.80%) when sesame intercropped with pearl millet (1:4).

3.3. Effect of different intercrops on capsule damage

The data on capsule damage recorded 5th to 12th weeks after sowing are presented in Table 3. Pooled over period data showed that sesame intercropped with cowpea recorded the lowest (3.42%) capsule damage and proved as best intercrop treatment among all the treatments, however, it was at par with sesame+pearl millet (4.00%) and sesame+blackgram (4.46%). It was followed by sesame intercropped with

Table 2: Effect of intercrops on web infestation due to *A. catalaunalis* infesting sesame

Tr. No.	Treatments	Number of webs plants^{-1}								
		5 WAS	6 WAS	7 WAS	8 WAS	9 WAS	10 WAS	11 WAS	12 WAS	Pooled over period
T_1	Sesame (Sole crop)	1.29^{a} (1.15)	1.37^{a} (1.39)	1.44^{a} (1.57)	1.52^{a} (1.81)	1.64^{a} (2.20)	1.69^{a} (2.37)	1.73^{a} (2.49)	1.76^{a} (2.60)	1.56^{a} (1.93)
T_2	Sesame+Black gram (2:1)	0.92^{bcd} (0.34)	0.95^{cd} (0.40)	0.97^{cd} (0.45)	1.01^{bcd} (0.53)	1.07^{cd} (0.64)	1.12^{cd} (0.75)	1.15^{cde} (0.82)	1.17^{bcd} (0.88)	1.05^{d} (0.60)
T_3	Sesame+Pearl millet (2:1)	0.89^{cd} (0.28)	0.92^{cd} (0.35)	0.96^{cd} (0.42)	0.98^{cd} (0.46)	1.03^{cd} (0.56)	1.08^{cd} (0.66)	1.10^{de} (0.72)	1.13^{cd} (0.78)	1.01^{de} (0.52)
T_4	Sesame+Cowpea (2:1)	0.84^{d} (0.21)	0.87^{d} (0.26)	0.90^{d} (0.32)	0.93^{d} (0.37)	0.97^{d} (0.44)	1.02^{d} (0.54)	1.04^{e} (0.59)	1.06^{d} (0.62)	0.96^{e} (0.42)
T_5	Sesame+Sorghum (2:1)	1.01^{bc} (0.52)	1.04^{bc} (0.58)	1.08^{bc} (0.67)	1.13^{bc} (0.77)	1.19^{bc} (0.91)	1.24^{bc} (1.03)	1.27^{bcd} (1.11)	1.30^{bc} (1.19)	1.16^{c} (0.85)
T_6	Sesame+Cluster bean (2:1)	1.04^{bc} (0.58)	1.07^{bc} (0.64)	1.10^{bc} (0.71)	1.15^{bc} (0.82)	1.22^{bc} (0.99)	1.27^{bc} (1.11)	1.31^{bc} (1.23)	1.33^{bc} (1.27)	1.19^{bc} (0.92)
T_7	Sesame+Marigold (2:1)	1.07^{b} (0.66)	1.12^{b} (0.76)	1.14^{b} (0.79)	1.20^{b} (0.94)	1.27^{b} (1.11)	1.32^{b} (1.25)	1.36^{b} (1.36)	1.40^{b} (1.45)	1.24^{b} (1.04)
CD (p=0.05)		0.16	0.15	0.16	0.17	0.18	0.18	0.19	0.21	0.05

WAS: Weeks after sowing, Figures in parentheses are retransformed values of $\sqrt{(X+0.5)}$; Treatment means with the letter(s) in common are not significantly different by DNMRT at 5% level of significance

Table 3: Effect of intercrops on capsule damage due to *A. catalaunalis* infesting sesame

Tr. No.	Treatments	Capsule damage (%)								
		5 WAS	6 WAS	7 WAS	8 WAS	9 WAS	10 WAS	11 WAS	12 WAS	Pooled over period
T_1	Sesame (Sole crop)	6.62^{a} (1.33)	8.94^{a} (2.41)	17.64^{a} (9.18)	23.28^{a} (15.62)	25.91^{a} (19.10)	28.99^{a} (23.50)	30.67^{a} (26.01)	31.72^{a} (27.64)	21.72^{a} (13.70)
T_2	Sesame+Black gram (2:1)	5.48^{ab} (0.91)	6.43^{bcd} (1.25)	9.22^{cd} (2.57)	12.66^{cd} (4.81)	14.32^{de} (6.12)	15.63^{cd} (7.26)	16.67^{cd} (8.22)	17.11^{de} (8.66)	12.19^{de} (4.46)
T_3	Sesame+Pearl millet (2:1)	5.08^{bc} (0.78)	6.18^{cd} (1.16)	8.78^{cd} (2.33)	11.82^{d} (4.19)	13.50^{e} (5.45)	14.58^{d} (6.34)	15.89^{cd} (7.49)	16.43^{de} (8.00)	11.53^{e} (4.00)
T_4	Sesame+Cowpea (2:1)	4.18^{c} (0.53)	5.44^{d} (0.90)	7.83^{d} (1.86)	10.71^{d} (3.45)	12.39^{e} (4.60)	14.06^{d} (5.90)	15.11^{d} (6.80)	15.46^{e} (7.10)	10.65^{e} (3.42)
T_5	Sesame+Sorghum (2:1)	5.59^{ab} (0.95)	6.81^{bc} (1.41)	10.54^{c} (3.35)	14.31^{c} (6.11)	16.79^{cd} (8.34)	18.27^{bc} (9.83)	19.00^{bc} (10.59)	19.43^{cd} (11.07)	13.84^{cd} (5.72)
T_6	Sesame+Cluster bean (2:1)	6.07^{ab} (1.12)	7.24^{bc} (1.59)	12.78^{b} (4.89)	17.47^{b} (9.02)	19.13^{bc} (10.74)	20.18^{b} (11.90)	21.12^{b} (12.98)	21.58^{bc} (13.53)	15.70^{bc} (7.32)
T_7	Sesame+Marigold (2:1)	6.21^{ab} (1.17)	7.52^{b} (1.71)	13.62^{b} (5.55)	18.30^{b} (9.86)	20.44^{b} (12.20)	21.45^{b} (13.37)	22.41^{b} (14.53)	22.88^{b} (15.12)	16.61^{b} (8.17)
CD (p=0.05)		1.13	1.15	1.97	2.28	2.97	3.21	3.54	3.24	0.834

WAS: Weeks after sowing, Figures in parentheses are retransformed values of Arcsign transformation; Treatment means with the letter(s) in common are not significantly different by DNMRT at 5% level of significance

sorghum (5.72%). While, sesame+cluster bean was found next best treatment with 7.32% capsule damage. While sesame intercropped with marigold (8.17%) was found less effective among all the treatments but significantly superior over the sole crop of sesame (13.70%). The present studies are in agreement with Khidher et al. (2023) who revealed that sesame intercropped with cowpea recorded the lowest (18.00% /25 capsules) capsule damage. Similarly, Varma

(2012) observed the lowest capsule damage in sesame intercropped with mungbean (7.67%) and it was at par with sesame+pearlmillet (10.22%). Further, sesame intercropped with pearl millet registered the lowest capsule damage (4.17%) followed by sesame+sorghum (4.95%)

3.4. *Equivalent yield of sesame*

Data on the equivalent yield of sesame are presented in Table 4. Differences among the treatments of equivalent yield of sesame were found significant. All intercrop treatments recorded significantly higher equivalent yields than the sole crop of sesame. A significantly higher equivalent yield (1467 kg ha^{-1}) was recorded in sesame intercropped with marigold (only flower yield was considered). The treatment sesame+ pearl millet (892 kg ha^{-1}) and sesame+cowpea (881 kg ha^{-1}) was at par with each other and also found higher equivalent seed yield. Among the treated plots, sesame+sorghum (694 kg ha^{-1}), sesame+blackgram (685 kg ha^{-1}) and sesame+ cluster bean (683 kg ha^{-1}) stood with less sesame equivalent yield. The sole crop of sesame recorded 382 kg ha^{-1} which was significantly lowest as compared to the rest of the treatments. According to Varma (2012) revealed that sesame+mungbean (512 kg ha^{-1}) and sesame+pearlmillet (438 kg ha^{-1}) recorded the highest seed yield among all treatments and these findings are more or less similar to the present findings.

Table 4: Impact of intercropping systems on sesame equivalent yield

Tr. No.	Treatments	Seed yield (kg ha^{-1})		Sesame equivalent yield (kg ha^{-1})
		Sesame	Intercrop	
T_1	Sesame (Sole crop)	382	-	382^d
T_2	Sesame+Black gram (2:1)	370	392	685^c
T_3	Sesame+Pearl millet (2:1)	381	1767	892^b
T_4	Sesame +Cowpea (2:1)	393	301	881^b
T_5	Sesame+Sorghum (2:1)	357	917	694^c
T_6	Sesame+Cluster bean (2:1)	300	331	683^c
T_7	Sesame+Marigold (flower yield) (2:1)	285	1702	1467^a
CD (p=0.05)		71.61	89.20	102.69

Treatment means with the letter(s) in common are not significant by DNMRT at 5% level of significance

4. CONCLUSION

Among the six intercrop treatments evaluated, significantly lower incidence was recorded in sesame +cowpea and sesame+pearl millet with respect to larval population (0.73 and 0.87 larvae plant^{-1}), web infestation (0.42 and 0.52 webs plant^{-1}) and capsule damage (3.42 and 4.00%) of leaf webber and capsule borer. The significantly higher sesame equivalent yield was recorded in sesame+ marigold (1467 kg ha^{-1}), sesame+pearl millet (892 kg ha^{-1}) and sesame+cowpea (881 kg ha^{-1}), respectively.

5. ACKNOWLEDGEMENT

I am thankful to the Professor and Head, Department of Agricultural Entomology and Farm Manager, Agronomy Instructional Farm, C. P. College of Agriculture, S. D. Agricultural University, Sardarkrushinagar for providing facilities for conducting the experiments.

6. REFERENCES

Ahirwar, R.M., Gupta, M.P., Banerjee, S., 2010. Bio-ecology of leaf roller/capsule borer, *Antigastra catalaunalis* (Dup.). Advances in Bioresearch 1(2), 90–104.

Anilakumar, K.R., Pal, A., Khanum, F., Bawa, A.S., 2010. Nutritional, medicinal and industrial uses of sesame (*Sesamum indicum* L.) seeds-An overview. Agriculturae Conspectus Scientificus 75(4), 159–168

Anonymous, 2023. Oilseeds statistics information system, data analytics and visualization. Retrieved from https://tilhantec-osis.icar.gov.in/national-statistics/state-wise-crop-wise-area-production-yield-retirve.

Asekova, S., Eunyoung, O., Krishnanand, P., Kulkarni., Myoung Hee, L., Jung In, K., Suk-Bok, P., Minsu, K., Ki-Won, O., Kwang-Soo, C., Sungup, K., 2020. A combinatorial approach of biparental QTL mapping and genome-wide association analysis identifies candidate genes for Phytophthora blight resistance in sesame. bioRxiv 18, 2020–03.

Asekova, S., Oh, E., Kulkarni, K.P., Siddique, M.I., Lee, M.H., Kim, J.I., Lee, J.D., Kim, M., Oh, K.W., Ha, T.J., Kim, S.U., Cho, K.S., 2021. An Integrated approach of QTL mapping and genome-wide association analysis identifies candidate genes for Phytophthora blight resistance in sesame (*Sesamum indicum* L.). Frontiers in Plant Science 12, 604709. doi: 10.3389/fpls.2021.604709.

Baskaran, R.K.M., Mahadevan, N.R., Thangavelu, S., 1991. Influence of intercropping on infestation of shoot webber (*Antigastra catalaunalis*) in sesame (*Sesamum indicum*). Indian Journal of Agricultural Sciences 61(6), 440–442.

Behera, P.K., Jena, B.C., 2013. Intercropping and incidence of *Antigastra catalaunalis* (Duponchel) and yield in sesamum. Indian Journal of Entomology 75(4), 274–276.

Bhadauria, N.K.S., Bhadauria, N.S., Dwivedi, U.S., 2000. Pest complex of sesamum and their status under Gwalior condition (MP). Agricultural Science Digest 20(2), 108–109.

Degri, M.M., Samaila, A.E., 2014. Impact of intercropping tomato and maize on the infestation of tomato fruit borer [*Helicoverpa armigera* (Hubner)]. Journal of Agricultural and Crop Research 2(8), 160–164.

Gebregergis, Z., Assefa, D., Fitwy, I., 2016. Assessment of incidence of sesame webworm *Antigastra catalaunalis* (Duponchel) in western Tigray, north Ethiopia. Journal of Agriculture and Ecology Research International 9(4), 1–9.

Ghaley, B.B., Hauggaard-Nielsen, H., Hogh-Jensen, H., Jensen, E.S., 2005. Intercropping of wheatand pea as influenced by nitrogen fertilization. Nutrient Cycling in Agroecosystems 73(2), 201–212.

Khidher, K.Q., Amin Mohamed, A.M., Kadir, N.B., 2023. Seasonal incidence of sesame webworm, *Antigastra catalaunalis* (Dup.) and evaluation of selected cultural control practices, on sesame crop in Erbil city. Agricultural Science Digest 43(5), 713–717.

Manisegaran, S., Manimegalai, M., Venkatesan, S., Mohammed, S.E.N., 2001. Effect of intercropping on the incidence of shoot webber *Antigastra catalaunalis* in sesame. Annals of Plant Protection Sciences 9(1), 131–133.

Nzikou, J.M., Mvoula-Tsiéri, M., Ndangui, C.B., Pambou-Tobi, N.P.G., Kimbonguila, A., Loumouamou, B., 2010. Characterization of seeds and oil of sesame (*Sesamum indicum* L.) and the kinetics of degradation of the oil during heating. Research Journal of Applied Sciences, Engineering and Technology 2, 227–232.

Pandey, S., Jaglan, R.S., Jood, S., Singh, R., 2019. Assessment of losses caused by sesame leaf webber and capsule borer *Antigastra catalaunalis* (Dup.). Indian Journal of Entomology 81(2), 242–246.

Pathak, K., Rahman, S.W., Bhagawati, S., Gogoi, B., 2017. Sesame (*Sesamum indicum* L.), an underexploited oil seed crop: Current status, features and importance-A review. Agricultural Reviews 38(3), 223–227.

Prakash, K., Naik, S.N., 2014. Bioactive constituents as a potential agent in sesame for functional and nutritional application. Journal of Bioresource Engineering and Technology 1, 48–66.

Rai, H.S., Verma, M.L., Gupta, M.P., 2001. Efficacy of some dust formulations the incidence of *A. catalannalis*. Annals of Plant Protection Sciences 9, 117–119.

Reddy, S.R., 2012. Agronomy of field crops,1., New Delhi, Kalyani Publishers. pp.58.

Sathiyaseelan, M., Balaji, K., 2023. Major insect pests of oil seed crops and their management. Insect Pests of Crops and Their Eco-friendly Management, 53–69.

Sullivan, P., 2003. Intercropping production practices. Retrieved from http://altra.ncot.org/attran.pub/pdf.

Varma, H., 2012.Seasonal abundance and integrated management of leaf webber, *Antigastra catalaunalis* (Duponchel) in sesame crop. M.Sc. (Agri.) Thesis, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, Gujarat.

Woomer, P.L., Longet, M., Tungami, J.O., 2004. Innovative maize-legume intercropping results in above and below ground competitive advantages for under store legumes. West African Journal of Applied Ecology 6(1), 85–94.

Yan, W., Ni, Y., Liu, X., Hui, Z., Yanhua, C., Min, J., Mingming, L., Hongyan, L., Baoming, T., 2021. The mechanism of sesame resistance against *Macrophomina phaseolina* was revealed via a comparison of transcriptomes of resistant and susceptible sesame genotypes. BMC Plant Biology 21, 159. https://doi.org/10.1186/s12870-021-02927-5.