FIELD SCREENING IN SESAME (*Sesamum indicum* L.) FOR RESISTANCE TO SESAME LEAF WEBBER, *Antigastra catalaunalis (*DUPONCHEL) (LEPIDOPTERA: PYRALIDAE)

By

V. KARUPPAIAH

DEPARTMENT OF AGRICULTURAL ENTOMOLOGY AND PLANT NEMATOLOGY
PANDIT JAWAHARLAL NEHRU COLLEGE OF AGRICULTURE AND RESEARCH INSTITUTE
TAMIL NADU AGRICULTURAL UNIVERSITY
KARAIKAL – 609 603, U.T. OF PONDICHERRY

2006

FIELD SCREENING IN SESAME (*Sesamum indicum* L.) FOR RESISTANCE TO SESAME LEAF WEBBER, *Antigastra catalaunalis* (DUPONCHEL) (LEPIDOPTERA: PYRALIDAE)

Thesis submitted in part fulfilment of the requirement for the Degree of
Master of Science (Agriculture) in Agricultural Entomology
to Tamil Nadu Agricultural University, Coimbatore

By

V. KARUPPAIAH

I.D. No. 04-602-018

DEPARTMENT OF AGRICULTURAL ENTOMOLOGY AND PLANT NEMATOLOGY
PANDIT JAWAHARLAL NEHRU COLLEGE OF AGRICULTURE AND RESEARCH INSTITUTE
TAMIL NADU AGRICULTURAL UNIVERSITY
KARAIKAL – 609 603, U.T. OF PONDICHERRY

2006

CERTIFICATE

This is to certify that the thesis entitled **"FIELD SCREENING IN SESAME (*Sesamum indicum* L.) FOR RESISTANCE TO SESAME LEAF WEBBER, *Antigastra catalaunalis* (DUPONCHEL) (LEPIDOPTERA: PYRALIDAE)"** in part fulfilment of the requirements for the award of the degree of **MASTER OF SCIENCE** (**AGRICULTURE**) IN **AGRICULTURAL ENTOMOLOGY** to the Tamil Nadu Agricultural University, Coimbatore is a record of bonafide research work carried out by **Mr. V. KARUPPAIAH,** under my supervision and guidance and that no part of this thesis has been submitted for the award of any other degree, diploma, fellowship or other similar titles or prizes and that the work has not been published in part or full in any scientific or popular journal or magazine.

Place: Karaikal **(Dr. L. NADARAJAN)**

Date : Chairman

Approved by

Chairman :

(Dr. L. NADARAJAN)

Members :

(Dr. K. KUMAR)

(Dr. R. GOVINDARASU)

ACKNOWLEDGEMENT

I am so ineffably happy to express my gratitude and thanks to my chairman Dr. L. Nadarajan, Dean cum Professor and Head, Department of Agricultural Entomology and Plant Nematology, Pandit Jawaharlal Nehru College of Agriculture and Research Institute, Karaikal. He evinced his great interest, amicable guidance, cordial treatment, valuable keen suggestions, unforgettable care and encouragement to me throughout the progress of study as a post graduate.

I have boundless pleasure in placing on record my deep sense of gratitude to my advisory committee members Dr. K. Kumar, Assistant Professor (Agricultural Entomology) for his critics and valuable suggestions and help through out my research programme and also I express my heartfelt thanks to Dr. R. Govindarasu, Associate Professor (Plant Breeding and Genetics), for his involvement in rendering constant criticism, guidance and timely help.

I here by express my sincere thanks and indebt gratitude to Dr. D. Adiroubane, Associate Professor (Agricultural Entomology), Dr. J. Alice R. P. Sujeetha, Assistant Professors (Agricultural Entomology) and Dr. V. Ramesh, Assistant Professor (Agricultural Nematology) for their sustained interest and suggestions through my studies.

I owe my special gratitude to Dr. Nallathambi, HOD, RRS Vridhachlam and to Dr.R. Govindarasu Associate Professor (Plant Breeding and Genetics) for sparing their valuable sesame genotype seeds for my study.

I would like to acknowledge the timely help rendered by Dr. P. Selvaraj, HOD, Department of Horticulture and Dr. K. A. Shanmuga sundaram, Assistant Professor (Horticulture), for permitting and helping me to take photograph with image analyser.

I wish to thank the PAJANCOA & RI Society and Government of Pondicherry for providing the fellowship during my study.

I would like to express my gratitude and thanks to the farm manager Miss. S. Mala and other staff members and HOD of Department of Agronomy for their cooperation and assistance in raising the crop for research purpose.

I express my profound thanks to attenders of Department of Agricultural Entomology, Mr. S. Rajendran, Mr. K. Kaliaperumal and Mr. J. Samraj for their help to me in the laboratory and field studies during my stay.

I express my deep sense of gratitude to my classmates K. Santhosh Kumar, L. Ramazeame, K. Raghuraman and M. Syamala and my P.G. juniors J. Soundar, K. Raja and T. Sakthivel for their help during my period of study.

I also thank my friends S. Dharmarajan, B. Radha Krishnan, E. Senthilnathan, M. Karuppaiya, S. Ravichandran, D. Kalaivanan, M. Shanmuga sundaram, M. Ramesh Kumar, C. Kalaiselvan, S. Kalaiselvan, S. Karthick, D. Dhinesh, M. Prabhakaran, A. Haridass, P. Vijayaganesh, D. Sivaram, A. Raja, J. Sadeesh, V. Vivek, T. Kasirajan, V. Elavarasan and S. Velmurugan for their love and moral support during my study.

My heart out weight with cheer and gratitude to submit my praise on the foot my parents Mr. P. Vadivelu and Mrs. V. Adaikammal, my sister V. Revathi and my brother V. Venketachalam for their support, selfless devotion, love and inspiration throughout my carrier.

Last but not least, my respected and grateful thanks to the god, who is the master designer of my heart, soul and mind for his endless blessing thought carrier.

Karuppaiah. V

ABSTRACT

FIELD SCREENING IN SESAME (*Sesamum indicum* L.) FOR RESISTANCE TO SESAME LEAF WEBBER, *Antigastra catalaunalis* (DUPONCHEL) (LEPIDOPTERA: PYRALIDAE)

By

V. KARUPPAIAH

Degree : Master of Science (Agriculture) in Agricultural Entomology
Chairman : **Dr. L. NADARAJAN**
Professor and Head
Department of Agricultural Entomology and Plant Nematology
Pandit Jawaharlal Nehru College of Agriculture and Research Institute, Karaikal-609603

2006

Sesame leaf webber, *Antigastra catalaunalis* (Duponchel) (Lepidoptera: Pyralidae) is a pest of serious concern in sesame. In the present study, field screening of sesame genotypes for resistance to leaf webber was attempted. In addition, information on the biochemical basis of resistance, antibiosis mechanism and the ovipositional preference of *A. catalaunalis* in different sesame genotypes was also studied along with field screening experiment.

The field screening indicated that all the stages of crop and all plant parts were infested by *A. catalaunalis.* The infestation was noticed from the 10 days after sowing till the harvest. Mostly the infestation was recorded in all the 43 genotypes taken for study. None was totally free from infestation of *A. catalaunalis*. The reaction of the genotype to *A. catalaunalis* was determined using per cent leaf damage at different stages of vegetative phase, flower and pod damages. These were converted in to scores and grades. Among the 43 genotypes tested three genotypes ES 22, UMA and SI 250 showed resistance (R) and TKG 22 and KMR 14 were moderately resistant (MR) to *A. catalaunalis* in first trial. Out of 43 genotypes, 31 were selected for second trial sown during July 2005. The per cent leaf, flower and pod damage were recorded in same manner as in first trial. Among the 31 genotypes screened in the II trial, the

genotype ESS 22 was highly resistant (HR) and SI 250, YLM 66 and UMA were resistant and TKG 307, KMR 14, RT 343, VS 9701, ES 34 and TKG 22 exhibited moderately resistant reaction (MR). The check TC 25 showed high susceptibility (HS). The remaining genotypes were susceptible to A. *catalaunalis* in II trial. The genotypes ES 22, SI 250 and UMA showed resistance in both the trials. The pest incidence was noticed comparatively less in the II trial than in I trial.

Growth index of *A. catalaunalis* was prepared on resistant and susceptible genotypes using the larval duration, larval weight, larval length and per cent pupation rate. Least growth index was recorded in the genotypes exhibited resistance reaction in the field and it indicated the presence of antibiosis in the resistant genotypes. There was highly significant positive correlation between number of trichomes on leaves and egg laid by adult moth. The maximum number of eggs was recorded in the genotype KMR 85 having more number of trichomes on the leaves.

Biochemical basis of resistance was studied by estimating total phenol in genotypes showing resistant and susceptible to leaf webber. A highly significant negative correlation was also noticed between damaged leaf, flower pod and total phenol.

Among the 43 genotypes studied, the higher yield was recorded in the genotypes VRI 1 and YLM 66. Though the genotype VRI 1 was susceptible to *A. catalaunalis* in both the trials, the high yield may be due to the fact that the leaves showed high infestation but flower buds and pods were less attacked. And the data on phenolic content indicated that its level was low in leaves but high in flowering and fruiting stage. Hence they are tolerant to the pest attack.

CONTENTS

LIST OF TABLES

LIST OF TABLES Contd…

LIST OF PLATES

LIST OF FIGURES

13	Growth index of *A. catalaunalis* in different sesame genotypes	
14	Relationship between trichomes density in leaf of sesame genotypes and egg laying preference by *A. catalaunalis*	
15	Relationship between total phenols and damage intensity of *A. catalaunalis* in sesame genotypes	
16	Yield in sesame genotypes	

INTRODUCTION

Sesame, *Sesamum indicum* L. known as the ‘queen of oil seeds,’ is one of the oldest oilseed crops cultivated in India. The genus *Sesamum* belongs to the family Pedaliaceae and the order Tubuliferae, which comprises of 16 genera and 60 species (Weiss, 1983). It is also known as **sesamum, til and gingelly** (Sharma, 1967); **sim sim**, **beniseed**, **til, safed til, kalatil** and **tillie** (Vishwanath and Chhotey Lal, 1995).

India ranks first in area under cultivation having 2.09 million hectares with an annual production of 0.56 million tonnes, representing 30 per cent of the world output. The other sesame growing countries are Aden, Burma, Cyprus, East and West Africa, France, Italy, Srilanka, Syria, Russia, Egypt and Spain (Singhal, 1999); China, Nigeria, Sudan, Asia, Europe, North, Central and South America (Vishwanath and Chhotey Lal, 1995); Mexico, Turkey and Pakistan (Sharma, 1967).

In India, the states growing sesame are Rajasthan, Maharashtra, Gujarat, Madhya Pradesh, Andhra Pradesh, Karnataka, Uttar Pradesh, West Bengal, Orissa, Punjab and Tamil Nadu (Singhal, 1999). The crop is also grown in Assam, Bihar, Haryana, Jammu and Kashmir, Kerala, Himachal Pradesh, North Eastern hill states and Pondicherry (Vishwanath and Chhotey Lal, 1995). Tamil Nadu is having sesame cultivation in 1.51 lakh hectares with a production of 0.72 lakh tonnes (Singhal, 1999). In Tamil Nadu and Pondicherry, sesame is grown in different seasons and in different conditions like irrigated, rainfed and rice fallow. In Pondicherry, the total production of sesame was 100 Metric tonnes (GOI, 2004). The total area under sesame was 38 hectares in Karaikal and the total production of sesame was 4 metric tonnes (Season and Crop report, 2002).

Sesame seed contains 46 to 64 per cent oil, 25 per cent protein, high amount of minerals *viz*., calcium, iron and phosphorus (Seegeler, 1983) and due to high oil content it is easily amenable for oil extraction (Singh *et al.*, 1994). Sesame flowers are popular as perfume. The oil is highly effective as a fixative in the perfume industry (Prahlad, 1997) and seeds are edible as such and can also be eaten as fried, roasted and pounded. It is used in bakery products and topping on breads or in candies and confectionaries (Weiss, 1971). Sesame cultivation is mostly concentrated in the dry areas of marginal and sub-marginal farmer's holdings. In tropics and sub-tropics of the world, the **sesame leaf roller** or **sim sim webworm** or **til leaf and pod borer**, *Antigastra catalaunalis* (Lepidoptera: Pyralidae) is the most important pest of the sesame (Weiss, 1983).

In India, among the 29 species of insect pests of sesame, *A. catalaunalis* causes upto 90 per cent yield loss (Ahuja and Bakhetia, 1995). The shoot and leaf webber attacks all parts of sesame plant except root and it feeds on the tender foliage by webbing top leaves and also bores into the shoots and capsules (Ayyar, 1940). Singh (1983) recorded 10 to 71 per cent plant infestation and 10 to 43.5 per cent capsule infestation, resulting in 8.9 to 71.5 per cent yield loss.

Management of this pest can be accomplished by the application of insecticides (Mahto, 1988; Sanjaykumar and Goel, 1994 and Rai *et al*., 2001). But majority of the farmers are not resorting to insecticide application, except those growing on commercial scale. Other than the chemical control, host plant resistance will be of much use to the farmers, as it involves no extra input.

Hence, the present study is aimed for the management of the shoot webber with the following objectives.

- To identify the resistant genotypes of sesame through field screening
- To find out the mechanism of resistance.

The identification of the resistant genotypes may pave way for developing resistant varieties by plant breeders.

REVIEW OF LITERATURE

2.1. NOMENCLATURE

Sesame leaf webber, *Antigastra catalaunalis* (Duponchel) belongs to the family Pyralidae of the order Lepidoptera. It is known by various names *viz*., till leaf roller (Hector, 1919 and Menon *et al.,* 1960), sesame leaf webber (Ritchie, 1927 and Vittal and Saroja, 1966) and till leaf and capsule borer (Teotia and Hussian, 1965) but it is more commonly referred as sesame leaf webber.

Sesame shoot and leaf webber was first described by Duponchel (1833) under the name of *Botys catalaunalis*. Lederer (1863) changed the genus *Botys* to *Antigastra.* Hampson (1899) used the name *Botys venosalis.*

2.2. Distribution

A. catalaunalis is the most important and destructive pest of sesame and it is distributed in India, Africa, South Europe, Indonesia, South East Asia, Burma, Srilanka, Bangladesh and U.S.S.R (Panwar, 1995).

The pest has also been reported from Europe, Africa, Cyprus, Indonesia, and South East Asia (Pradhan, 1969). It is said to be distributed in old world tropics and sub tropics including South Europe, U.S.S.R, Africa, India, Bangladesh, Srilanka and Burma and as minor pest in Kenya, North Uganda and other areas of tropics with occasional serious out break (Hill, 1983).

It has been recorded from West and East Africa from the Mediterranean region to South Russia, Iran and India to South East Asia and Indonesia (Weiss, 1971).

2.3. Host range

The sesame shoot and leaf webber, *A. catalaunalis* is a major pest of sesame in India. The pest was reported to feed mostly on the cultivated variety of *Sesamum indicum.* Borg (1930) reported that its usual food plant in Southern Europe was Toad flax, *Linaria* sp. Larvae were feeding on the leaves of closely related plant, *Martynia diandra* Glox. of the family Pedaliaceae, Petunia, *Petunia alba* Linn., a garden annual of the family Solanaceae (Singh, 1952); *S. occidentalis* (Heerd Regal) and *S. prostratum* Retz at Pusa, Bihar (Menon *et al*., 1960) and *Antirrhinum majus* (Linn) and *Russelia juncea* Zucc (Teotia and Hussain, 1965)

2.4. Nature and extent of damage

The damage caused by this pest was one of the limiting factors in the successful cultivation of this crop.

The larvae rolled the leaves of the host plant and bored into the seed pod (Lefroy and Hewlett, 1909; Pillai, 1921). Hall (1926) reported that the caterpillar was feeding on the tender shoots and leaves in a sort of nest made by webbing of the leaves together and also boring into the green pods of the plant, thus wholly or partly destroying the seeds for which this crop is grown (upto 30 per cent).

Menon *et al.* (1960) observed this pest attacking both the summer and *kharif* crops right from the beginning of the growth and reported that when the infestation took place at very early stage, the plants died without producing any branch or shoot and a single caterpillar could destroy 2 to 3 plants in about a week. If the attack occurred at a later stage, the infested shoots remained without further growth. In the flowering stage, the production of flowers ceased beyond the point of infestation and at pod formation stage, the larval bored into green pods destroying the pod content partly or wholly.

Vittal and Saroja (1966) reported that the infestation by this insect in winter season was ranging from 48 to 58 per cent and in summer, it did not exceed more than 10 per cent in Tamil Nadu. The loss varied from 3. 35 to 8.39 per cent, depending upon the variety (Dehspande and Singh, 1969).

Pradhan (1969) found that the larval stages damaged both the apical shoot and the young capsules. An early attack killed the plant as a whole, but infestation of shoots at later stages affected further growth and flowering process. The newly hatched larvae mine the young leaves and shoot tips, at a later stage they fasten the leaves and shoot together with silken threads and feed inside capsule. Flowers may also be destroyed (Weiss, 1971).

Nair (1975) reported that the caterpillars caused considerable damage by webbing up the top leaves and boring into the shoots, capsules and flowers and feeding on them. Vasantharaj David and Kumaraswami (1975) reported that the larvae of *A. catalaunalis* webbed together the top leaves or bore into the tender shoots and capsules and feed on them. A severe infestation of the pest contributed to the low yield of gingelly seeds.

Zumreoglu (1982) found the larvae webbing leaves or flowers together, on which they fed, boring into the young shoots and eventually entering the pods to feed on the seeds with 87 per cent damage. Singh and Yadav (1985) reported that the infestation started at early stage and the plant died without branching.

Cheema and Grudip Singh (1987) observed 28.5 per cent infestation in the field with 15.3, 27.8 and 9.9 per cent shoot, flower and pod damage respectively, which resulted in 53.1 per cent yield loss.

Patel and Bhalani (1989) reported that, the caterpillars attacked the leaves and flower parts of plants and caused direct loss in yield. The infestation of sesame leaf webber resulted in 66.31 per cent seed loss per capsule (Kumar and Goel, 1994). Ahuja and Bakhetia (1995) reported that *A. catalaunalis* was the most serious pest causing upto 90 per cent yield loss.

The loss in yield due to sesame leaf webber damage was to the tune of 57.54 per cent in the variety TMV 3 in Vridhachalam, Tamil Nadu. Also at Tikamgarh, the loss in yield was to the tune of 48.8, 50.0, 51.8 and 58.7 per cent in various varieties *viz.*, TKG 21, JTS 8, TKG 55 and TKG 21, respectively (AICRP (S & N), 2002).

The yield loss due to leaf webber in the varieties VRI 1, TMV 3, TMV 4 and TMV 6 was about 30.5, 31.3, 34.3 and 36 per cent respectively in Vridhachalam and it was to the tune of 39.9, 31.1, 31.8 and 42.8 per cent with the varieties TKG 22, JTS 8, TKG 55 and TKG 51, respectively in Tikamgarh (AICRP (S & N), 2003).

2.5. Biology of sesame leaf webber

Biology of *A. catalaunalis* was studied in different regions of India. Nair (1975) studied the biology of this pest and reported that minute greenish eggs were laid on the tender leaves or on flowers. A female moth laid on an average of 86 eggs with a maximum number of 232 eggs during the oviposition period of 5 days. Egg stage lasted for 2 to 7 days depending upon the weather. The larvae become fully grown in 10.33 days under going 5 instars. They pupated within the webbing, under fallen leaves or in soil crevices in a thin transparent cocoon. The pupal period lasted for 4-19 days depending upon the weather. Adult longevity was 6-8 days. The total life cycle was completed in 67 days during winter and 23 days in summer.

The adults were small sized moth with orange brown forewings and pale yellow transparent hind wings. A female laid about 15-300 eggs on the undersurface of the apex of the leaves. The egg period lasted for 2-7 days. The younger larvae were pale yellow and older ones were green with black dots all over the body. The larval period lasted for 10-33 days. Pupation occurred in crevices in the soil or amongst the fallen leaves or even on the plant itself. The pupal period lasted for 4 to 20 days (Srivastava, 1993).

Cheema and Gurdip Singh (1987) studied the biology of this insect and reported that, the eggs were laid on all the above ground parts *viz*., leaves, petioles, stem, branches and capsules, but tender leaves were most preferred. The eggs were preferably laid along the midrib and veins on the under surface of leaf. They were mostly laid singly but also in batches of 2-3 eggs. The freshly laid eggs were greenish and oblong. The colour changed from greenish to greyish and finally red spots appeared on the chorion before hatching. The incubation period of eggs ranged from 2 days from May to August and 5.87 ± 0.61 days from mid December to February. The viability of egg was 78. 0 ± 11.4 per cent during August and September. The first instar larva was dirty white when freshly hatched and changed to greyish yellow and finally to green with 3 distort black spots on each side of mid dorsal line of the segment. The larval development was completed in 9.58 ± 0.79 days during July and 30.53 ± 1.56 days during December and January.

The average larval survival was 79.92 + 7.88 per cent. The optimum temperature for development and survival of the larvae was 30^{o}C. Full grown larvae rolled 1-2 leaves, spun them and pupated among the rolled leaves. The pupa was at first green and later became pale white with black spots. Then the colour changed to brownish green and finally dark brown just before emergence of moths. The pupal period lasted for 4.08 + 0.28 days in August and 14.90 + 2.77 days during November. The mean pupal survival was 87.97 + 0.54 per cent.

Moths were observed to emerge in the laboratory at all hours of the day and night but peak period of emergence was 5 pm to 9 pm. The adults are straw coloured. The sexual activity started two hours after the sun set, when it was sufficiently dark and it continued till 2 am. But majority of the moths mated between 8 p.m. and 12 p.m. The female mated only once. In July pre mating and mating periods were 25.7 + 2.90 and 1.27 + 0.29 hour respectively. The pre-oviposition period was 1.43 + 0.51 days from June to August and 3.43 + 1.3 days from late November to early March. The oviposition and post oviposition periods were 3.57 + 0.57 days and 0.56 + 0.51 days respectively from June to August. The females lived slightly longer than males. A minimum number of 17.81 + 4.76 eggs per female were laid from mid December to February and a maximum of 84.91 + 31.03 from May to August.

Kumar and Goel (1994) studied the life cycle of *A. catalaunalis* in western Uttar Pradesh and reported that the pre oviposition period was 2.20 + 0.13 days. The fecundity was 38.01 + 1.99 eggs per day and 152.70 ± 6.78 eggs during the entire oviposition period of 4.10 ± 0.23 days. The longevity of unmated males and females was more than that of mated ones. A polygamous male mated successful with 3 different females. The life cycle was completed in 19.86 ± 0.34 days (Kumar and Goel, 1994).

Singh (2003) studied the biology of *A. catalaunalis* in glass house under controlled condition. Incubation (egg) period, larval period, pupal period, adult longevity, developmental (larval and pupal) period, adult emergence, adult fecundity, life cycle and growth index were recorded as 2-4 days, 8-11 days, 6-8 days, 6-10 days, 14-19 days, 65-95 per cent, 20-30 eggs per female, 22-33 days and 4.65–5.00 respectively.

Sankarnarayanan (2002) studied the biology of *A. catalaunalis* and state that the incubation (egg) period, larval period, pupal period and life cycle were 4 days, 9.3 days, 4.65 days and 27 days respectively.

2.6. HOST PLANT RESISTANCE

2.6.1. Biophysical characters in resistance

Bhattacharjee and Rattan Lal (1962) reported that an early maturing variety with relatively sparse branching was less susceptible than that of late and more profusely branching types. The hairy plants were more susceptible to *A. catalaunalis* larvae than glabrous plants (Anon, 1966). A varietal difference in susceptibility is because of the differences in the time of maturity and external morphological characteristics of the varieties than the biochemical characteristics. They further reported that sesame varieties NP 29, NP 2 and NP 6 were relatively less susceptible to *A. catalaunalis* attack.

A number of lines which are resistant or tolerant have been developed through large array of screening against this pest by Directorate of Oilseeds Research, Hyderabad. Eleven lines have been recommended as resistant lines, hairiness being the morphological feature that confers resistance. Sesame lines OMT 30, ES 22 and KIS 306 are some of the varieties that have been recommended as resistant varieties in India. The characters imparting resistance are hairiness and profuse branching (Anon, 1995).

Manisegaran *et al*. (2001) found that non-preference was the mechanism of resistance in sesame to shoot webber and capsule borer, *A. catalaunalis.* Fifteen day old plants of 3 resistant sesame (*Sesamum indicum)* cultivars (ES 12, ES 22 and S1 250) and *S. alatum*, showed different degree of resistance on oviposition rate, trichome density, larval length and pupation rate. The 3 cultivars and *S. alatum* exhibited non-preference for oviposition and had higher number of trichomes.

Thirteen genotypes of sesame were evaluated under green house conditions to find out their reaction to *A. catalaunalis*. The genotype ES 22 showed non-preference for oviposition and S1 250, IS-23-1, KIS 305 and ES 12 exhibited low preference for oviposition. The over all development of *A. catalaunalis* was also very low on these genotypes (Singh, 2002).

Philip Sridhar and Gopalan (2002) studied the mechanism of resistance against the shoot webber *A. catalaunalis* with 877 sesame germplasm entries. The wild species *S. alatum, S. laciniatum* and *S. prostratum* exhibited high resistance and about 18 lines were found to be less damaged and therefore, scored under resistance category. The entries SI 1115, ES 22, SI 250 and *S. alatum* were highly resistant under caged condition. The lines SI 1115 and *S. alatum* were non-preferred for oviposition and found to have very few trichomes as in SI 1115. The variety TMV 3, having 13.5 trichomes per microscopic field was recorded.

The studies on the antibiosis mechanism on selected entries showed that *S. alatum*, ES 22 and SI 250 adversely affected the larval period, larval weight and larval length. High growth index was recorded in the susceptible variety TMV 3 (7.13). The entries *S. alatum*, ES 22 and SI 250 exhibited least growth indices 1.55, 3.04, and 3.00 respectively.

2.6.2. Biochemical characters in resistance

Crosses between *S. indicum* and *S. prostratum* led to the synthesis of a hybrid species, *S. indicatum* (Ramanujam, 1942; 1944) that was found to be susceptible to this pest. The presence of excess soluble solids in the cell sap of the leaves of *S. prostratum* renders it less liable to attack (Mukherjee, 1947).

Yadav (1976) reported the two lines, *viz*., 1367 and RAUSS 17-6 as resistant to *A.* c*atalaunalis*. The genotypes contained low amount of proteins in leaves (10.9 and 11.4 per cent respectively), high phenol content in flowers (0.27 and 0.28 per cent respectively) and low oil content in seeds 33.4 and 34.0 per cent respectively.

Manisegaran *et al*. (2000) attributed that number of trichomes on leaves and phenol contents of the plants were responsible for resistant mechanism. Mishra *et al. (*2001) studied antibiosis mechanism in rice varieties against rice leaf folder and noticed that highest larval length (33.10 ± 2.35 mm), larval survival (96.5 per cent), larval weight (0.49 g/10 larvae) and growth index (2.92) in the susceptible check Jaya, which was higher than the resistant check TKM-6.

Rao and Panwar (2002) reported that the presence of fewer amounts of biochemical factors such as leaf chlorophyll, carotenoid, nitrogen, crude protein and moisture content was positively correlated with leaf injury of *C. partellus*. Less carotenoid content in early stage of crop growth contributed resistance against the borer.

2.6.3. Genetics of resistance

Aiyadurai *et al.* (1962) found that the hybrids produced in inter-specific hybridization programme exhibited the resistance in *S. laciniatum* Kleinto *A. catalaunalis*. *S. prostratum*, a wild species is comparatively resistant to its attack (Nath and Agarwal, 1982).

Dora and Kamala (1988) described a hybridization programme to incorporate the resistant characteristics of the sesame varieties *viz*., IS 104 and B 67 to *A. catalaunalis* into the varieties Gowri and Madhavi. The six cross combinations *viz*., Gowri x B 67, Gowri x IS 104, Madhavi x IS 104, B 67 x IS 104 and IS 104 x B 67 were highly resistant and had significantly high seed yield.

Ganesh *et al.* (1999) evaluated the combining ability and heterosis performance of genotypes by crossing with ruling varieties for the capsule borer resistance and reported that the parents SI 3315/11 and CO1 could be utilized as donors in the hybridization programme for capsule borer resistance.

2.6.4. Varietal resistance

Krishi *et al.* (1969) screened nine varieties of sesame and the infestation varied between 3.35 and 8.39 per cent. The varieties, TMV 2, B 14 and T 4 were least damaged. Singh and Phamdhere (1986) found that the variety C 1036 recorded minimum flower (22.76 per cent) and capsule infestation (7.77 per cent) by leaf webber and registered highest yield (867 Kg/ha). Whereas variety G-5 recorded maximum flower (66.76 per cent) and capsule infestation (20 per cent) resulting in lowest yield of 203 Kg/ha JT-7, C-7 and Anand 74 was observed to be the promising varieties.

Bhattacharjee and Rattan Lal (1970) categorized 14 different varieties under non overlapping categories based on the degree of infestation of the crop by leaf webber; 4 varieties *viz*., C 47, C 50, B 67 and T 4 recorded infestation ranging from 35.3 to 40.4 per cent comprising the most susceptible group. Three varieties *viz*., Chandra 3, C 1036 and 105/22 recording infestation ranging from 6.4 to 8.4 per cent were designated as resistant; the third category covered seven varieties *viz*., ES 8, C 2, Sel R, C 35, D 7-11-1, T 13 and T 12, which showed infestation from 11.8 to 33.3 per cent and formed the moderately susceptible group.

Jakhmola and Yadav (1975) screened about 64 different varieties and found that the capsule infestation varied from 0.2 to 3.9 per cent in 1970 and from 6.1 to 24.4 per cent in 1971, while webbed plants amounted to 3.5 to 26 per cent in 1971 and no relationship was observed between the time of flowering or seed ripening and the degree of infestation. Based on per centage of damaged capsule, M3-2 was the least susceptible variety.

Sood *et al*. (1982) evaluated 450 genotypes including exotic and indigenous collections for their resistance to sesame leaf webber. The pest reaction on each entry was observed at two stages of the crop *viz*., flowering and capsule formation and the varieties were graded based on the damage as resistant (0-5 per cent), moderately resistant (6-10 per cent), susceptible (11-20 per cent) and highly susceptible (20 per cent damage).

Cheema *et al*. (1982) reported that TC 289 cultivar recorded the lowest number of larvae followed by Punjab Til No.1 recording 12.8 and 15.4 per cent infestation respectively when compared to TC 103, TC 151, TC 160 and TC 325 having the infestation per centage between 25.8 and 42.2.

Tiwari and Shaw (1988) observed 46 varieties of *S. indicum* as susceptible and found C-7 variety as the most promising one against the shoot webber by recording 2.91 per cent capsule infestation compared to JT 66-74-202 recording 9.37 per cent.

Mahadevan (1988) screened 250 germplasms and reported that ES 22, SI 250 and ES 12 were highly resistant to the attack of this pest. These entries showed less than 5.6 per cent infestation. The entries SI 53, SI 75, SI 810, SI 889, SI 935, SI 953, SI 964, SI 968, SI 990, SI 1002, SI 1004, SI 1029, SI 1671, SI 3315/6, SI 3315/11, PDK 31, 20-3-1 and 59-1-1 showed the field resistance to leaf webber. The commonly cultivated variety TMV 4 recorded a maximum of 25 per cent damage.

Fourty genotypes of sesame were grown in paired rows of 4 m length in three replications and percentage of infestation was recorded at various stages of crop growth. The genotypes RAUSS-17-4 and B-67 showed consistent low incidence of *A. catalaunalis* damage (Kumar *et al.*, 1990).

Selvanaraynan and Baskaran (1996) had suggested the use of less branching varieties of sesame to reduce infestation by *A. catalaunalis*. Screening local varieties and strains is considered to be the most important tool in combating local pests.

Germplasm screening against sesame leaf rollers and pod borers was done by Muralibaskaran *et al*. (1994). Twenty-seven *S. indicum* entries (including 5 local varieties) and the wild species *S. alatum* were screened against sesame leaf roller and pod borer under artificial condition and natural infestation. Percentage of damage was recorded after 45 and 70 days. Only 7 entries were identified as moderately resistant under artificial condition while 12 entries were moderately resistant under natural condition. Entries SI 3315/11, SI 53, SI 882, 59-1-1, PDK 31, SI 889 and SI 990 were identified as moderately resistant under *in vitro* condition. The wild species *S. alatum* and two entries ES 22 and S1 250 were highly resistant to this pest under both conditions.

Rath *et al.* (1997) studied the varietal reaction in sesame to leaf webber and capsule borer and reported that variety OMT 30 exhibited least infestation (10.00 per cent). The genotypes B 67, OMT 32, Usha and Bolangir local exhibited highest infestation of 20 per cent. Among them, OMT 30 was classified as resistant variety and other four genotypes were grouped under moderately resistant category.

Manimegalai and Mahalingam (1997) conducted screening experiment in sesame against *A. catalaunalis* during *kharif* 1994 and 1995 with 125 test entries and they reported that the entries IS 99 and SI 250 were found to be resistant. The entries ES 34, KIS 302, RT 106, UT 81, SI 1029, SI 2928, SI 53, SI 3232, KRR-1, SI 1778, SI 3315/4 and SI 73 were reported as moderately resistant in both the seasons. The least leaf damage was recorded in the entry KRR-1 and maximum in SI 1778.

Sharma and Raghuwanshi (2000) reported that the variety PKDS 1 produced maximum seed yield and it exhibited least capsule borer incidence during the summer. Patra (2001) studied the response of sesame varieties during rainy season with 10 sesame cultivars. The cultivars Balangir local, Kalika, UMA and OTM 10 showed least damage by *A. catalaunalis*.

Patil *et al*. (2001) studied the reaction of sesame genotypes against major insect pests of sesame with 24 genotypes. The genotypes OS 15 and OS 5 exhibited a better tolerance to gall fly and capsule borer. The highest capsule borer damage was recorded in the genotypes AT 83 and NT 14-91. The genotypes RT 238 and RT 281 exhibited better tolerance to pests and diseases.

Talpur *et al.* (2002) studied the incidence and abundance of insect pest in sesame with four sesame cultivars S 17, PR-19/9, PR-28/88 and PR-37/88. The population of leaf roller was highest during capsule formation and early vegetative stages. The lowest population recorded during flowering. In this, PR-19/9 and S 17 showed relative resistance and PR-19/9 and S-17 recorded significantly higher yield than the susceptible ones.

Shrivastava *et al.* (2002) tested 782 germplasm lines of sesame against *A. catalaunalis* and reported that the flower and pod damage were ranged from 2.0 to 75.0 per cent and 1.4 to 31.2 per cent respectively. The line SI-73 was found to be free from *A. catalaunalis* and the lines SI-1729, SI-3239, IC 132246, IC 204137, IC-285071, EC 205052 and IC-205304 were found to be promising, presenting the least susceptibility to *A. catalaunalis* at flowering and pod formation stages.

Rai *et al.* (2002) studied the reaction of sesame genotypes TC 25, TKG 9, TKG 21, JT-7 and N 32 against *A. catalaunalis* at various dates of sowing and noticed that significant variation in the incidence of leaf webber. The maximum leaf, flower and pod damage were recorded at 13th August sown crop.

Thirteen genotypes of sesame were evaluated under green house conditions to find out their reaction to *A. catalaunalis*. The genotype ES 22 showed non-preference for oviposition. S1 250, IS 23-1, KIS 305 and ES 12 exhibited low preference for oviposition. The overall development of *A. catalaunalis* was also very low on these genotypes (Singh, 2002).

Rohilla (2003) reported that the sesame genotypes RAUSS-17-4 and B-67 exhibited resistance against *A. catalaunalis.* These genotypes appeared to be armored with some features to fight with pest. The yield loss due to pest attack in resistant genotypes RAUSS -17-4 and B-67 were 15-62 and 17.29 per cent respectively. The genotype CST-785 showed highest yield loss of 66.83 per cent.

Ten AVT entries were screened for the reaction to *A. catalaunalis* at vegetative, flowering and capsule formation stages. Among the 10 entries, PKDS 12, TKG 22 and UMA were found to be moderately resistant during vegetative and flowering stages. The entry Ajit-13 was found to be moderately resistant at capsule stage. Considering the over all performance at all three stages, entry TKG 22 (NC) and UMA (ZC) were observed to be moderately resistant to *A. catalaunalis* (AICRP (S & N), 2004).

Screening experiment was conducted at Vridhachalam. The observations on nine germplasm lines were recorded on 10 plants per germplasm for the incidence of capsule borer *A. catalaunalis* at vegetative, flowering and capsule formation stages. The lines KMR 43 and KMR 82 were found to be moderately resistant to *A. catalaunalis* (AICRP (S & N), 2004).

Screening trial was conducted at Tikamgarh, (AICRP centre) using 153 entries and the damage by sesame leaf webber *A. catalaunalis* was recorded at 30, 50 DAS and at harvest stage. Six entries *viz.*, IS-359, IS 405, IS-406, IS 421, IS-446 and SI-250 were found as moderately resistant at vegetative stage. In general, the

A. catalaunalis damage at flowering stage was very low. One hundred fifty one entries recorded less than 5 per cent flower damage and 2 entries showed 6.1 per cent flower damage. At capsule stage, 150 entries showed less than 5 per cent capsule damage and one entry showed 9.1 per cent capsule damage. In the susceptible checks, TC 25 and C 50, the plant infestation with capsule borer was 25 per cent and 21 per cent respectively (AICRP (S & N), 2004).

Gupta (2004) conducted field screening experiment in sesame against *A. catalaunalis* with 223 germplasm lines of sesame. Observations on the incidence of pests were recorded at 30, 50 and 70 DAS during crop growth. He reported that the germplasm lines SI-232-2, SI-911, SI-928, SI 1934, SI-1400, SI-1496, SI-1499, SI-1556, SI-1843, SI-2174-2, SI-2253, SI-2584, SI-3175, TZA / 91-640, IC-204788 and IC- 205595 showed resistance against *A. catalaunalis.*

2.7. Management of sesame leaf webber and capsule borer

The efficacy of synthetic pyrethroids for the management of *A. catalaunalis* on sesame was studied in Faridabad. The results showed that the knock down effect of pyrethroids was more than quinalphos. deltamethrin 125 g and cypermethrin 60 g effectively persisted on the same plant for 15 days followed by fenpropathrin 100 g and fluvalinate 75 g for 10 days and fenvalerate 75 g quinolphos 500 g / ha for 7 days to check the pest multiplication. cypermethrin, deltamethrin, fenpropathrin and fluvalinate reduced the pod infestation efficiently (Sanjay Kumar and Goel, 1994).

Singh and Singh (1997) studied the effectiveness of seven plant products and endosulfan by spraying twice against capsule borer, *A. catalaunalis* and phyllody in sesame for two years in Gwalior. They reported that among all the plant products, neem oil 1 per cent, neem seed kernel extract 2 per cent and neem leaves extract 2 per cent were found effective against the pest and in turn the yield was also higher.

The field efficacy of six insecticides at two concentrations each against the shoot webber and capsule borer, *A. catalaunalis* was studied in Tamil Nadu with a popular sesame cultivar TMV 3. Among the various insecticides tested, etofenprox was found to be superior followed by *Bacillus thuringiensis* formulation and dimethoate while padan and endosulfan were ranked last. etofenprox at the rate of 400 g per acre showed highest percentage of larval population followed by *Bacillus* formulation 400 g per acre and dimethoate 100 g per acre (Selvanarayanan and Baskaran, 1999).

Ahuja (1999) conducted field experiment in Rajasthan during the kharif season of 1995-96 and reported that the estimated economic threshold level was calculated as 10 per cent plant damage and control could be achieved by using endosulfan.

Rai *et al.* (2001) conducted a study to evaluate the efficacy of dust formulation of six insecticides for the control of *A. catalaunalis* in sesame and reported that the dusts were applied twice at 35 and 50 days after sowing. Grain yield was highest (1156.9 Kg/ha) with 0.07 per cent endosulfan followed by 4 per cent phosalone (1136.3 Kg/ha) and then 4 per cent endosulfan, 5 per cent malathion and 1.5 per cent quinalphos (979.2-985.3 Kg/ha).

The effects of neem based formulation (NSKE, neemark, nimbicidin, neemta 2100, aniloguard plus and RD-9 repelin) on the population of insect pests of sesame variety Gujarat-1 were determined in a field experiment conducted in Varanasi, Uttar Pradesh during 1997-99. Among the various treatments tested, NSKE (5 per cent) was the most effective in reducing the pest population. Nimbicidin showed the most effective control on the capsule borer (Nath *et al.*, 2002).

Study on incidence of parasitoids *viz*., *Trathala flavoorbitalis* and *Apanteles* sp., was observed on *A. catalaunalis* at Vridhachalam. In Mandore village, it was observed that the predators like *Chrysoperla* and spider were predating on the early instars of *A. catalaunalis* and parasitoids like *T. flavoorbitalis* and *Bracon* sp., were parasitizing the larvae of *A. catalaunalis* (AICRP, 2003).

MATERIALS AND METHODS

The research work was carried out both in field and laboratory. The trials were conducted (Plate 1) in the Eastern farm of Pandit Jawaharlal Nehru College of Agriculture and Research Institute, Karaikal, during the year 2004-2005. The rearing of insect and the laboratory experiments were carried out in the Post Graduate Laboratory of the Department of Agricultural Entomology, PAJANCOA & RI, Karaikal.

3.1. Mass culturing of the sesame leaf webber.

Grown up larvae collected from the field around the Serumavilangai village and PAJANCOA & RI farm were transferred over the fresh sesame plants kept in 500 ml conical flask containing water to maintain the turgidity of the plants (Plate 2). The plants were secured with cotton plug so that they stand stiff and erect in the conical flask. The plants were replaced with fresh plants as and when required. The larvae grew and pupated in the plant itself. Pupae were collected and kept for observing the adult emergence. After the emergence of adults, they were sexed by observing the tips of abdomen and released in the mating cage, containing fresh sesame plants in the conical flask for oviposition and 10 per cent honey solution in cotton, dipped in a vial served as adult food. After the oviposition period, the plants containing eggs were collected and kept for hatching. The neonate larvae were transferred to the fresh plants using camel hair brush and the entire process was repeated to maintain the culture.

3.2. Field screening methodology

Fourty three entries of sesame germplasm were collected from various sources (Table 1) and raised under replicated condition with spacing of 30 x 30 cm. The unit plot size was 4.5 x 3 m (Plate 1). The design of experiment was Randomized Complete

Block Design. The recommended crop management practices were followed uniformly except plant protection. Row of resistance check SI 250 and susceptible check TC 25 was planted at every 5 m of plot or at every 12 rows of plant. After sowing, periodical observations were made on the crop to record the occurrence of pests. Observations of leaf damage were commenced on 10th day after sowing (DAS) and continued at every 10 days interval upto harvesting of the crop. Observation was made on 5 random plants in each row. Each replication consisted of a single row. Totally 15 plants were allowed to grow in a single row. The entries were screened against the shoot webber by using scoring technique. Based on the intensity of infestation, the following methodology was followed.

3.2.1. Leaf damage

Leaf damage by shoot webber was recorded on 10, 20, 30 and 60 DAS in three replications, five plants in each replication and per cent leaf damage was worked out based on the number of leaves damaged by shoot webber and the total number of leaves during different stages of crop.

3.2.2. Flower bud damage

The per cent bud damage caused by the caterpillar was recorded by observing the total number of flower buds and affected flowers buds at 45 DAS in three replications. Five plants in each replication were observed and mean per cent damage was worked out.

3.2.3. Pod damage

Number of pods damaged by the shoot webber was recorded at 60 and 80 DAS in three replications. Five plants in each replication were taken and per cent pod damage was worked out by counting total pods and affected pods in the randomly selected plants.

Damage assessed on different plant parts at various stages was converted to 1 to 9 score by referring score chart developed by Philip Sridhar and Gopalan (2002). Score chart (Table 2) was formulated based on intensity of damage. As the damage on reproductive parts like flower and pods is reflected more on yield than the leaves, least pod, lesser flower and more leaf damage were equated to a particular score. After arriving at the cumulative score based on per cent damage on leaf, flower or pod (Plate 3) for a particular entry, grade (1-9) was allotted by referring grade chart (Table 3) which was standardized based on the principles of standard evaluation technique followed for screening insect resistance in rice (Heinrichs *et al*., 1985). Resistance level ranging from highly resistant (HR), resistant(R), moderately resistant (MR), susceptible (S) and highly susceptible (HS) was arrived from the grade.

Procedure to evaluate the resistance level for a genotype (Eg.) having 8, 12 and 1 per cent leaf, flower and pod damage is described below.

Step 1: By referring score chart for leaf (8 per cent), flower (12 per cent) and pod (1 per cent) damage, the score 1, 5 and 1 are given.

Step 2: Cumulative score for the damages is calculated in 1 + 5 + 1 = 7 and mean cumulative score is arrived at 7/3 = 2.3

Step 3: Mean cumulative score 2.3 is referred to grade chart which falls in the group between >2 and 3 referring grade 5

Step 4: Grade 5 is read against the resistance level which represents the category, moderately resistant (MR).

3.3. Intensity of feeding on capsule

The intensity of feeding on capsule was quantified as per the following method. The damage in the locules directly affects the seed yield. In the case of multilocular capsule, whole capsule was considered as 100 per cent and per centage of damage was given based on the following (Table 4).

Number of locules fed by larvae	Per cent fed
1	25
2	50
3	75
4	100

Based on two types of data collected, score was given to categorise test entries into either resistant or susceptible.

$$\text{Cumulative score} = \frac{a+b}{2}$$

Where a = corresponding score for per cent leaf damage

b = corresponding score for per cent internal content of capsule fed.

3. 4. Field reaction of sesame genotypes at different crop stages

To judge the resistance reaction at the different crop stages (vegetative, flowering and maturation stages) the genotypes were categorized into resistant (R), moderately resistant (MR), moderately susceptible (MS), susceptible (S) and highly susceptible (HS) based on the mean per cent damage (Table 5). For that categorization, the data recorded on 30 DAS, 45 DAS and 80 DAS were taken to study the reaction at early, middle and later stages of crop. It was worked out in the first trial only, because in the second trial the pest incidence was less compared with first trial.

3.5. Mechanism of resistance

3.5.1. Ovipositional preference

Sesame lines exhibiting resistance or susceptibility in the screening programmes were tested for ovipositional preference to *A. catalaunalis* in laboratory under no choice conditions with three replications. For this experiment, small transparent mylar cages (20 x 10 cm) were used to cover the single sesame plant. The whole unit was placed under the wire net cage in controlled condition.

A pair of mated adults was released inside each cage and moths were replaced if any death occurred within five days. A 10 per cent honey solution was placed with cotton inside the mylar cage (Plate 4) to provide adequate nourishment to the egg laying adults. The eggs laid were recorded consecutively for 5 days.

3.5.2. Trichome density

Trichomes or hairs are glandular structure present in the sesame plant. To study the morphological basis of resistance, the genotypes showing resistance or susceptibility were examined for trichome density. On 25th day after seedling emergence, second leaf from each of the five randomly selected plants was sampled in each line. Standard procedure for clearing of the leaves for microscopic study was adopted for the observation of leaf trichome density as described by Maiti *et al*. (1980).

Leaf samples cut into segments of about 1-2 cm^2 were kept in 20 cc of water in small glass vials for 15 minutes and kept in an incubator at 85^o C. The water was poured off and 20 cc of 96 per cent ethyl alcohol was added and the boiling procedure was repeated for complete removal of chlorophyll from the leaf. The alcohol was again poured off and 20 cc of concentrated (90 per cent) lactic acid was added, the vials were stoppered and heated again at 85^{o} C until the leaf segments were cleared (approximately 15 minutes). The vials were cooled and stored for observation.

To observe the trichomes, leaf segments were taken from the stored vials and mounted on the clean slides using a drop of lactic medium and trichomes were observed under microscope at 450 X magnification. Number of trichomes per randomly selected microscopic field was counted. The over all mean of trichomes was calculated.

3.6. Antibiosis mechanism

Individual sesame lines were sown inside a wire net cage. Fifteen days after the emergence of plants, the newly emerged larvae from the laboratory culture were transferred with the help of moist camel hair brush @ 5 larvae per plant and covered with transparent mylar film cages. The accessions were replicated three times. The observations on larval and pupal development and weight were recorded from three plants from the date of release of larvae till pupation. Growth indices were calculated by dividing the per cent pupation with average larval period

$$\text{Growth index} = \frac{\text{Pupation rate}}{\text{Average larval duration}} \times 100$$

3.6.1. Biochemical analysis

To estimate the total phenols present in the leaves, flower buds and pod, the samples were collected from different germplasms from the top, middle and bottom parts of the plant and the pods from the different parts of the plant at 30, 45 and 60 DAS respectively and the pooled samples were taken for the analysis. The total phenols was determined by using colorimetric method (Thimmaiah, 1999).

3.7. Yield

To estimate the yield, five plants were selected in each entry and the single plant yield was calculated and finally it was converted into Kg / ha.

3.8. Statistical analysis

Data on the per cent leaf damage, flower bud damage and capsule damage were transformed to $\sin^{-1}\sqrt{x/100}$ units for statistical interpretation. Randomized Block Design (RBD) was followed for statistical analysis. Co-efficient of correlation was worked out to ascertain the relation between the trichomes in different genotypes and egg laying preference of the adult moth and total phenol present in different parts of the plant and intensity of damage of *A. catalaunalis* at different crop stages. If zero value was recorded, the per cent damage was transformed to ($\sqrt{x} + 0.5$) units for statistical analysis.

EXPERIMENTAL RESULTS

4.1. Field screening of sesame genotypes for resistance to *A. catalaunalis*

The data recorded on field screening of sesame genotypes for resistance to *A. catalaunalis* are presented in this chapter. A total number of 43 genotypes were screened for their reaction to sesame leaf webber under field condition at PAJANCOA & RI. The first trial was conducted during the months of June-Aug 2005. Second trial was conducted during July-Oct 2005 for confirmation of the performance of these genotypes.

4.1.1. Leaf damage at early growth stages.

The leaf damage was recorded from 10 DAS onwards and it showed significant variation among the 43 genotypes. In the 10^{th} DAS, the higher per cent leaf damage was recorded in the genotypes KMR 14 (20.00) followed by TMV 3 (16.66), KS 95010 (16.66) and KMR 95 (16.66) and the susceptible check TC 25 (16.66) (Table.6). The least incidence was recorded in the genotype TKG 22 (1.66) followed by PKDS 40 (3.33) and TKG 314 (3.33), MT-19-03 (3.33), RT 342 (3.33) and TKG 309 (3.33). Out of 43 genotypes, 12 did not show any pest incidence. The resistant check SI 250 and ES 22 also showed no damage at 10 DAS. The overall mean of per cent leaf damage was 6.72 at 10 DAS.

At 20 DAS, higher per cent leaf damage was recorded (Table.6) in the genotypes TMV 5 (35.87), MT-19-03 (35.00), KMR 95 (33.33), MT - 111 (31.66) and IC 42549 (32.93). A lower per cent damage was recorded in the genotypes *viz*., TCSI-94-20 (6.33) followed by TKG 22 (8.00), TKG 306 (8.85), LTK 4 (8.76), KMR 92 (9.92) and resistant check SI 250 (10.00). The per cent leaf damage recorded in the susceptible check TC 25 was 23.57. Among the 43 genotypes only 6 entries exhibited less than 10 per cent leaf damage. Remaining genotypes exhibited above the 10 per cent leaf damage. At 20 DAS no genotype was free from leaf webber infestation.

At 30 DAS, higher per cent leaf damage was recorded in the genotypes TKG 201 (27.00) and PKDS 40 (26.97) (Table.6). The per cent leaf damage in the resistant check SI 250 was 9.28 and in the susceptible check TC 25 was recorded as 20.22. The other genotypes *viz*., TKG 309 (8.49), CST 2001-3 (9.39), ES 22 (9.33) and UMA (9.42) also exhibited a lower level of damage at 30 DAS. Out of 43 genotypes, less than 10 per cent leaf damage was recorded in five genotypes. The overall mean of per cent leaf damage at 30 DAS was 16.85.

At 60 DAS, leaf damage per cent was maximum in the genotype IC 42549 (31.21) followed by PKDS 40 (29.47) and ES 34 (29.10). The least per cent leaf damage was (4.61) recorded in the resistant check SI 250 followed by ES 22 (6.61), UMA (7.67), TCSI-94-20 (7.91), KMR 14 (8.82), TKG 22 (8.88) and TKG 314 (9.93) (Table.6). The leaf damage per centage in the susceptible check, TC 25 was recorded as 19.50. The overall mean per cent leaf damage at 60 DAS was recorded as 17.23. Out of 43, 7 genotypes showed less than 10 per cent leaf damage. But only one genotype IC 42549 showed above 30 per cent damage at 60 DAS. In other genotypes 10 to 20 per cent range of leaf damage was recorded on an average.

The increasing trend of leaf damage was recorded from 10 DAS to 30 DAS, after the flowering and pod formation, the leaf damage was in decreased rate.

4.2. Flower bud damage at 45 DAS

The per cent flower bud damage was recorded at 45 DAS. The highest per cent flower damage was recorded in the genotype IC 42549 (31.33), followed by MT-111 (32.00), PKDS 40 (29.14), ES 34 (29.87) and TAC-89-309 (29.67) (Table.6). Lower rate of damage was seen in the genotypes UMA (4.24), ES 22 (4.61) and the resistant check SI 250 (4.95) and TCSI-94-20 (5.31) (Table 7). Among the 43 genotypes, 7 genotypes exhibited less than 10 per cent flower bud damage. At 45 DAS, the genotypes TKG 22 (8.88), KMR 14 (8.33), TKG 314 (9.93) and YLM 66 (9.28) recorded lower per cent flower bud damage. The overall mean flower bud damage was 18.30 per cent.

4.3.1. Pod damage at 60 DAS.

The per cent pod damage was recorded at 60 and 80 DAS. At 60 DAS higher per cent pod damage was recorded in the genotypes PKDS 40 (25.19) and MT-111 (23.17). Lower pod damage was recorded in the genotypes TKG 22 (3.41) followed by YLM 66 (3.71), KMR 14 (3.92), ES 22 (3.98) and the resistant check SI 250 (4.00) (Table 7). The per cent pod damage in the susceptible check TC 25 was recorded as 13.01. Out of 43 genotypes only 5 genotypes exhibited less than five per cent damage and 6 genotypes showed 5 to 10 per cent damage. Six genotypes exhibited above 20 per cent pod damage. The remaining genotypes showed a range of 10-20 per cent pod damage at 60 DAS. The overall mean of pod damage was maximum (12.69) at 60 DAS.

4.3.2. Pod damage at 80 DAS.

Per cent pod damage was recorded before the harvest of the crop at 80 DAS. The higher pod damage was recorded in the genotype LTK 4 (20.13), followed by TAC-89-309 (18.51), PKDS 40 (17.45) and MACSS 1 (15.34). The lower pod damage was recorded in the genotype TKG 22 (2.70), followed by UMA (3.26), VRI 1 (3.44), KMR 14 (3.68), ES 22 (3.73) and in the resistant check SI 250 (3.84) (Table.7). Out of 43 genotypes, 6 genotypes exhibited less than 5 per cent pod damage at 80 DAS and 22 genotypes exhibited pod damage between 5 to 10 per cent and remaining genotypes exhibited above 10 per cent pod damage at 80 DAS. The over all mean of pod damage was 5.62 at 80 DAS.

4.4. Grading of sesame genotypes for resistance to *A. catalaunalis*

The per cent leaf, flower bud and pod damage were recorded at 30, 45 and 80 DAS respectively. Based on the per cent mean damage, the score was given individually at each stage of the genotypes as described in Table.2. By referring the score chart, the cumulative score was calculated and the reaction of genotype was graded based on the cumulative score by referring grade chart.

The least mean score was recorded in the resistant check SI 250 (1.66) (Table 8). Genotypes ES 22 and UMA recorded 1.66 score showing a corresponding grade 3.0 to the respective score. Based on the grading, the genotypes *viz*., SI 250, ES 22 and UMA exhibited resistant reaction to *A. catalaunalis*. Among the 43 genotypes, TKG 22 and KMR 14 were designated as moderately resistant to *A. catalaunalis.* The mean score was recorded as 3.0 and the grade for corresponding score was given as 5.0.

The genotypes *viz*., TKG 314, TCSI-94-20 and YLM 66 exhibited a susceptible reaction to *A. catalaunalis* in the field. The recorded score was 3.6 and the grade was 7.0. The genotypes JCS 399, TKG 309, CST 2001-3 exhibited a susceptible reaction and the remaining 32 genotypes were classified as highly susceptible. A higher mean score was recorded in the genotypes *viz*., PKDS 40, LTK4, MT-19-03, MT-20-03 and VS 9701. The susceptible check TC 25 had a score of 7.6 and grade of 9.0. The high level of differential reaction was seen among the 43 genotypes to the damage by *A. catalaunalis*.

4.5. Field reaction of sesame genotypes at different crop stages.

To judge the resistance reaction at different crop stages (vegetative, flowering and maturation), the genotypes were categorized into resistant (R), moderately resistant (MR), moderately susceptible (MS), susceptible (S) and highly susceptible (HS) based on the mean per cent damage as described in Table 5. For that purpose, the data recorded on 30, 45 and 80 DAS were taken to see the reaction at early, middle and later stages of crop.

4.5.1. Field reaction at vegetative stage (30 DAS)

The genotypes exhibiting less than 10 per cent leaf damage were categorized under the resistant genotypes. The genotypes SI 250, ES 22, UMA, TKG 309 and CST 2001-3 were found to be resistant to *A. catalaunalis* at the early stage of the crop. Out of 43 genotypes, only 5 genotypes exhibited resistance (Table.9) in the early stage of growth. The overall mean leaf damage was recorded as 9.18 per cent.

The genotypes exhibiting 10 to 20 per cent leaf damage were categorized as moderately resistant (Table 9). Out of 43 genotypes, 20 were found to be moderately resistant. Among them, TKG 22 and KMR 14 were found to be moderately resistant in overall grading. The overall mean leaf damage was recorded as 13.95 per cent.

The genotypes exhibiting 20 to 30 per cent leaf damage were categorized under susceptible group and 18 genotypes were found to be susceptible. The susceptible check TC 25 and TMV 3, TMV 4, TMV 5, TMV 6, VRI 1, VS 9701 and KS 95010 were found to be susceptible at early stage. The overall mean damage of susceptible genotypes was recorded as 22.22 per cent. The genotypes exhibiting damage above 30 per cent at early stage were categorized under highly susceptible group. No entries were recorded as highly susceptible at early stage.

4.5.2. Field reaction at flowering stage (45 DAS)

The genotypes exhibited less than 5 per cent flower bud damage at 45 DAS was categorized under resistant group. Out of 43 genotypes, SI 250, ES 22 and UMA were found to be resistant (Table 10). The overall mean flower bud damage was recorded as 4.6 per cent. There were 5 genotypes exhibiting flower bud damage between 5 to 10 per cent and were categorized under moderately resistant group. Among these, TKG 22 and KMR 14 were found as moderately resistant at final scoring. The overall mean was 8.35 for moderately resistant genotypes.

The genotypes had flower bud damage between 10-15 per cent were categorized under moderately susceptible group. There were 6 genotypes recorded as moderately susceptible with the overall mean of 13.16 per cent.

The genotypes exhibiting flower damage between 16 to 20 per cent were categorized under susceptible group. Out of 43 genotypes, 13 were recorded as susceptible. The overall mean of susceptible group was recorded as 17.96 per cent.

There were 16 genotypes exhibiting more than 20 per cent flower damage were designated under highly susceptible group. The susceptible check TC 25 showed highly susceptible at 45 DAS and the overall mean of highly susceptible group was recorded as 24.04 per cent.

4.5.3. Field reaction at maturation stage (80 DAS)

The reaction of sesame genotypes at 80 DAS was categorized based on the per cent pod damage by *A. catalaunalis.* The genotypes exhibiting less than 5 per cent pod damage were classified under resistant group at 80 DAS. The genotypes *viz*., SI 250, ES 22, UMA, VRI 1, KMR 14 and TKG 22 were found to be resistant at 80 DAS (Table 11). The overall mean damage of resistant genotypes was recorded as 3.45 per cent.

Out of 43 genotypes, 22 were categorized under moderately resistant group. They were showing mean pod damage between 6 to 10 per cent. The overall mean of moderately resistant genotypes was found to be 7.58 per cent. There were 10 genotypes exhibiting pod damage between 11 to 15 per cent and they were grouped under moderately susceptible group. The susceptible check TC 25 was designated as moderately susceptible and the overall mean damage of moderately susceptible genotypes was registered as 11.84 per cent.

Only 4 genotypes recorded pod damage between 15 to 20 per cent and were categorized under susceptible group. The overall mean damage of susceptible genotypes were recorded as 16.79 per cent. There was one genotype, LTK 4 exhibiting maximum pod damage (above the 20 per cent) and came under highly susceptible group. The over all mean damage was recorded as 20.13 per cent.

4.6. Field screening of sesame genotypes for resistance to *A. catalaunalis* (II trial)

Among the 43 genotypes screened in the first trial, the genotypes showing resistant, moderately resistant, susceptible and highly susceptible reactions were considered for second trial. Thirty one genotypes selected in such manner, same criteria were followed as in the first trial to screen the 31 genotypes. A significant variation was noticed among the genotypes infested by *A. catalaunalis* throughout the study.

4.6.1. Leaf damage at early stages of crop.

The per cent leaf damage was recorded from 10 DAS onwards. At 10 DAS the maximum damage was recorded in the genotype KS 95010 (17.00 %) followed by susceptible check TC 25 (12.84 %) and TMV 6 (12.65 %). The least damage was recorded in the genotype RT 343 (3.22 %) followed by UMA (3.33 %). Out of 31 genotypes tested, 14 were found free from leaf webber incidence at 10 DAS (Table12).

At 20 DAS, a maximum per cent leaf damage was recorded in the variety TMV 5 (20.96) followed by TC 25 (19.28) and VRI 1 (17.86). The least damage was recorded in the genotype YLM 66 (2.14 %) followed by UMA (3.88 %). Out of 31 genotypes, only two genotypes YLM 66 and UMA exhibited less than 5 per cent leaf damage and 14 genotypes had shown the leaf damage between 5 to 10 per cent. The other had registered above 10 per cent leaf damage at 30 DAS.

At 60 DAS, maximum per cent leaf damage was recorded in the genotype TKG 201 (19.22) which was more than the susceptible check TC 25 (16.34). The least damage was recorded in the genotypes ES 22 (1.67) and SI 250 (1.68.) There was a general decrease in the trend of leaf damage per centage noticed from 30 DAS to 60 DAS (Table12). The over all mean per cent leaf damage was recorded in the genotypes

TC 25 (14.15), TMV 5 (11.90) and TMV 6 (11.75). The lower mean per cent leaf damage was recorded in genotypes SI 250 (2.28), ES 22 (2.58), YLM 66 (3.04) and UMA (3.73).

4.6.2. Flower bud damage

The per cent flower bud damage was recorded in various genotypes at 45 DAS. The leaf webber incidence was noticed in all the genotypes at flowering stage. A significant variation was observed among the genotypes having leaf webber infestation (Table13). The maximum per cent flower bud damage was seen in the genotypes TC 25 (15.29), JCS 399 (13.36) and TMV 6 (12.37). The least damage was found in ES 22 (2.43) and UMA (3.07). The resistant check SI 250 exhibited 5.57 per cent flower bud damage at 45 DAS.

4.6.3. Pod damage.

The per cent pod damage was recorded in two spells at 60 and 80 DAS. Maximum infestation was noticed at 60 DAS when compared to 80 DAS.

At 60 DAS, maximum pod damage was recorded in the genotype TKG 356 (14.86), where as in LTK 4 and MACSS 1, this was 10.24 and 10.07 per cent respectively. The least per cent pod damage was recorded in the genotype, YLM 66 (1.25). Out of 31 genotypes, less than 5 per cent pod damage was recorded in 9 genotypes (Table13).

At 80 DAS, the maximum per cent pod damage was recorded in the genotype TMV 3 (4.27) followed by the susceptible check TC 25 (4.04). All the other genotypes exhibited less than 5 per cent pod damage at 80 DAS. The least damage was recorded in the genotype ES 22 (1.28) followed by SI 250 (1.29), YLM 66 (1.94) and UMA (2.03).

4.6.5. Grading of sesame genotypes based on the leaf, flower and pod damaged by *A. catalaunalis*.

To find out the reaction of sesame genotypes to *A. catalaunalis*, the standard scoring technique was followed as described in Table 2. The score was given individually for per cent leaf, flower and pod damage at 30, 45 and 60 DAS and the grade was given based on the cumulative score. The reaction of sesame genotypes was noticed by referring the grade chart as described in methodology.

Among the 31 genotypes, ES 22 was identified as highly resistant (HR) with the grade 1. The genotypes SI 250, YLM 66 and UMA showed resistance reaction in the second trial. Among these the genotype YLM 66 exhibited susceptible reaction in the first screening trial. But SI 250 and UMA exhibited resistance in first trial also and they had the cumulative score of 1.6 and grade 3 (Table 14).

Among the 31 genotypes, 6 were recorded as moderately resistant group, based on scoring. The genotypes TKG 307, KMR 14, VS 9701, RT 343, TKG 22 and ES 34 were recorded as moderately resistant. In these the genotypes KMR 14 and TKG 22 exhibited moderate resistance in both the trial and 19 genotypes exhibited susceptible reaction in second trial. The susceptible TC 25 was recorded highly susceptible at second screening trial.

Compared with the first trial the pest infestation was minimum especially in the early crop stages. But in the flowering stage, the infestation was more or less same as that of the first trial. In the first trial, no entry was recorded as highly resistant (HR).

But in the second trial the genotype ES 22 was noticed as highly resistant. Only 2 genotypes were classified as moderately resistant in first trial but in the second trial 6 genotypes came under that category and only one genotype TC 25 was found to be highly susceptible in the second trial.

4.7. Damage intensity of *A. catalaunalis* in sesame genotypes

Grading of sesame genotypes based on the damage intensity was carried out by using per cent leaf damage at 30 DAS and internal content of capsule fed by larvae (locules damage) as described in Table 4. Based on the intensity of damage, the reaction of sesame genotypes was recorded.

4.7.1. Internal content of capsule fed (locule damage)

Based on the number of locules fed by the larvae at 60 DAS, per cent internal content of capsule damage was recorded. A maximum internal content damage was found in the genotype MACSS 1 (37.76) followed by susceptible check TC 25 (37.14) (Table 15). The least per cent internal content of capsule damage was seen in genotypes ES 22 (4.98) and in the resistant check SI 250 (6.00). Out of 43 genotypes, only two genotypes exhibited less than 10 per cent damage. The genotype ES 22 showed less than 5 per cent damage. The genotypes TKG 22, UMA, KMR 14, YLM 66 and TKG 314, the per cent internal content of capsule fed were 11.14, 10.92, 13.74, 11.12 and 12.38 respectively. The over all mean of capsule fed was recorded as 23.16 per cent.

4.7.2. Grading of sesame genotypes based on the damage intensity.

Scoring was done individually for each genotype based on leaf damage (per cent) and internal content of the capsule fed (per cent) by referring score chart as described in the methodology, (Table 4). The mean of score was calculated and graded based on the corresponding cumulative score as referred in the grade chart.

A least score was recorded in the genotype ES 22 (1.0), followed by SI 250 (3.00). The grade for corresponding scores for ES 22 and SI 250 were 1 and 2 respectively.

Among the 43 genotypes, ES 22 showed a highly resistant reaction against the *A. catalaunalis*. The genotypes SI 250 and UMA exhibited resistace reaction in the field (Table 15). The genotypes *viz*., LTK 4, TKG 314, TCSI-94-20, KMR14, KMR 85, KMR 79, KMR 75, KMR 92, KMR 95, YLM 66, JCS 399, TKG 309, CST 2001-3, TKG 22 and ES 34 were moderately resistant to *A. catalaunalis* in the field. Fifteen genotypes had the grade of 5.0 and other showed susceptible reaction.

4.8. Mechanism of resistance

4.8.1. Ovipositional preference

The significant variation was observed among the genotypes studied for ovipositional preference. The range of egg laying was recorded between 12.33 ± 2.33 and 31.00 ± 1.73.The genotypes classified as highly resistant (HR), resistant (R), moderately resistant (MR), susceptible (S) and highly susceptible in the field condition were further tested intensively for the ovipositional preference by *A. catalaunalis* under no choice condition with susceptible and resistant checks.

Twenty one genotypes were selected for this purpose. Out of them, only 3 genotypes were less preferred for oviposition than the other genotypes. A least number of eggs were laid in the genotypes UMA (12.33 ± 2.33), SI 250 (13.67 ± 2.03), KMR 14 (14.67 ± 0.88) and ES 22 (16.33 ± 2.33) (Plate 5 and Plate 6). Among these the genotypes, SI 250, ES 22 and UMA were resistant and KMR 14 was moderately resistant to *A. catalaunalis.* But a maximum preference for egg laying was seen in the genotypes KMR 85 (31.00 ± 1.73), KMR 79 (27.67 ± 4.91) and KMR 95 (25.33 ± 1.45). These genotypes were highly susceptible to *A. catalaunalis* reaction in the field. The overall mean number of eggs laid per plant was 19.69 (Table 16).

Grouping of sesame genotypes based on the ovipositional preference and field reaction is presented in Table 17.Out of 21 genotypes, 3 genotypes SI 250, ES 22, UMA exhibited resistance in the field screening. The overall mean number of eggs laid in these resistant genotypes was recorded as 14.11 eggs per plant per adult (Table17). Genotypes exhibited moderately resistance in the field had the over all mean of 13.67 eggs per plant per adult.

The genotypes TKG 314 and YLM 66 exhibited susceptible reaction to *A. catalaunalis* and the over all mean number of eggs laid by a female was 17.83 per plant per adult. The genotypes exhibiting highly susceptible field reaction (HS) had a mean of 22.02 eggs per plant per adult. The resistant genotypes were less preferred for egg laying as compared to the susceptible genotypes.

4.8.2. Morphological basis of resistance

The leaves of the sesame genotypes utilized for ovipositional preference were examined for trichomes. The number of trichomes present on the lower side of leaves was observed under compound microscopic field (450 X). The range of trichomes was recorded between 7.67 ± 1.15 to 49 ± 4.93.

Among the 21 genotypes with different reactions to shoot webber, TC 25, SI 250, ES 22 and KMR 14 were less preferred for oviposition and also had a lower number of trichomes 7.67 ± 1.15, 9.00 ± 1.73, 11.33 ± 1.20 and 10.00 ± 3.18 respectively. The genotypes SI 250 and ES 22 were resistant and KMR 14 was moderately resistant in the field. A higher number of trichome density was recorded in the genotype KMR 79 (49.00 ± 4.93) followed by KMR 85 (31.66 ±2.02) and KMR 95 (29.33 ± 1.85) which was susceptible in the field. The overall mean of trichome density was recorded as 17.69 (Table 18).

Out of 21 genotypes, the genotypes resistant in the field *viz*., SI 250, ES 22, UMA had the over all mean number of 11.11 trichomes (Table 19) and the genotypes TKG 22 and KMR 14 moderately resistant in the field and had the overall mean number of 10.89 trichomes. The susceptible genotypes had the over all mean of 19.49 trichomes per microscopic field.

A minimum number of trichomes were recorded in the genotypes exhibiting resistant and maximum number of trichomes was recorded in the susceptible genotypes. Which may one of the reasons for higher number of egg laying.

4.8.3. Antibiosis for larval development

The data on various developmental parameters of *A. catalaunalis* on different genotypes are presented in Table 20. The larval period, larval weight and larval length were adversely affected in the resistant entries. The larvae were found to be healthiest possessing the highest weight TMV 6 (26.16 ± 0.99 mg) and length 14.17 ± 0.14 mm but lesser larval period 9.00 ± 0.27 days was recorded in the genotype TC 25 which was highly susceptible reaction in the field.

4.8.3.1. Larval duration/period

Out of 21 genotypes tested, the resistant check SI 250, ES 22, TKG 22, UMA and KMR 14 having the highest larval period 12.25 ± 0.19, 11.50 ± 0.22, 11.30 ± 0.25, 11.30 ± 0.20 and 10.40 ± 0.37 days respectively. The least larval period was recorded in the susceptible check TC 25 (8.70 ± 0.34 days) followed by TMV 5 (9.00 ± 0.22 days) and TMV 6 (9.00 ± 0.27 days). Among these genotypes SI 250, ES 22 and UMA exhibited resistant reaction and TKG 22 and KMR 14 were found moderately resistant in the field (Table 20).

4.8.3.2. Larval length

The larval length was found to be less in the genotype ES 22 (9.83 ± 0.13 mm) followed by TKG 22 (10.23 ± 0.03 mm) and the resistant check SI 250 (10.27 ± 0.12 mm). The susceptible check TC 25 recorded higher larval length of 14.17 ± 0.06 mm followed by TMV 6 (14.17 ± 0.14 mm) (Table 20).

4.8.3.3. Larval weight

Among the 21 genotypes the maximum larval weight was recorded in TMV 6 (26.16 ± 0.99 mg per larva). The least larval weight was recorded in the resistant genotypes *viz*., SI 250 (13.48 ± 0.24 mg) followed by ES 22 (16.42 ± 0.28 mg) (Table 20).

4.8.3.4. Pupation rate

The per cent pupation was maximum in the variety TMV 4 (80.00) having susceptible reaction in the field. The varieties TMV 5 (78.57) and TMV 6 (76.92) also exhibited highest pupation rate. The least pupation rate was recorded in the genotype

ES 22 (33.33 %) followed by resistant check SI 250 (35.71 %) and TKG 22 (38.46 %). The per cent pupation rate was found to be 73.33 in the susceptible check TC 25 (Table 20).

4.8.3.5. Growth Index

Growth index was found to be maximum in the highly susceptible genotypes TMV 4 (8.79 %) followed by other genotypes TMV 5 (8.73 %) and TMV 6 (8.54 %). Growth index in susceptible check TC 25 was found to be (8.42 %). The resistant genotypes SI 250, UMA and ES 22 exhibited least growth indices of 2.91, 4.08 and 2.89 respectively (Table 20).

The moderately resistant genotypes TKG 22 and KMR 14 had the growth index of 3.40 % and 5.61 % respectively. The over all mean of larval duration, larval length, larval weight, pupation rate and growth indices of resistant genotypes were recorded as 11.68 days, 10.44 mm, 16.21 mg, 38.39 % and 3.29 % respectively. The genotypes found as moderately resistant in the field had the over all mean of 10.85 days, 11.33 mm, 9.10 mg, 48.39 % and 4.51 % respectively (Table 21).

The larval duration was maximum in the resistant genotypes. The larval length was less in resistant genotypes when compared with the larvae fed on susceptible genotypes. The larval weight was also minimum in the resistant genotypes. A minimum pupation rate and less growth indices were shown by the larvae fed with resistant genotypes.

The larval duration in the susceptible genotypes was 9.55 days, the mean larval length was 13.21 mm, mean larval weight was 21.95 mg with a higher pupation rate of

65.71 per cent and the growth index was 6.88 in susceptible genotypes and all these were higher than the resistant check SI 250 (Table 21).

4.9. Bio chemical basis of resistance

Phenol is the one of important biochemical compounds that imparts resistance against pests and diseases. To find out the biochemical basis of resistance, the total phenol content was estimated in the genotypes showing resistance, moderate resistance, susceptibility and high susceptibility reactions in the field. The samples were collected from different parts of the plant *viz.*, leaf, flower and pod and used for estimation.

4.9.1. Total phenol in leaf

Out of 14 genotypes studied, the maximum amount of total phenol was recorded in the resistant genotype ES 22 (1.907 g / 100 g). It was higher when compared with susceptible check TC 25 (0.703) in leaves (Table 22).

4.9.2. Total phenol in flower.

The maximum amount of phenol was recorded in the genotype ES 22 (2.19) g/100 g followed by resistant check SI 250 (2.12). It was higher when compared with the phenol content in leaf. The susceptible check TC 25 had 0.537 g / 100 g phenol (Table 22).

4.9.3. Total phenol in pod

In the pod, maximum amount of total phenol was recorded in the genotype ES 22 (1.803 g /100 g).

It was noticed that the presence of phenol imparts resistance. The genotypes reacted resistant to *A. catalaunalis* had higher amount of total phenol when compared with susceptible genotypes (Table 22).

The over all mean of genotypes (ES 22, SI 250 and UMA) reacted resistant in the field had the quantity of phenol 1.965, 1.764 and 1.543 g per 100g of leaf, flower and pod respectively. The significant variation was noticed among the genotypes. The genotypes (ES 22, SI 250, UMA) showing resistance to *A. catalaunalis* had higher amount of phenol than the susceptible genotypes (Table 23).

4.10. Yield

The significant variation in the yield was noticed among the genotypes. In the I trial, the maximum yield was recorded in the genotypes YLM 66 (655 Kg / ha) followed by susceptible variety VRI 1 (772 kg / ha) (Table 8 and Table 14). In the second trial maximum yield was recorded in the genotypes YLM 66 (571 Kg / ha) followed by susceptible variety VRI 1 (595 kg / ha).

The yield recorded in the genotype exhibited high resistance (HR) ES 22 was (337.00 kg/ha) and resistant check SI 250 yielded 285.00 kg / ha. The yield recorded in susceptible check, TC 25 was 291.70 kg / ha. The minimum quantity of yield recorded in the genotype, MACSS 1 was 197.70 kg / ha.

DISCUSSION

The results of the present study about the resistance of various genotypes to sesame leaf webber, *A. catalaunalis* are discussed here under the topics *viz*., field screening for resistance to *A. catalaunalis*, ovipositional preference of *A. catalaunalis*, and role of trichome density in resistance, antibiosis due to phenolic content and growth index of larva of *A. catalaunalis* in different genotypes.

5.1. Field screening of sesame genotypes for resistance to *A. catalaunalis*.

The sesame leaf webber and capsule borer affected almost all parts, *viz*., leaves, flower buds and pods of the plant. The screening was done based on the scoring methodology developed by Philip Sridhar and Gopalan (2002). Vasiler and Bacnobe (1935) stated that, even though *A. catalaunalis* affected all the parts, the damage caused by the sesame leaf webber to flower buds and pods was considered important from the point of view of yield.

Among the 43 genotypes raised in the I trial, a minimum leaf damage was seen in the following order SI 250 > TKG 22 > TKG 22 > TKG 314 > TCSI-94-20 > TMV 4 > VRI 1 > ES 22 > UMA > VS 9701 and YLM 66 at 10 DAS. The higher damage was noticed in TMV 5, TMV 6, TMV 3, KS 95010, TC 25 and KMR 14 (Fig. 1).

During the II trial, the leaf damage was lower in the genotypes *viz*., TKG 356, TCSI-94-20, YLM 66, TKG 307, KMR 14, SI 250, ES 22, ES 34 and RT 343. The genotypes TKG 22, UMA, TC 25, VRI 1, TMV 3, VS 9701 and KS 95010 showed higher damage. In both the trails, the leaf infestation was lesser in the genotypes SI 250, ES 22, TCSI-94-20 and YLM 66 and due to this consistency, they were designated as resistant to *A. catalaunalis* at vegetative stage (Fig. 2). VRI I, TC 25 and

KS 95010 showed susceptible reaction to leaf webber at early stages. The genotype KMR 14 showed more leaf damage during I trial but it was observed with lesser leaf damage in the II trial. The higher per cent leaf damage during I trial might be due to high pest load during June.

The genotypes TC 25 and VRI 1 showing higher leaf damage and TKG 307 showing least infestation at vegetative stage was reported in the annual report of AICRP (S & N) (2003).

In the present investigation, the pest incidence was less in the II trial than the I trial. It might be due to seasonal variation. Saroja (2004) also reported that the sesame leaf webber population was higher during June sown crop than July sown crop while studying the seasonal abundance of this pest in Karaikal region with the popular variety TMV 3.

The observation of per cent leaf damage taken on 20 DAS in the I trial showed lower incidence in the genotypes TC SI- 94 -20, TKG 22, SI 250 and ES 22 and higher damage in the TC 25, TMV 4, UMA, VS 9701 and KMR 14. In the II trial, least infestation was noticed in the genotypes YLM 66, SI 250, ES 22, UMA, KMR 14 and TKG 356. The genotypes, TMV 4, VS 9701 and TC 25 showed the higher damage. In both the trials, SI 250 and ES 22 were noticed as resistant at 20 DAS (Fig. 1).

The genotypes SI 250 and ES 22 showing high resistance and TMV 4 showing high susceptibility reaction to *A. catalaunalis* were earlier reported by Mahadevan (1988).

The per cent leaf damage at 30 DAS observed in different genotypes SI 250, ES 22 and UMA raised in the I trial on 30 DAS was lower. .A maximum leaf damage was noticed in TCSI-94-20, TKG 22, KMR 14, YLM 66, TKG 314, TC 25, VS 9701, VRI 1, TMV 3, TMV 4, TMV 5, KS 95010 and TMV 6. In the second trial lesser leaf damage was observed in genotypes YLM 66 and UMA. In both the trials, the genotypes SI 250, ES 22, TKG 22 and UMA showed the promising reaction at vegetative stage. It might be due to the presence of higher phenol content compared with other susceptible and highly susceptible genotypes (Table 22).

The genotypes TKG 22, UMA and SI 250 showing resistance to *A. catalaunalis* was reported in AICRP (S & N) (2003) and the genotypes TMV 3, TMV 4, TMV 5, TMV 6 and TC 25 showing higher leaf damage was earlier reported by Muralibaskaran *et al*. (1994). The same trend was noticed in the present investigation also.

The per cent flower damage recorded at 45 DAS showed the higher damage of *A. catalaunalis* in the susceptible check TC 25 and lesser flower bud damage in ES 22, UMA, SI 250, KMR 14, TKG 22 and YLM 66 in both the trials. The genotypes TMV 3, TMV 4, TMV 5, KS 95010, VS 970 and VRI 1 showed higher damage in both the trials (Fig. 3 and Fig. 4).

The genotypes TMV 3 and VRI 1 showing higher flower bud damage was reported in AICRP (S & N) (2003). The data recorded at various stages in the present investigation showed that the leaf damage was in decreasing trend from the 30 DAS to 60 DAS. It might be due to the nutritional changes in the plant from vegetative stage to maturation stage. After the 30 DAS, the larvae started feeding the flower buds and pods. That might be the reason for lesser leaf damage. Gurdip Singh (1987) revealed that the number of larvae was maximum during initial stage and it was steadily decreasing upto maturity. This may be attributed due to the changes in the nutritional status of the crop because of physiological and phenological changes in different stages of the crop.

In both the trials, over all mean per cent of flower bud damage was minimum in the genotypes SI 250, ES 22, TKG 22 and UMA. This resistant reaction might be due to presence of higher phenolic content when compared with susceptible genotypes (Table 23).

At 60 DAS, in both the trials the lesser leaf damage was noticed in the genotypes SI 250, ES 22, UMA, TKG 22 and KMR 14. The genotypes TMV 3, TMV 4, TMV 5, TMV 6 and TC 25 showed the higher leaf damage in the all crop stages (Fig. 3 and Fig. 4). It indicates the absence of resistant mechanism and if one because of the phenol content. All these genotypes are showing lower phenol content in all stages of crop growth than others (Table 22). Hence this may be attributed for higher attack by the pest.

In both the trials, per cent pod damage recorded at 60 and 80 DAS was lower in the genotypes TKG 22, SI 250, YLM 66 and UMA. The resistance shown by the genotype UMA, SI 250 and TKG 22 and the tolerance in YLM 66 was earlier reported in the AICRP (S & N) (2003) and confirms our findings too.

5.2. Field reaction at different crop growth stages

To judge the reaction of sesame genotypes on various crop stages, the categorization was done based on the mean per cent damage at vegetative, flowering and maturation stages was earlier attributed by Gupta (2004).

In the present investigation, the data recorded during vegetative (30 DAS) and flowering (45 DAS) stages, the genotypes SI 250, ES 22 and UMA showed resistance and the genotype CST 2001-3 was found resistant at vegetative stage (Fig. 5 and Fig. 6). The genotype, SI 250 showing resistance at vegetative stage was also earlier reported by Gupta (2004) and the genotype, CST 2001-3 showing tolerance to *A. catalaunalis* was reported in AICRP (S & N) (2003).

In the maturation stage, the genotypes UMA, ES 22, SI 250 and VRI 1 are classified as resistant (Fig. 7) and TKG 22 under moderately resistant. Among these, the genotype VRI 1 showed the susceptible reaction at vegetative and flowering phase. It might be due to the changes in the phenolic content at maturation stage, which acted as a tolerant mechanism.

Thangavelu *et al*. (1987) reported that the genotypes ES 22 and SI 250 were found to be resistant to the leaf webber and capsule borer at vegetative as well as pod stages. The same reaction was noticed in the present investigation also at vegetative and maturation stages.

The genotype CST 2001-3 showed resistance at vegetative stage, but it was categorized as susceptible genotypes during flowering and maturation phases. It might be due to host evasion or escapism in the vegetative stage.

5.3. Grading of sesame genotypes based on the leaf, flower and pod damage.

The reaction of sesame genotypes against *A. catalaunalis* was graded based on the scoring methodology developed by Philip Sridhar and Gopalan (2002).

In the I trial, among 43 genotypes, SI 250, ES 22 and UMA showed resistance to *A. catalaunalis* having the mean score of 1.6 and corresponding grade 3. The genotypes, TKG 22 and KMR 14 were found as moderately resistant having a score of 3 and grade 5. The highest score (7.6) was recorded in the susceptible check TC 25. The genotypes, TKG 314, YLM 66, VRI 1 and TCSI-94-20 showed the susceptible reaction with the score of 3.6 and grade 7. TMV 3, TMV 4, TMV5 and TMV6 were classified as highly susceptible with a maximum score of 7 and grade 9 (Fig. 8).

In the II trial, the incidence of *A. catalaunalis* was lesser when compared with that of I trial. The genotype ES 22 was classified as highly resistant with the score of 1 and grade 1 in the II trial but as resistant in I trial because of lower pest incidence (Fig. 9). In both the trials, the genotypes SI 250, UMA and ES 22 were found as resistant and TKG 22 and KMR 14 were classified as moderately resistant. The genotypes TKG 307, ES 34, KMR 14, TKG 22, RT 343 and VS 9701 showing susceptible reaction in the I trial were categorized under moderately resistant in the II trial. This might be due to the escapism of genotypes from the leaf webber infestation and seasonal variation in the incidence of pest. The genotype UMA showing least capsule borer incidence was earlier reported by Patra (2001).

The resistance nature of the genotypes SI 250 and ES 22 to *A. catalaunalis* was reported by Manisegaran *et al*. (2001) and Singh (2002). The genotype UMA showing resistance and TKG 22 showing moderate resistance to *A. catalaunalis* were earlier reported in AICRP (S & N) (2004).

The genotypes SI 250 and ES 22 showed resistance reaction and this may be attributed to the presence of less number of trichomes (Table 18) and higher phenolic content. Hence, a less ovipositional preference and a lower growth index was shown by the sesame leaf webber, *A. catalaunalis* resulting in lower damage.

Philip Sridhar and Gopalan (2002) reported that the genotypes SI 1115, ES 22 and SI 250 and the wild species *S. alatum* showed resistance to *A. catalaunalis* under caged condition and the genotype TMV 3 was susceptible to *A. catalaunalis*. The same trend was noticed in the present investigation also.

The susceptible nature of genotypes TMV 3, TMV 4, TMV 5, VRI 1 and KS 95010 might be due to the absence of antibiosis, which was because of less phenol content (Table 22).

Bhattacharjee and Rattan Lal (1962) reported that an early maturing variety with sparse branching shows lower susceptibility to *A. catalaunalis* than more profusely branching type. The varietal differences in susceptibility may also be due to the differences in the time of maturity and external morphological characters of the varieties than the biochemical characters.

5.4. Grading of sesame genotypes based on the damage (locule damage) intensity.

The damage intensity due to *A. catalaunalis* was worked out by recording the locule damage. The scoring methodology was earlier developed by Muralibaskaran *et al*. (1994).

In the present investigation, the genotype ES 22, SI 250 and UMA were noticed as resistant based on the locule damage and the genotypes TKG 22, KMR 14, KMR 75, KMR 79, KMR 85, KMR 92, KMR 95, YLM 66, TKG 314 and TCSI-94.20 were noticed as moderately resistant (Fig. 10).

The capsule borer, just make a small bore and fed a least amount of internal content in the resistant genotypes, ES 22 and SI 250 which exhibited resistance. But it was higher in the susceptible check, which indicated the non preference / or biochemical factors present in the resistant genotypes. Hence, it could be inferred that the less trichome numbers and higher phenol content play major role in conferring resistance to *A. catalaunalis.*

Muralibaskaran *et al*. (1994) reported that the pod borer larvae did not prefer the internal content of capsule of *S. alatum,* which was highly resistant to *A catalaunalis* and the genotypes ES 22 and SI 250 exhibited just nibbling of the capsule and later a cessation of feeding which indicated a non preference factor both *in vivo* and *in vitro* screening.

The genotypes *viz*., KMR 85, KMR 79, KMR 75, KMR 92, KMR 95, KMR 14, YLM 66, TKG 314, TCSI-94-20 and TKG 22 were moderately resistant having a score between 5 and 7 and the susceptible check TC 25 showed higher locule damage. This might to due lower amount of phenol and absence of antibiosis.

5.5. Ovipositional preference of *A. catalaunalis*

The ovipositional preference of *A. catalaunlis* was studied under no choice condition. Among the 43 genotypes 21 were selected for this study. The lesser number of eggs laying (Fig. 11) was recorded in the genotypes UMA, SI 250, TKG 22, KMR 14 and ES 22 which might be due to the presence of antibiosis and / or less number of trichomes in the leaf. The over all mean number of eggs laid was minimum in the genotypes UMA, SI 250, and ES 22, those showed resistance to *A. catalaunalis*. The highly significant positive correlation (r = 0.749) was noticed between the trichomes on the leaf and eggs laid by adult moth (Fig. 12).

Singh (2002) reported that the ovipositional preference of *A catalaunalis* was nil on the genotype ES 22 and very low on SI 250. The same trend was noticed in the present investigation. Philip Sridhar and Gopalan (2002) stated that the susceptible sesame genotypes to *A. catalaunalis* had higher number of trichomes on the leaf and least oviposition on the genotypes with glabrous nature (*S. alatum*). The susceptibility of hairy varieties to *A catalaunalis* was reported (Anon, 1966). The pubescent leaf surface might have provided a better foot hold for the female as reported for *Heliothis zea* (Broddie) (Callahan, 1957). These studies supported the findings of the present study that the genotypes with more number of trichomes were susceptible since they were most preferred for egg laying. Sathyanarana Rao (2000) studied the reaction of ground nut genotypes against ground nut leaf miner and reported that pubescent genotypes were found to have higher egg load than glabrous genotypes.

5.6. Antibiosis mechanism

Study of antibiosis is important in host plant resistance. Jotwani *et al*. (1978) concluded that the growth index was the most reliable estimate for determining the antibiosis and reported that the larvae of *Chilo partellus* (Swinhoe) reared on the susceptible sorghum genotypes attained higher larval weight and length with reduced larval duration and higher pupation leading to maximum growth index.

Growth index of *A. catalaunalis* was minimum in the resistant genotypes ES 22, SI 250 and UMA. The genotype TKG 22 also showed minimum growth index. The higher growth index was recorded in the susceptible genotypes TMV 3, TMV 4, TMV 5, TMV 6 and TC 25 (Fig. 13). The genotype YLM 66 also showed less growth index when compared with susceptible check TC 25. This was due to the non-preference and presence or absence of secondary metabolites like phenol. The larvae fed on the genotypes having higher total phenol content showed lesser growth index. The genotype showed resistance to *A. catalaunalis* had some chemical mechanism affecting the growth and development of larvae of *A. catalaunalis*. The minimum larval length, minimum larval weight, lesser pupation rate and higher larval duration were noticed in the genotypes showing resistance to *A. catalaunalis*.

Singh (2002) also reported that the over all development of *A catalanualis* was highly reduced in resistant genotype ES 22 and lower development in SI 250 and a good growth was noticed when the larvae fed with the susceptible check TC 25.

Phlip Sridhar and Gopalan (2002) found that the larval development of shoot webber in *S. alatum*, ES 22 and SI 250 were unfavourable and it exhibited prolonged larval period, reduction in size, weight, per cent pupation and growth index indicating the antibiosis mechanism. In the present study also, the same phenomenon was noticed and this was in accordance with the reports mentioned above.

5.7. Biochemical basis of resistance

Data on the total phenol is presented in Table 22. Manisegaran *et al.* (2000) reported that phenol content of the plant was responsible for the resistance mechanism in sesame to *A. catalaunalis.*

In the present study also phenol content estimated from the leaf, flower and pod of the genotypes showing resistance, had higher amount of total phenols than susceptible group. The maximum amount of phenol was recorded in the resistant genotype, SI 250 at vegetative, in ES 22 at flowering and maturation stages. The least amount was recorded in the genotype TMV 6 at vegetative phase and in TC 25 at flowering and pod maturation stages, respectively. Yadav (1976) reported that the genotypes (1367 and RAUSS 17-6) resistant to *A. catalaunalis* had higher amount of phenol in the flower buds.

The same trend of high phenol content was seen in the studies conducted by Dharma Reddy and Misra (1995) in rice variety Ptb 33 screened against BPH, *Nilaparvata lugens* (Stal).

5.8. Correlation coefficient between biophysical (trichomes), biochemical (total phenol) and leaf webber incidence

Data on number of trichomes and egg laying of *A. catalaunalis* in sesame genotypes showed highly significant positive correlation (r = 0.749) (Fig. 14). The genotypes with least number of trichomes were less preferred by the adult moth for oviposition. The egg laying of *A. catalaunalis* in sesame genotypes showed direct relation to the numbers of trichomes present in the leaves as reported by Philip Sridhar and Gopalan (2002).

Data on total phenol recorded on sesame genotypes in the present study showed a highly significant negative correlation between total phenols recorded in (Fig. 15) leaf (r = -0.768), flower buds (r = -0.813) and pods (r = -0.731) and damage intensity. Jat and Pareck (2003) reported a similar trend in brinjal against *Leucinodes orbonalis* (Guenee) while studying the biophysical and biochemical factors of resistance in brinjal and they recorded a highly significant negative correlation between fruit infestation and total phenol present in brinjal varieties.

5.9. Yield

The yield recorded in various genotypes used in the present investigation (Table 8 and Table 14) showed that visual damage score was a reliable tool in identifying the good yielder during a heavy attack by *A. catalaunalis.* The yield showed a significant variation among the various genotypes screened against the leaf webber. The higher yield was achieved in the cultivated varieties like VRI 1, TMV 3, TMV 4 and TMV 5 (Fig. 16) than the other susceptible genotypes. This may be due to the tolerance seen in these varieties giving higher yield even under a moderate level of infestation.

Data on yield recorded in both the trials indicated that the yield was maximum in the genotypes YLM 66, VRI 1 and UMA than the other resistant genotypes. Among these, the genotype YLM 66 was noticed as susceptible in the I trial but it showed the resistant reaction in the II trial and this may be due to the seasonal variation in the pest infestation. Rai *et al.* (2002) studied the reaction of sesame genotypes against sesame leaf webber at various dates of sowing and reported that significant variation of pest incidence in crop sown at various dates, the least incidence was noticed in the July 23 sown crop than the crop sown at other dates.

It is concluded from the present investigation on field screening of sesame genotypes against *A. catalaunalis* that the genotypes ES 22, SI 250, YLM 66, KMR 14 and TKG 22 were the promising genotypes and they have resistance mechanism against the leaf webber. They will be useful donors to develop resistant variety. As far as the yield is concerned, VRI 1 and YLM 66 are better compared with other genotypes.

SUMMARY

Results of the investigations carried out on the field screening and reaction of genotypes to *Antigastra catalaunalis*, antibiosis in larval development, morphological and biochemical basis of resistance are summarised below.

Field screening in sesame for resistance to sesame leaf webber *A. catalaunalis*

The standard scoring technique was followed to grade reaction of genotypes to *A. catalaunalis*. Out of 43 genotypes screened in the first trial, only three genotypes *viz*., SI 250, ES 22 and UMA were identified as resistant with the score of 1.66 and genotypes TKG 22 and KMR 14 were found to be moderately resistant (MR) with the cumulative score of 3.0.There were six genotypes *viz.*, TKG 314, TCSI-94-20, YLM 66, JCS 399, TKG 309 and CST 2001-3 were found as susceptible to *A. catalaunalis* with the score of 3.6. Remaining genotypes were highly susceptible to *A. catalaunalis*.

The genotypes showed promising performance against *A. catalaunalis* in the I trial were taken into further study. Out of 31 genotypes screened in the II trial, the genotype ES 22 showing resistance having the score of 1.0. The genotypes SI 250, YLM 66 and UMA were found as resistant in the II trial with the cumulative score of 1.6. There were six genotypes TKG 307, KMR 14, VS 9701, RT 343, TKG 22 and ES 34 found to be MR and remaining 19 genotypes were susceptible to *A. catalaunalis*.

The data recorded on the over all mean damage at early stage of II crop indicated the pest incidence in the II trial was some what less when compared with the I trial. The genotypes SI 250, ES 22 and UMA were noticed as resistant to leaf webber in both trials. The genotypes KMR 14, TKG 22 were found to be MR in the both the trials and the genotype YLM 66 exhibited susceptible reaction in I trial was graded under resistant in the II trial.

Grading of sesame genotypes based on damage intensity.

The damage intensity was studied based on the locule damage. Out of 43 genotypes, the least per cent locule damage recorded in the genotype ES 22 showed resistance to *A. catalaunalis*. The genotypes SI 250 and UMA were also found to be resistant to *A. catalaunalis*.

Field reaction of sesame genotypes at various growth stages

To judge the reaction of genotypes at various growth stages the reaction was graded based on the per cent mean damage. The over all mean per cent leaf damage indicated that there were five genotypes *viz.,* TKG 309, CST 2001-3, SI 250, ES 22 and UMA noticed as resistant at vegetative stage.

Out of 43 genotypes, three genotypes *viz*., UMA, ES 22 and SI 250 adjudged as resistant with less than 5 per cent flower buds damage at flowering. The genotypes TKG 22, UMA, VRI 1, ES 22, KMR 14 and SI 250 were found to be resistant at pod formation stage. The genotypes SI 250, ES 22 and UMA showed resistance at vegetative, flowering and maturation stages.

Antibiosis mechanism in sesame genotypes against the larval development

The genotypes having resistance to *A. catalaunalis* were found to be unfavourable for the larval development. The maximum larval period, minimum larval weight, larval length and growth index were recorded in the genotypes ES 22 and SI 250. The maximum larval weight, larval length, growth index and minimum larval days recorded in the genotypes exhibiting susceptible reaction. This indicated that the feeding preference of *A. catalaunalis* was higher in susceptible genotypes than the resistant one.

Morphological basis of resistance in sesame genotypes to *A. catalaunalis*

The genotypes with more number of trichomes were found to be preferred for egg laying of adult moth. The minimum number of eggs was laid in the genotypes with less number of trichomes on the leaves. The highly significant positive correlation was recorded between number of trichomes in the leaves of sesame genotypes and egg laying of adult moth.

Biochemical basis of resistance

The total phenol was estimated from the genotypes showed resistant and susceptible reaction to *A. catalaunalis* in the field. The genotypes exhibiting resistant had higher amount of total phenol than the susceptible genotypes. The maximum amount of phenol was recorded in the flower buds than the leaves and pods. A highly significant negative correlation was noticed between the total phenol recorded in sesame genotypes at various growth stages and leaf webber incidence in the genotypes.

The highest yield was recorded in the genotype VRI 1 showing susceptible reaction to *A. catalaunalis* in the both the trials followed by YLM 66.

REFERENCES

Ahuja, D. B. and D. R. C. Bakhetia. 1995. Bioecology and management of insect pest of sesame. **A. Review. J. Insect Sci., 8** (1): 1-19.

Ahuja, D.B. 1999. Economic threshold level for leaf webber and capsule borer *Antigastra catalaunalis* on sesame in arid region of Rajasthan. **Indian J**. **Agric. Sci., 69** (1): 65- 66.

AICRP (S & N). 2002. Annual progress report. 2001-2002. All India Co-ordinated Research project on Sesame and Niger (ICAR), Jawaharlal Nehru Agriculture University campus, Jabalpur.

AICRP (S & N). 2003. Annual progress report. 2002-2003. All India Co-ordinated Research project on Sesame and Niger (ICAR), Jawaharlal Nehru Agriculture University campus, Jabalpur.

AICRP (S & N). 2004. Annual progress report. 2002-2004. All India Co-ordinated Research project on Sesame and Niger (ICAR), Jawaharlal Nehru Agriculture University campus, Jabalpur.

Aiyadurai, S. G., N. Srinivasalu and N. Sundaram. 1962. Interspecific hybridization between *Sesamum orientale* Linn. and *Sesamum laciniatum* Kheri. **Indian Oilseeds J., 11**: 31-32.

*Anonymous. 1966. Annual report of the Institute of Agricultural Research, Samaru 1965-66, Ahmedu Bello University, Zaria, Nigeria, 167: 64.

Anonymous. 1995. Annual report, 1994-95. Directorate of oilseeds Research, Hyderabad, India.

Ayyar, T. V. R. 1940. Hand Book of Economic Entomology for South India. Govt. of Madras. pp. 202-204.

Bhattacharjee, N. S. and Rattan Lal. 1962. Studies on varietal susceptibility of til (*Sesamum orientale*) to the attack of *Antigastra catalaunalis* (Duponchel). **Indian J. Ent., 24** (1): 58-63.

Bhattacharjee, N.S. and Rattan Lal. 1970. Varietal differences in the incidence of *Antigastra catalaunalis* (Duponchel) on sesame (*Sesamum indicum* L.) **Indian J. Entomol., 32**: 279.

*Borg, P. 1930. Bionomics of *Antigastra catalaunalis* (Dup.) on sesame. Entomological notes. Malta Dept. Agric., pp. 9.

Callahan, P. S .1957. Oviposition response of corn earworm to differences in surface texture, **J. Kanas. Ent. Soc., 30**: 59-63.

Cheema, J. S. and Gurdip Singh. 1987. Biology of sesame leaf webber and capsule borer, *Antigastra catalaunalis* (Duponchel) (Lepidoptera: Pyralidae) in Punjab. **J. Res. Punjab Agric. Univ., 24** (1): 65-74.

Cheema, J. S., Gurdip Singh and G. S. Grewal. 1982. Comparative incidences of sesame shoot and leaf webber *Antigastra catalaunalis* (Duponchel) in different cultivars of sesame. **J. Res. Punjab Agric. Univ., 19**: 170-171.

Deshpande, R. R. and Z. Singh. 1969. Assessment of damage to til by leaf and pod caterpillar, *Antigastra catalaunalis* (Duponchel). **JNKVV Res. J., 12** (1): 85.

Dharma Reddy, K. and D. S. Misra. 1995. Varietals response of rice against Brown plant hopper *Nilaparvatha lugens* (Stal). **Indian J. Ent., 57** (30): 169-178.

Dora, K. B. and T. Kamala. 1988. Resistance of sesame (*Sesamum indicum* L.) varieties to gall fly (*Asphondylia sesami*) and capsule borer (*Antigastra catalaunalis*). **Indian J. Agri. Sci., 58**: 180-183.

Duponchel, P. 1833. Lepidoptera. Hist. Nat. Lepid. France S: pp. 330.

Ganesh, S. K., N. Nadarajan and S. Raguraman. 1999. Combining ability and heterosis for pod borer damage in sesame. **Madras Agric. J. 86** (4/6): 185-187.

Government of India. 2004. Directorate of Economic and Statistics. Department of Agriculture and Cooperation. Ministry of Agriculture.

Gupta, M. P. 2004. Field screening of sesame germplasm against leaf roller and capsule borer, *Antigastra catalaunalis* (Dup.). **Indian J. of Pl. Protec., 32** (1): 42- 44.

*Hall, W. J. 1926. A caterpillar pest of sesame. **Farming in South Africa**, 1 (7): 223.

Hampson, G. F. 1899. Revision of the moths of subfamily: Pyraustidae. Proc. Zool. Soc. London. Pp. 215.

*Hector, G. P. 1919. Reports of the Economic Botanist to the Government of Bengal Reports of department of Agriculture, Bengal. pp. 31-33.

Heinrichs, E. A., F. G., Medrano and H. R. Rapusas. 1985. General procedure for the screening programme. In: Genetic Evaluation for Insect Resistance in Rice, IRRI, Manila, pp. 11-22.

Hill, S. D. 1983. Agricultural insect pests of the tropics and their control. Cambridge University publication, London, pp. 746.

Jakhmola, S. S and H. S. Yadav. 1975. Varietal susceptibility of sesamum (*Sesamum indicum* L.) to *Antigastra catalaunalis* (Dup). **JNKVV Res. J., 8** (3/4): 285.

Jat, K. L and B. L. Pareck. (2003). Biophysical and biochemical factors of resistance in brinjal against *Leucinodes orbonalis*. **Indian J. Ent., 65** (2): 252-258.

Jotwani, M. G., S. Chadudhari and S.P. Singh. 1978. Mechanism of resistance to *Chilo partellus* (Swinhoe) in sorghum. **Indian J. Ent., 40**: 237-276.

Krishi, J. N., V. Vishwa., R. R. Desphande and R. Singh. 1969. Assessment of damage to til (*Sesamum orientale* L.) by the leaf and pod caterpillar, *Antigastra catalaunalis* (Duponchel). **JNKVV Res. J., 1**: 57-58.

Kumar, S. and S. C Goel. 1994. Studies of the life history of a Pyralid, *Antigastra catalaunalis* (Duponchel) in Western Uttar Pradesh. Bulletin of Entomology New Delhi, **35** (1-2): 123-128.

Kumar, S., H.R. Rohilla and Harvir singh, 1990. Evaluation of sesame genotypes against the incidence of shoot webber cum pod borer, *A. catalaunalis*. **Haryana Agric. Univ. J. Res.,** 20(4): 291-294.

*Lederer, W. 1863. Hist. Nat. Lepld. France. **8**: 412.

Lefroy, H. M. and F. M. Howlett. 1909. **Indian Insect Life**, Thacker spink and Co., Calcutta, pp. 186.

Mahadevan, N. R. 1988. Screening of sesamum entries for resistance to leaf webber, *Antigastra catalaunalis* (Duponchel). **Madras Agric. J., 75** (5-6): 224.

Mahto, M. 1988. Chemical control of *Antigastra catalaunalis* (Dup.). a serious pest of sesame. **Indian J. Ent., 47** (3): 333-335.

Maiti, R. K., F. R. Bidinger, K. V. Seshu Reddy, Paul Gibson and J.C. Davis. 1980. Nature and occurrence of trichomes in sorghum lines with resistance to the sorghum shootfly. Joint progress Rep. Sorghum Physiology -3, Sorghum Entomol., ICRISAT, Patencheru, India.

Manimegalai, M., C. A. Mahalingam. 1997. Screening of sesame entries against sesame shoot webber and capsule borer. **Madras Agric. Sci., 84** (2): 103

Manisegaran, S. and S. E. N. Mohammed. 2000. Probable sources of resistance in certain promising sesame cultures to shoot webber and capsule borer. **Insect Environ., 6** (2): 57.

Manisegaran, S., N. Manimegalai, J. Pushpa and S. E. N. Mohammed. 2001. Non-preference mechanism of resistance in sesame to shoot webber and capsule borer *Antigastra catalaunalis* (Dup.). **Ann. of Pl. Protec. Sci., 9** (1): 123-124.

Menon, M. G. R., Rattan Lal and N. S. Bhattacharjee. 1960. Studies on *Antigastra catalaunalis* (Duponchel) the til leaf roller bionomics and biology. **Indian J. Ent., 22** (1): 1-6.

Mishra, B. K., B. Senapathi, P. K. Mishra and S.M.A. Mandal. 2001. Antixenosis and Antibiosis of some Rice varieties to the rice leaf folders. **Ann. Pl. Protec. Sci., 9** (2): 179-185.

Mukherjee, S. 1947. On the probable role of soluble solids on the causation of resistance or susceptibility of the Indian species of sesamum to the larval attack of *Antigastra catalaunalis* (Lepidoptera: Pyralidae). **Nature, 160**: 95.

Muralibaskaran, R. K., S. K. Ganesh and S.Thangavelu. 1994. Germplasm screening against sesame leaf roller and pod borer. **Madras Agric. J., 81**(11): 618-621.

Nair, M. R.G. K. 1975. Insects and Mites of crops in India. Indian Council of Agricultural Research, New Delhi, pp. 408.

Nath, P., S. Bhushan and A.K. Singh. 2000. Evaluation of neem based formulations and neem seed kernal extract against the insect pest of sesamum. **Ann. of Pl. Protect. Sci., 10** (2): 207-211.

Nath, V. and R. A. Agarwal. 1982. Insect pests of crops and their control. Bharathi publication, IARI, New Delhi, pp. 94.

Panwar, V. P. S. 1995. Agricultural Insect pests of crops and their control. Kalyani publishers, New Delhi, pp. 286.

Patel, A. A. and P. A. Bhalani. 1989. A new record of *Diadegma* sp as a larval parasite of the sesame leaf roller in Gujarat. **Indian J. Ent., 51**(4): 474.

Patil, S. K., P. K. Dharne and K.A. Shambharkar. 2001. Response of different promising genotypes of sesame to major insect pests and leaf spot disease. **Sesame and Safflower Newsletter**, **16**: 72-74.

Patra, A. K. 2001. Response of sesame (*Sesamum indicum)* varieties to dates of sowing during rainy season. **Indian Journal of Agric. Sci., 71** (8): 523-524.

Philip Sridhar, R. and M. Gopalan. 2002. Studies on screening and mechanism of resistance against the shoot webber *Antigastra catalaunalis* (Duponchel). **Entomon, 27** (4): 365–373.

Pillai, R. M. 1921. Short notes on insect pests of crops in Travancore. Travancore Dept. Agric.

Pradhan, S. 1969. Insect pests of crops. National Book Trust, India, New Delhi. pp. 198.

Prahlad, P. 1997. Magical sesame. Women era, September issue.

Rai, H. S., M. L. Verma and M. P. Gupta. 2001. Efficacy of some dust formulations against the incidence of *Antigastra catalaunalis* **Ann. of Pl. Protec. Sci., 9** (1): 117-119.

Rai, H.S., M.L. Verma and M.P Gupta. 2002. Effect of date of sowing on shoot webber and pod borer incidence on sesame. **Ann.Pl. Protect. Sci., 10** (1): 134-138.

Ramanujam, S. 1942. An Interspecific hybrid in sesamum: *S. orientale* and *S. prostratum*. **Current. Sci., 11**: 426-428.

Ramanujam, S. 1944. The cytogenetics of an amphidiploid *Sesamum orientale* and *S. prostratum*. **Current. Sci., 13**: 40-42.

Rao, C.N. and V. P. S. Panwar. 2002. Biochemical plant factors affecting resistance *to Chilo partellus* (Swinhoe) in maize. **Ann.Pl. Protec. Sci., 10** (1): 28-30.

Rath, L. K., A. Mishra and S. K. Mukherjee. 1997. Varietal reaction in sesamum to leaf webber and capsule borer, *Antigastra catalaunalis* (Duponchel). **Insect Environ., 3** (2): 50-51.

*Ritchie, A. H. 1927. Entomological Report 1925-26. Tanganika Terr. Rept. Dept. Agric. pp. 33-36.

Rohilla, H. R., B. S. Chhillar and Harvir Singh. 2003. Assessment of yield losses caused by *Antigastra catalaunalis* (Dup.) in different genotypes of sesame under agro climatic conditions of Haryana **J. Oilseeds Res., 20** (2): 315-316.

Sanjay Kumar and S. C. Goel. 1994. Residual toxicity of synthetic pyrethroids against *Antigastra cataunalis* (Duponchel) on sesamum. **Indian J. Ent., 56** (2): 156-163.

Saroja, J. 2004. Seasonal abundance of sesame leaf webber *A. catalaunalis* Duponchel (Lepidoptera: Pyralidae) and its natural enemies. *M. Sc., (Ag) Thesis* Dept. of Entomology. TNAU, Coimbatore

Sathyanarayana Rao, R. V. 2000. Resistance to leaf miner *Aproaerema modicella* in ground nut. **Indian J. Ent., 62** (3): 280-285.

Season and Crop report. 2002. Published by Directorate of Economics and Statistics. Government of Pondicherry. p. 33

*Seegeler, C. J. P. 1983. Oil plants in Ethiopia, their taxonomy and agricultural significance. Centre for Agricultural publishing and documentation, Wageningen. pp. 120-121.

Selvanarayanan, V. and P. Baskaran. 1999. Can the sesame shoot webber and capsule borer, *Antigastra catalaunalis* Duponchel (Lepidoptera: Pyraustidae) be controlled chemically?. **Sesame and Safflower News letter 14** (5): 55

Selvanaraynan, V. and P. Baskaran. 1996. Varietal response of sesame to shoot webber and capsule borer, *Antigastra catalaunalis* (Duponchel) Lepidoptera: Pyraustidae). **International J. Pest Management**, **42** (4): 333-336.

Sharma, P. B. and S. P. Raghuwanshi. 2000. Studies on suitability of summer sesame and its insect-pest incidence in Tawa command area. Bhartiya Krishi Anusandhan latrika, **15** (1/2): 29-33.

Sharma, R. P. 1967. Hand Book of Agriculture. Indian Council of Agricultural Research, Krishi Anusandhan Bhavan, Pusa, New Delhi. pp. 1303.

Shrivastava, N., S. S. Duhoon and K. M. S. Raghuwanshi. 2002. Testing of different germplasm lines of sesame against leaf roller and capsule borer (*Antigatra catalaunalis* Dup.) **Sesame and safflower Newsletter,** 17 -69.

Singh, D. 1952. Sesame, its genetics, breeding and culture. Tech. Bull. No 7, Dept. Agric., Uttar Pradesh, India.

Singh, H. and T. P. Yadava. 1985. In: oil seeds production, constraints and opportunities (eds.) Srivastava, H. C., S. Baskaran, B. Vatsya and K. K. G. Menon. Oxford and IBH Publishing Co. pp. 427-431.

Singh, N.V., N. D. Pandey and V.P. Singh. 1994. Effectiveness of vegetable oils on the development of *Callosobruchus chinensis* infesting stored gram. **Indian J. Ent., 56** (2): 9-12.

Singh, R. 1983. Biology and assessment of losses caused by til leaf roller and pod borers *Antigastra catalaunalis* to sesame. *M.Sc.,Thesis*. Dept. of Entomology, Haryana Agricultural University, Hissar, India.

Singh, U.C and R. Singh. 1997. Effectiveness of plant products against sesame capsule borer, *A. catalaunalis* and phyllody disease. **Indian J**. **Ent.,** 59(2): 187-189.

Singh, V. 2002. Reaction of sesame genotypes to leaf /shoot webber and capsule borer, *Antigastra catalaunalis* (Duponchel) (Lepidotera: Pyraustidae). **Sesame and Safflower Newsletter, 17**: 52-53.

Singh, V. 2003. Biology of shoot webber and capsule borer, *Antigastra catalaunalis* Duponchel (Lepidoptera: Pyraustidae) on sesame. **Indian J. of Pl. Protec., 31**(1): 88-89.

Singh, V. G and S. V. Phamdhere. 1986. Response of sesamum varieties to *Antigastra catalaunalis* (Duponchel). **Narendra Dev J. Agri. Res., 1**: 109-111.

Singhal, V. 1999. Indian Agriculture. Indian Council of Agricultural Publication, New Delhi. pp. 600.

Sood, N. K., S. R. Shrivas and S. Shrivastava. 1982. Evaluation of genotypes of sesame for resistance to *Antigastra catalaunalis* (Duponchel). **JNKVV Res. J., 16**:160.

Srivastava, K. P. 1993. A Text book of Applied Entomology. Vol. II Kalyani publishers, New Delhi, pp.507.

Talpur, M.A., R.D. Khuhro, M.A. Rustamani and I.A.Nizamani. 2002. Insect pests associated with sesame at Tando jam. **Pak J of Appl. Sci., 2** (7): 723-726.

Teotia, T. P. S and R. Hussain. 1965. Bionomics of til leaf and pod borers, *Antigastra catalaunalis* (Duponchel) (Pyralidae: Lepidoptera). **Labdev. J. Sci, Tech., 3** (3): 195-198.

Thangavelu, S., G. Kandasamy, M. Sivanandan and R. K. Muralibaskaran. 1989. Problems and progress of sesame production in India. **In**: Proceedings of Oilseeds Network; Sesame and Safflower. A. Omran (Eds). Agricultural Research Centre Morgiza, Egypt and International Development Research Centre, Canada.

Thimmaiah, S.R. 1999. Standard methods of biochemical analysis. Kalyani publishers, New Delhi, p. 287.

Tiwari, K.K. and S.S. Shaw. 1988. Assessment of losses caused by *Antigastra catalaunalis* (Dup.) in different varieties of sesamum. **Agric. Sci. Dig**., **8**(1): 1-4.

Vasantharaj David, B and T. Kumaraswami. 1975. Elements of Economic Entomology, Popular Book Depot, Madras. pp. 536.

*Vasiler, I. and B. Bacnobe. 1935. *Antigasra catalaunalis* (Dup.) In the Turkoman U.S.S.R. (Transcaspian region) **Plant Protec.,** 1: 150.

Vishwanath and Chhotey Lal. 1995. Oil seeds in India- An overview. Westvill Publishing House, New Delhi. pp. 228.

Vittal, S.M and R. Saroja. 1966. A note on the insecticidal control of shoot and leaf webber, *Antigastra catalaunalis* (Dup) on Gingelly. **Madras Agric. J., 53**: 215-216.

Weiss, E.A. 1971. Castor, sesame and safflower Leonard Hill Books, Great Britain, London. pp. 901.

Weiss, E.A. 1983. Castor, sesame and safflower Leonard Hill Books, Great Britain, London. pp. 217.

Yadav, R.P. 1976. Field trial on relative susceptibility of some important sesamum varieties to *Antigastra catalaunalis* (Duponchel). **Oilseeds J., 6**: 34- 35.

*Zumreoglu, S. 1982. Investigations on the sesame moth, *Antigastra catalaunalis* (Duponchel) (Lepidoptera: Pyralidae) which causes considerable damage in sesame growing areas of the Aegeon region. Turkeiye, Bitki Dergisi, **6**: 227-232.

* Original not seen

Table 1. Details of sesame genotypes used in the study

Sl. No.	Genotypes	Source
1	PKDS 40	PAJANCOA & RI, Karaikal
2	MACSS 1	PAJANCOA & RI, Karaikal
3	LTK 4	PAJANCOA & RI, Karaikal
4	TKG 201	PAJANCOA & RI, Karaikal
5	TKG 356	PAJANCOA & RI, Karaikal
6	TKG 314	PAJANCOA & RI, Karaikal
7	TCSI-94-20	PAJANCOA & RI, Karaikal
8	MT-19-03	PAJANCOA & RI, Karaikal
9	MT-20-03	PAJANCOA & RI, Karaikal
10	CST 2001-5	PAJANCOA & RI, Karaikal
11	RT 341	PAJANCOA & RI, Karaikal
12	RT 342	PAJANCOA & RI, Karaikal
13	RT 343	PAJANCOA & RI, Karaikal
14	TMV 3	PAJANCOA & RI, Karaikal
15	TMV 4	PAJANCOA & RI, Karaikal
16	TMV 5	PAJANCOA & RI, Karaikal
17	TMV 6	PAJANCOA & RI, Karaikal
18	VRI 1	PAJANCOA & RI, Karaikal
19	VS 9701	PAJANCOA & RI, Karaikal
20	KS 95010	PAJANCOA & RI, Karaikal
21	KMR 14	RRS, Vridhachalam

Sl. No.	Genotypes	Source
22	KMR 85	RRS, Vridhachalam
23	KMR 79	RRS, Vridhachalam
24	KMR 75	RRS, Vridhachalam
25	KMR 92	RRS, Vridhachalam
26	KMR 95	RRS, Vridhachalam
27	YLM 66	PAJANCOA & RI, Karaikal
28	JCS 399	PAJANCOA & RI, Karaikal
29	TKG 306	PAJANCOA & RI, Karaikal
30	TKG 307	PAJANCOA & RI, Karaikal
31	TKG 308	PAJANCOA & RI, Karaikal
32	TKG 309	PAJANCOA & RI, Karaikal
33	TAC-89-309	PAJANCOA & RI, Karaikal
34	MT-111	PAJANCOA & RI, Karaikal
35	CST 2001-3	PAJANCOA & RI, Karaikal
36	SI 250	RRS, Vridhachalam
37	TKG 22	PAJANCOA & RI, Karaikal
38	TC 25	RRS, Vridhachalam
39	DT 16 -9- 306	RRS, Vridhachalam
40	ES 22	RRS Vridhachalam
41	IC 42549	RRS, Vridhachalam
42	ES 34	RRS, Vridhachalam
43	UMA	RRS, Vridhachalam

*RRS - Regional Research Station

*PAJANCOA - Pandit Jawaharlal Nehru College of Agriculture and Research institute

Table 2. Methodology for scoring genotypes for shoot webber resistance (Field)
Score chart

Per cent damage (Mean of the 3 replications)			
Leaf	**Flower bud**	**Pod**	**Score**
0-10	0-5	0-2	1
> 10-20	> 5-10	> 2-4	3
> 20-30	> 10-15	> 4-6	5
> 30-40	> 15-20	>6-8	7
> 40	> 20	>8	9

Table 3. Methodology for grading genotypes for shoot webber resistance (Field)
Grade chart

Score	Grade	Degree of resistance
0-1	1	Highly Resistant (HR)
> 1-2	3	Resistant (R)
> 2-3	5	Moderately Resistant (MR)
> 3-5	7	Susceptible (S)
>5-9	9	Highly Susceptible (HS)

Table 4. Methodology for scoring genotypes for shoot webber resistance based on the intensity of damage (Field) Score chart for intensity of damage

Score	(%) Leaf damage	(%) Internal content of capsule fed	Cumulative score	Grade	Category
1	0.0-10	0.0-5	0-1	1	Highly resistant
3	10.1-20	5.1-10	1-3	3	Resistant
5	20.1-30	10.1-15	3-5	5	Moderately resistant
7	30.1-40	15.1-20	5-7	7	Susceptible
9	>40	>20	>7	9	Highly susceptible

Table 5. Methodology for categorizing the reaction of sesame genotypes at different crop stages based on the percent mean damage

Leaf damage (%)	Reaction	Flower damage (%)	Reaction	Pod damage (%)	Reaction
0-10	R	0-5	R	0-5	R
10.1-20	MR	5.1-10	MR	5.1-10	MR
20.1-30	S	10.1-15	MS	10.1-15	MS
30.1-40	HS	15.1-20	S	15.1-20	S
		>20	HS	>20	HS

R - Resistant; **MR** - Moderately; **R** - Resistant; **MS** - Moderately Susceptible

S - Susceptible; **HS** - Highly Susceptible

Table 6. Leaf damage (%) by *A. catalaunalis* in sesame genotypes at different crop stages (I Trial)

Sl. No.	Genotypes	(Mean of three replications of 5 observations each)				Over all mean
		10 DAS	20 DAS	30 DAS	60 DAS	
1	PKDS 40	3.33 (1.55)^{abc}	15.33 (23.05)^{defghi}	26.97 (31.29)^{p}	29.47 (32.88)^{r}	18.77
2	MACSS 1	0.00 (0.71)^{a}	26.50 (30.97)$^{k-p}$	22.82 (28.54)^{mno}	15.12 (22.88)^{ghijk}	17.56
3	LTK 4	0.00 (0.71)^{a}	8.76 (16.99)^{ab}	10.89 (19.26)^{b}	17.73 (24.89)^{ijklmn}	9.34
4	TKG 201	0.00 (0.71)^{a}	13.30 (21.38)^{bcdef}	27.00 (31.30)^{p}	18.32 (25.32)^{jklmno}	14.65
5	TKG 356	0.00 (0.71)^{a}	18.33 (25.34)^{fghijk}	11.25 (19.59)^{bc}	10.31 (18.72)^{cdef}	9.97
6	TKG 314	3.33 (1.79)^{abc}	23.90 (29.26)^{klmno}	16.00 (23.57)^{gh}	9.93 (18.37)^{cde}	13.29
7	TCSI-94-20	3.33 (1.55)^{abc}	6.33 (14.57)^{a}	10.98 (19.33)^{b}	7.91 (16.33)^{bc}	7.13
8	MT-19-03	3.33 (1.79)^{abc}	35.00 (36.27)^{pq}	23.79 (29.18)^{o}	20.26 (27.02)^{ijklm}	20.59
9	MT-20-03	10.00 (2.69)^{abcd}	21.66 (27.70)$^{g-n}$	20.40 (26.85)^{jkl}	21.15 (27.38)^{nopq}	18.30
10	CST 2001-5	6.66 (2.39)^{abcd}	19.42 (26.14)$^{f-l}$	21.28 (27.46)^{lmn}	18.20 (25.25)^{jklmno}	16.39
11	RT 341	0.00 (0.71)^{a}	13.92 (21.89)^{bcdefg}	23.43 (28.95)^{no}	16.14 (23.69)^{ghij}	13.37
12	RT 342	3.33 (1.55)^{abc}	18.15 (25.21)$^{e-k}$	21.21 (27.42)^{klmn}	12.87 (21.01)^{efg}	13.89
13	RT 343	0.00 (0.71)^{a}	28.33 (32.15)^{mnopq}	20.27 (26.75)^{jkl}	18.58 (25.52)^{klmno}	16.79
14	TMV 3	16.66 (4.13)^{de}	20.55 (26.96)$^{f-m}$	21.21 (27.42)^{klmn}	17.42 (24.67)$^{i-o}$	18.96

Contd…

Table 6 Contd...

Sl. No.	Genotypes	10 DAS	20 DAS	30 DAS	60 DAS	Over all mean
15	TMV 4	5.00 (1.78)^{abcd}	16.67 (24.09)^{efghij}	21.77 (27.70)^{lmno}	16.45 (23.91)^{hijkl}	14.97
16	TMV 5	10.00 (3.07)^{bcde}	35.87 (36.79)^{q}	21.62 (27.78)^{lmno}	14.61 (22.47)^{def}	20.52
17	TMV 6	13.33 (3.54)^{bcde}	25.60 (30.39)^{klmno}	23.16 (28.76)^{mno}	22.09 (27.98)^{opq}	21.04
18	VRI 1	7.50 (2.09)^{abcd}	18.85 (25.72)^{ijkl}	20.61 (26.99)^{klm}	17.29 (24.56)^{ijklmn}	16.06
19	VS 9701	10.00 (2.69)^{abcde}	15.00 (22.75)^{cdefgh}	21.15 (27.38)^{klm}	21.86 (27.87)^{opq}	17.00
20	KS 95010	16.66 (4.00)^{de}	26.67 (31.08)^{klmno}	22.76 (28.49)^{mno}	17.57 (24.78)^{ijklmn}	17.16
21	KMR 14	20.00 (4.49)^{e}	19.32 (26.11)$^{f-l}$	12.89 (21.08)^{cde}	8.82 (17.28)^{bcd}	15.25
22	KMR 85	0.00 (0.71)^{a}	21.84 (27.86)$^{h-n}$	19.59 (26.26)^{jkl}	16.18 (23.69)^{ghijkl}	14.40
23	KMR 79	8.33 (2.63)^{abcde}	18.89 (25.73)^{ijkl}	11.71 (20.00)^{bc}	20.78 (27.13)^{mnopq}	14.92
24	KMR 75	13.33 (3.59)^{cde}	23.17 (28.77)^{ijklmn}	12.82 (20.98)^{cde}	24.89 (29.92)^{q}	18.55
25	KMR 92	6.66 (2.33)^{abcde}	9.92 (18.34)^{abcd}	17.26 (24.53)^{hi}	19.14 (25.90)^{lmnop}	13.24
26	KMR 95	16.66 (4.09)^{dc}	33.33 (35.26)^{opq}	13.91 (21.89)^{def}	22.73 (28.47)^{pq}	21.65
27	YLM 66	10.00 (2.82)^{abcde}	27.03 (31.29)^{lmnop}	14.19 (22.13)^{efg}	17.73 (24.90)^{ijklmn}	17.23
28	JCS 399	0.00 (0.71)^{a}	16.35 (23.84)^{defghij}	11.56 (19.85)^{bc}	11.02 (19.37)^{def}	9.73
29	TKG 306	0.00 (0.71)^{a}	8.85 (17.25)^{abc}	14.13 (22.07)^{efg}	20.94 (27.19)^{mnopq}	10.98
30	TKG 307	6.66 (2.39)^{abcde}	23.33 (28.88)^{fijkl}	18.31 (25.33)ij	17.66 (24.85)^{ijklmn}	16.49

Contd…

Table 6 Contd...

Sl. No.	Genotypes	10 DAS	20 DAS	30 DAS	60 DAS	Over all mean
31	TKG 308	13.33 (3.54)[bcde]	19.09 (25.87)[fijkl]	15.28 (23.00)[fg]	20.01 (26.57)[lmnop]	16.92
32	TKG 309	3.33 (1.55)[abc]	21.24 (27.44)[g-n]	8.49 (16.94)[a]	14.26 (22.19)[ghi]	11.83
33	TAC-89-309	10.00 (3.24)[bcde]	14.84 (22.65)[efghij]	13.86 (21.82)[def]	18.50 (25.47)[klmno]	14.30
34	MT-111	8.33 (2.94)[abcde]	31.66 (34.24)[opq]	11.69 (19.98)[bc]	18.29 (21.37)[fgh]	17.49
35	CST 2001-3	0.00 (0.71)[a]	18.00 (24.47)[efghij]	9.39 (17.85)[a]	14.56 (22.43)[ghij]	10.40
36	SI 250	0.00 (0.71)[a]	10.00 (18.38)[abcd]	9.28 (17.73)[a]	4.61 (12.39)[a]	5.97
37	TKG 22	1.66 (1.25)[ab]	8.00 (16.41)[ab]	12.26 (20.47)[bcd]	8.88 (17.32)[bcd]	7.7
38	TC 25	16.66 (4.13)[de]	23.57 (28.18)[h-n]	20.22 (26.70)[jkl]	19.50 (26.19)[lmnop]	19.98
39	DT 16 -9- 306	6.66 (2.39)[abcde]	29.00 (32.58) [mnopq]	18.94 (25.79)[ijk]	24.58 (29.72)[q]	19.79
40	ES 22	5.00 (1.78)[abcd]	11.20 (19.55)[abcde]	9.33 (17.75)[a]	6.61 (14.87)[b]	18.03
41	IC 42549	10.00 (3.06)[bcde]	32.93 (35.01)[opq]	20.19 (26.69)[jkl]	31.21 (33.96)[r]	23.58
42	ES 34	8.33 (2.63)[bcde]	26.67 (30.94)[klmnop]	11.63 (19.91)[bc]	29.10 (32.64)[r]	18.93
43	UMA	6.66 (2.64)[abcde]	14.16 (21.92)[bcdefg]	9.42 (17.87)[a]	7.67 (16.05)[bc]	9.47
CD (0.05)		1.91**	0.43**	0.91**	0.22**	
Over all mean		6.72	20.24	16.85	17.23	

*DAS-Days after sowing significant at p = 0.01 level significant at 0.05 level

*Values in parentheses are arc sin transformed values. If 0 values recorded, values are sqrt transformed.

Table 7. Flower bud and pod (%) damage by *A. catalaunalis* in sesame genotypes at different crop stages (I Trial)

Sl. No.	Genotypes	(Mean of three replications of 5 observations each)			Over all mean
		(%)Flower buds damage	(%) Pod damage		
		45 DAS	60 DAS	80 DAS	
1	PKDS 40	29.14 (32.67)[rs]	25.19 (30.12)[o]	17.45 (24.69)[opq]	23.93
2	MACSS 1	15.12 (22.88)[ij]	18.89 (25.76)[h-o]	15.34 (23.06)[nop]	16.45
3	LTK 4	26.67 (31.73)[r]	19.09 (25.90)[ijklmno]	20.13 (26.66)[q]	22.30
4	TKG 201	18.32 (25.34)[klmn]	12.35 (20.57)[c-o]	8.01 (16.44)[hijk]	12.89
5	TKG 356	12.19 (20.39)[fg]	12.76 (20.93)[c-m]	6.48 (14.74)[bcd]	10.48
6	TKG 314	9.93 (18.36)[de]	17.88 (24.97)[ghijklmno]	5.88 (14.03)[bc]	11.23
7	TCSI-94-20	5.31 (13.31)[a]	10.28 (18.69)[cdefg]	5.97 (14.14)[bc]	7.19
8	MT-19-03	20.65 (27.02)[no]	13.13 (21.34)[c-m]	11.25 (19.59)[ijkl]	15.01
9	MT-20-03	21.16 (27.38)[op]	20.92 (27.22)[mno]	14.69 (22.53)[mno]	18.92
10	CST 2001-5	18.20 (25.25)[klmn]	20.01 (26.57)[klmno]	10.36 (18.78)[hijk]	16.19
11	RT 341	16.15 (23.69)[ijk]	16.26 (23.27)[f-o]	11.28 (19.61)[ijkl]	14.56
12	RT 342	12.97 (21.10)[gh]	17.09 (24.41)[f-o]	11.03 (19.37)[ijkl]	13.70
13	RT 343	18.28 (25.31)[klmn]	10.89 (19.27)[c-j]	5.92 (14.04)[bc]	11.70
14	TMV 3	17.43 (24.67)[kl]	14.62 (22.46)[e-n]	9.20 (17.65)[efghij]	13.75
15	TMV 4	17.16 (24.44)[jk]	20.62 (27.01)[lmno]	9.48 (17.87)[ghij]	15.75
16	TMV 5	14.01 (24.47)[hi]	10.43 (18.84)[cdefg]	6.88 (15.22)[bcdef]	10.44
17	TMV 6	20.00 (26.56)[mno]	12.02 (20.28)[d-l]	8.12 (16.53)[cdefgh]	13.38
18	VRI 1	17.62 (24.81)[klm]	9.53 (17.98)[bcdef]	3.44 (10.65)[a]	10.20
19	VS 9701	22.19 (28.10)[opq]	10.42 (18.82)[cdefg]	9.45 (17.92)[ghij]	14.02
20	KS 95010	17.91 (25.03)[klm]	11.14 (19.47)[cdefghij]	6.99 (15.32)[bcdefg]	12.01
21	KMR 14	8.33 (16.72)[cd]	3.92 (11.42)[ab]	3.68 (11.03)[a]	5.31
22	KMR 85	21.77 (27.80)[op]	6.90 (15.22)[abcd]	6.37 (14.52)[bcd]	11.68

Contd...

Table 7 Contd...

Sl. No.	Genotypes	(%) Flower buds damage at 45 DAS	(%) Pod damage		Over all mean
			60 DAS	80 DAS	
23	KMR 79	20.59 (26.98)^{no}	6.92 (15.17)^{abcd}	5.94 (14.07)^{bc}	11.15
24	KMR 75	24.30 (29.53)^{q}	13.68 (21.70)$^{d-m}$	8.56 (16.11)^{defghi}	15.51
25	KMR 92	19.72 (26.36)^{lmno}	12.42 (20.62)$^{c-m}$	7.90 (16.11)^{bcdefgh}	13.35
26	KMR 95	23.33 (28.88)^{pq}	11.65 (19.92)$^{c-k}$	5.58 (13.66)^{b}	13.52
27	YLM 66	9.28 (17.74)^{d}	3.71 (11.10)^{ab}	5.67 (13.74)^{b}	8.09
28	JCS 399	11.00 (19.36)^{ef}	7.14 (15.47)^{abcd}	8.62 (17.06)^{defghi}	8.92
29	TKG 306	19.94 (26.51)^{mno}	11.76 (20.03)$^{c-k}$	9.43 (17.87)^{ghij}	13.71
30	TKG 307	17.66 (24.85)^{klm}	9.84 (18.28)^{bcdefg}	9.39 (17.82)^{fghij}	12.30
31	TKG 308	20.01 (26.57)^{mno}	8.03 (16.45)^{abcde}	12.9 (21.05)^{klmn}	13.65
32	TKG 309	14.26 (22.19)^{hi}	15.67 (23.32)$^{e-n}$	11.36 (19.68)^{ijkl}	13.76
33	TAC-89-309	29.67 (32.99)^{rst}	20.52 (26.94)^{lmno}	18.51 (25.47)^{pq}	22.90
34	MT-111	32.00 (34.45)^{t}	23.17 (28.72)^{no}	15.87 (23.45)^{nop}	23.68
35	CST 2001-3	14.56 (22.43)^{hi}	16.44 (23.92)$^{f-o}$	13.51 (21.56)^{lmn}	14.84
36	SI 250	4.95 (12.65)^{a}	4.00 (11.53)^{ab}	3.84 (11.29)^{a}	4.26
37	TKG 22	8.88 (17.33)^{d}	3.41 (10.63)^{a}	2.70 (9.54)^{a}	5.02
38	TC 25	37.83 (37.96)^{u}	13.01 (21.13)$^{c-m}$	10.10 (18.53)^{hijk}	20.31
39	DT 16 -9- 306	24.58 (29.72)^{q}	13.29 (21.38)$^{c-m}$	11.89 (20.17)^{jlm}	16.59
40	ES 22	4.61 (12.39)^{a}	3.98 (11.50)^{ab}	3.73 (11.13)^{bcde}	4.11
41	IC 42549	31.33 (34.08)st	10.43 (18.84)^{cdefg}	9.55 (15.53)^{ghij}	17.10
42	ES 34	29.87 (33.12)^{rst}	10.62 (19.00)^{cdefgh}	7.55 (15.53)^{bcdefg}	16.01
43	UMA	4.24 (11.88)^{a}	5.92 (14.08)^{abc}	3.26 (10.08)^{a}	5.47
CD (0.05)		0.42^{**}	0.34^{**}	0.67^{**}	
Over all mean		18.30	12.69	5.62	

*Values in parentheses are arc sin transformed values.

*DAS-Days after sowing significant at p = 0.01 level significant at 0.05 level

Table 8. Over all grading of sesame genotypes to sesame leaf webber *A. catalaunalis* (I Trial)

(Mean of three replications of 5 observations each)

Sl. No.	Genotypes	(%) Leaf damage	Score	(%) Flower bud damage	Score	(%) Pod damage	Score	Mean Score	Grade	Reaction	Yield $Kgha^{-1}$
1	PKDS 40	26.97 $(31.29)^{df}$	5	29.14 $(32.67)^{rs}$	9	17.45 $(24.69)^{oq}$	9	7.6	9	HS	281
2	MACSS 1	22.82 $(28.54)^{lmn}$	5	15.12 $(22.88)^{ij}$	7	15.34 $(23.06)^{nop}$	9	7	9	HS	174
3	LTK 4	10.89 $(19.26)^{b}$	3	26.67 $(31.73)^{r}$	9	20.13 $(26.66)^{q}$	9	7	9	HS	318
4	TKG 201	27.00 $(31.30)^{p}$	5	18.32 $(25.34)^{klmn}$	7	8.01 $(16.44)^{hijk}$	9	7	9	HS	298
5	TKG 356	11.25 $(19.59)^{bc}$	3	12.19 $(20.39)^{fg}$	5	6.48 $(14.74)^{bcd}$	7	5	9	HS	356
6	TKG 314	16.00 $(23.57)^{gh}$	3	9.93 $(18.36)^{de}$	3	5.88 $(14.03)^{bc}$	5	3.6	7	S	455
7	TC SI-94-20	10.98 $(19.33)^{b}$	3	5.31 $(13.31)^{a}$	3	5.97 $(14.14)^{bc}$	5	3.6	7	S	444
8	MT-19-03	23.79 $(29.18)^{o}$	5	20.65 $(27.02)^{no}$	9	11.25 $(19.59)^{ijkl}$	9	7.6	9	HS	459
9	MT-20-03	20.40 $(26.85)^{jk}$	5	21.16 $(27.38)^{op}$	9	14.69 $(22.53)^{mno}$	9	7.6	9	HS	343
10	CST 2001-5	21.28 $(27.46)^{lmn}$	5	18.20 $(25.25)^{klmn}$	7	10.36 $(18.78)^{hijk}$	9	7	9	HS	397
11	RT 341	23.43 $(28.95)^{no}$	5	16.15 $(23.69)^{ijk}$	7	11.28 $(19.61)^{ijkl}$	9	7	9	HS	252
12	RT 342	21.21 $(27.42)^{klmn}$	5	12.97 $(21.10)^{gh}$	7	11.03 $(19.37)^{ijkl}$	9	7	9	HS	450
13	RT 343	20.27 $(26.75)^{jkl}$	5	18.28 $(25.31)^{klmn}$	7	5.92 $(14.04)^{bc}$	5	5.6	9	HS	422

Contd…

Table 8 Contd…

Sl. No.	Genotypes	(%) Leaf damage	Score	(%) Flower bud damage	Score	(%) Pod damage	Score	Mean Score	Grade	Reaction	Yield Kgha^{-1}
14	TMV 3	21.21 (27.42)^{klmn}	5	17.43 (24.67)^{kl}	7	9.20 (17.65)^{efghij}	9	7	9	HS	557
15	TMV 4	21.77 (27.70)^{lmno}	5	17.16 (24.44)^{jk}	7	9.48 (17.87)^{ghij}	9	7	9	HS	567
16	TMV 5	21.62 (27.78)^{lmno}	5	14.01 (24.47)^{hi}	5	6.88 (15.22)^{bcdef}	7	5.6	9	HS	432
17	TMV 6	23.16 (28.76)^{mno}	5	20.00 (26.56)^{mno}	7	8.12 (16.53)$^{c-h}$	9	7	9	HS	483
18	VRI 1	20.61 (26.99)^{klm}	5	17.62 (24.81)^{klm}	7	3.44 (10.65)^{a}	3	5	7	S	772
19	VS 9701	21.15 (27.38)^{klm}	5	22.19 (28.10)^{opq}	9	9.45 (17.92)^{ghij}	9	7.6	9	HS	413
20	KS 95010	22.76 (28.49)^{mno}	5	17.91 (20.03)^{klm}	7	6.99 (15.32)$^{b-g}$	7	6.3	9	HS	322
21	KMR 14	12.89 (21.08)^{cde}	3	8.33 (16.72)^{cd}	3	3.68 (11.03)^{a}	3	3	5	MR	341
22	KMR 85	19.59 (26.26)^{jkl}	3	21.77 (27.80)^{op}	9	6.37 (14.52)^{bcd}	7	6.3	9	HS	324
23	KMR 79	11.71 (20.00)^{bc}	3	20.59 (26.98)^{no}	9	5.94 (14.07)^{bc}	5	5.6	9	HS	348
24	KMR 75	12.82 (20.98)^{cde}	3	24.30 (29.53)^{q}	9	8.56 (16.11)$^{d-i}$	9	7	9	HS	344
25	KMR 92	17.26 (24.53)^{hi}	3	19.72 (26.36)$^{l-o}$	7	7.90 (16.11)$^{b-h}$	7	5.6	9	HS	475
26	KMR 95	13.91 (21.89)^{def}	3	23.33 (28.88)^{pq}	9	5.58 (13.66)^{b}	5	5.6	9	HS	309

Condt…

Table 8 Contd…

Sl. No.	Genotypes	(%) Leaf damage	Score	(%) Flower bud damage	Score	(%) Pod damage	Score	Mean Score	Grade	Reaction	Yield Kgha^{-1}
27	YLM 66	14.19 (22.13)^{efg}	3	9.28 (17.74)^{d}	3	5.67 (13.74)^{b}	5	3.6	5	S	665
28	JCS 399	11.56 (19.85)^{bc}	3	11.00 (19.36)^{ef}	5	8.62 (17.06)^{defghi}	9	5.6	7	S	126
29	TKG 306	14.13 (22.07)^{efg}	3	19.94 (26.51)^{mno}	7	9.43 (17.87)^{ghij}	9	6.3	9	HS	244
30	TKG 307	18.31 (25.33)^{ij}	3	17.66 (24.85)^{klm}	7	9.39 (17.82)^{fghij}	9	6.3	9	HS	362
31	TKG 308	15.28 (23.00)^{fg}	3	20.01 (26.57)^{mno}	9	12.9 (21.05)^{klmn}	9	7	9	HS	175
32	TKG 309	8.49 (16.94)^{a}	1	14.26 (22.19)^{hi}	5	11.36 (19.68)^{ijkl}	9	5	7	S	276
33	TAC-89-309	13.86 (21.82)^{def}	3	29.67 (32.99)^{rst}	9	18.51 (25.47)^{pq}	9	7	9	HS	236
34	MT-111	11.69 (19.98)^{bc}	3	32.00 (34.45)^{t}	9	15.87 (23.45)^{nop}	9	7	9	HS	467
35	CST 2001-3	9.39 (17.85)^{a}	1	14.56 (22.43)^{hi}	5	13.51 (21.56)^{lmn}	9	5	7	S	278
36	SI 250	9.28 (17.73)^{a}	1	4.95 (12.65)^{a}	1	3.84 (11.29)^{a}	3	1.66	3	R	495
37	TKG 22	12.26 (20.47)^{bcd}	3	8.88 (17.33)^{d}	3	2.7 (89.54)^{a}	3	3	5	MR	441
38	TC 25	20.22 (26.70)^{jkl}	5	37.83 (37.96)^{u}	9	10.10 (18.53)^{hijk}	9	7.6	9	HS	351
39	DT 16 -9- 306	18.94 (25.79)^{ijk}	3	24.58 (29.72)^{q}	9	11.89 (20.17)^{jlm}	9	7	9	HS	3.5

Contd…

Table 8 Contd…

Sl. No.	Genotypes	(%) Leaf dmage	Score	(%) Flower bud damage	Score	(%) Pod damage	Score	Mean Score	Grade	Reaction	Yield $Kgha^{-1}$
40	ES 22	9.33 (17.75)[a]	1	4.61 (12.39)[b]	1	3.73 (11.13)[bcde]	3	1.6	3	R	451
41	IC 42549	20.19 (26.69)[jkl]	5	31.33 (34.08)[st]	9	9.55 (15.53)[ghij]	9	7.6	9	HS	253
42	ES 34	11.63 (19.91)[bc]	3	29.87 (33.12)[rst]	9	7.55 (15.53)[bcdefg]	7	6.3	9	HS	346
43	UMA	9.42 (17.87)[a]	1	4.24 (11.88)[bc]	1	3.26 (10.08)[a]	3	1.6	3	R	624
CD (0.05)		0.91**	0.56**	0.42**	1.04**	0.67**	1.49**				41.89**
Over all mean		16.85		18.30		5.63					

*DAS-Days after sowing significant at p=0.01 level significant at 0.05 level
*Values in parentheses are arc sin transformed values

Table 9. **Field reaction of sesame genotypes to *A. catalaunalis* at vegetative stage (30 DAS I-Trial)**

Sl. No.	Mean Damage (%)	Reaction	No of entries	Name of the entries	Mean (%)	Over all mean
				TKG 309	8.49(16.94)[a]	
1	Below10	R	5	SI 250	9.28(17.73)[a]	
				ES 22	9.33(17.75)[a]	
				CST 2001-3	9.39(17.85)[a]	9.18
				UMA	9.42(17.87)[a]	
2	10.1-20	MR	20	LTK 4	10.89(19.26)[b]	
				TCSI94-20	10.98(19.33)[b]	
				TKG 356	11.25(19.59)[bc]	
				JCS 399	11.56(19.85)[bc]	
				ES 34	11.63(19.91)[bc]	
				MT-111	11.69(19.98)[bc]	
				KMR 79	11.71(20.00)[bc]	
				TKG 22	12.26(20.47)[bcd]	
				KMR 75	12.82(20.98)[cde]	
				KMR 14	12.89(21.08)[cde]	13.95
				TAC89-309	13.86(21.82)[def]	
				KMR 95	13.91(21.89)[def]	
				TKG 306	14.13(22.07)[efg]	
				YLM 66	14.19(22.13)[efg]	
				TKG 308	15.28(23.00)[fg]	
				TKG 314	16.00(23.57)[gh]	
				KMR 92	17.26(24.53)[hi]	

Contd…

Table 9 Contd…

Sl. No.	Mean Damage (%)	Reaction	No of entries	Name of the entries	Mean (%)	Over all mean
				TKG 307	18.31(25.33)^{ij}	
				DT16 -9- 306	18.94(25.79)^{ijk}	
				KMR 85	19.59(26.26)^{jkl}	
3	20.1-30	S	18	IC 42549	20.19(26.69)^{jkl}	22.22
				TC 25	20.22(26.70)^{jkl}	
				RT 343	20.27(26.75)^{jkl}	
				MT-20-03	20.40(26.85)^{jkl}	
				VRI 1	20.61(26.99)^{klm}	
				VS 9701	21.15(27.38)^{klm}	
				RT 342	21.21(27.42)^{klmn}	
				TMV 3	21.21(27.42)^{klmn}	
				CST 2001-5	21.28(27.46)^{lmn}	
				TMV 5	21.62(27.78)l^{mno}	
				TMV 4	21.77(27.70)^{lmno}	
				KS 95010	22.76(28.49)^{mno}	
				MACSS 1	22.82(28.54)^{mno}	
				TMV 6	23.16(28.76)^{mno}	
				RT 341	24.43(28.95)^{no}	
				MT-19-03	23.79(29.18)^{o}	
				PKDS 40	26.97(31.29)^{p}	
				TKG 201	27.00(31.30)^{p}	
4	30.1-40	HS	NIL			

*Values in parentheses are arc sin transformed values

Table 10. Field reaction of sesame genotypes to *A. catalaunalis* at flowering stage (45 DAS I-Trial)

Sl. No.	Mean damage (%)	Reaction	No of entries	Name of the entries	Mean (%)	Over all mean
1	Below5	R	3	UMA	4.24(11.88)[a]	4.60
				ES 22	4.61(12.39)[a]	
				SI2 50	4.95(12.65)[a]	
2	5.1-10	MR	5	TCSI-94-20	5.31(13.31)[ab]	8.35
				KMR 14	8.33(16.72)[cd]	
				TKG 22	8.88(17.33)[d]	
				YLM 66	9.28(17.74)[d]	
				TKG3 14	9.93(18.36)[dc]	
3	10.1-15	MS	6	JCS 399	11.00(19.36)[ef]	13.16
				TKG 356	12.19(20.39)[fg]	
				RT 342	12.97(21.10)[gh]	
				TMV 5	14.01(24.47)[hi]	
				TKG 309	14.26(22.19)[hi]	
				CST 2001-3	14.56(22.43)[hi]	
4	15.1-20	S	13	MACSS 1	15.12(22.88)[ij]	17.96
				RT 341	16.15(23.69)[ijk]	
				TMV 4	17.16(24.44)[jk]	
				TMV 3	17.43(24.67)[klm]	
				VRI 1	17.62(24.81)[klm]	
				TKG 307	17.66(24.85)[klm]	
				KS 95010	17.91(20.03)[klm]	
				CST 2001-5	18.20(25.25)[klm]	
				RT 343	18.23(25.31)[klm]	
				TKG 201	18.32(25.34)[lmno]	
				KMR 92	19.72(26.36)[lmno]	
				TKG 306	19.94(26.51)[mno]	

Contd…

Table 10 Contd…

Sl. No.	Mean damage (%)	Reaction	No of entries	Name of the entries	Mean (%)	Over all mean
				TMV 6	20.00(26.56)^{mno}	
5	20	HS	15	TKG 308	20.01(26.57)^{mno}	24.04
				KMR 79	20.59(26.98)^{no}	
				MT-19-03	20.65(27.02)^{no}	
				MT20-03	21.16(27.38)^{op}	
				KMR 85	21.77(27.80)^{op}	
				VS 9701	22.19(28.10)^{opq}	
				KMR 95	23.33(28.88)^{pq}	
				DT 16 -9- 306	24.58(29.72)^{q}	
				KMR 75	24.30(29.53)^{q}	
				LTK 4	26.67(31.73)^{r}	
				PKDS 40	29.14(32.67)^{rs}	
				TAC 89-309	29.67(32.99)^{rst}	
				IC 42549	31.33(34.08)st	
				MT-111	32.00(34.45)^{t}	
				TC 25	37.83(37.96)^{u}	

*Values in parentheses are arc sin transformed values

Table 11. Field reaction of sesame genotypes to *A. catalaunalis* at maturation stage (80 DAS I- Trial)

Sl. No.	Mean damage (%)	Reaction	No of entries	Name of the entries	Mean (%)	Over all mean (%)
1	Below5	R	6	TKG 22	2.72(9.54)[a]	3.45
				UMA	3.26(10.08)[a]	
				VRI 1	3.44(10.65)[a]	
				ES 22	3.73(11.03)[ab]	
				KMR 14	3.68(11.13)[ab]	
				SI 250	3.84(11.29)[ab]	
2	5.1-10	MR	22	KMR 95	5.58(13.66)[b]	7.58
				YLM 66	5.67(13.74)[b]	
				TKG 314	5.58(14.03)[bc]	
				TC SI-94-20	5.97(14.14)[bc]	
				KMR 79	5.94(14.07)[bc]	
				RT 343	5.92(14.04)[bc]	
				KMR 85	6.37(14.52)[bc]	
				TKG 356	6.48(14.74)[bcd]	
				TMV 5	6.88(15.22)[bcdef]	
				KS 95010	6.99(15.32)[bcdefg]	
				ES 34	7.55(15.53)[bcdefg]	
				KMR 92	7.90(16.11)[bcdefg]	
				TKG 201	8.01(16.44)[cdefgh]	
				TMV 6	8.12(16.53)[cdefgh]	
				KMR 75	8.56(17.01)[defghi]	
				JCS 399	8.62(17.06)[defgh]	
				TMV 3	9.20(17.65)[efghi]	
				TKG 307	9.39(17.82)[fghij]	
				VS 9701	9.45(17.92)[ghij]	
				TKG 306	9.43(17.87)[ghij]	
				IC 42549	9.55(18.00)[ghij]	
				TMV 4	9.48(17.87)[ghij]	

Condt…

Table 11Condt…

Sl. No.	Mean damage (%)	Reaction	No of entries	Name of the entries	Mean (%)	Over all mean (%)
3	10.1-15	MS	10	TC 25	10.10(18.53)^{hijk}	11.84
				CST 2001-5	10.36(18.78)^{hijk}	
				RT 342	11.03(19.37)^{ijkl}	
				MT-19-03	11.25(19.59)^{ijkl}	
				RT 341	11.28(19.61)^{ijkl}	
				TK G309	11.36(19.68)^{ijkl}	
				DT 16 -9- 306	11.89(20.17) ^{jklm}	
				TKG 308	12.90(21.05) ^{klmn}	
				CST 2001-3	13.51(21.56) ^{lmn}	
				MT-20-03	14.69(22.53) ^{mno}	
4	15.1-20	S	4	MACSS 1	15.34(23.06)^{nop}	16.79
				MT-111	15.87(23.45)^{nop}	
				PKDS 40	17.45(24.69)^{opq}	
				TAC89-309	18.51(25.47)^{pq}	
5	>20	HS	1	LTK 4	20.13(20.13)^{q}	20.13

*Values in the parentheses are arc sin transformed values

Table 12. Leaf damage (%) by *A. catalaunalis* in sesame genotypes at different crop stages (II Trial)

Sl. No.	Genotypes	Per cent leaf damage				Over all mean
		10 DAS	20 DAS	30 DAS	60 DAS	
		(Mean of three replications of 5 observations each)				
1	MACSS 1	5.25 (2.40)$^{c-i}$	2.74 (1.80)^{ab}	6.36 (2.62)^{c}	13.57 (3.75)^{o}	6.98
2	LTK 4	0.00 (0.71)^{a}	4.50 (2.24)^{bcd}	8.22 (2.95)^{de}	10.43 (3.31)^{k}	5.79
3	TKG 201	0.00 (0.71)^{a}	5.35 (2.42)^{cde}	8.43 (2.99)^{e}	19.22 (4.44)^{s}	8.65
4	TKG 356	0.00 (0.71)^{a}	3.81 (2.08)^{abc}	13.08 (3.69)^{mn}	12.65 (3.63)^{m}	7.38
5	TCSI-94-20	0.00 (0.71)^{a}	4.81 (2.30)^{cde}	12.12 (3.55)^{kl}	11.27 (3.43)^{l}	7.05
6	YLM 66	0.00 (0.71)^{a}	2.14 (1.63)^{a}	3.56 (2.01)^{a}	6.46 (2.64)^{ef}	3.04
7	CST2001-3	9.18 (2.33)$^{b-h}$	9.61 (3.18)^{ghij}	10.89 (3.38)^{hi}	10.34 (3.29)^{k}	10.05
8	CST2001-5	0.00 (0.71)^{a}	8.30 (2.97)f^{gh}	9.35 (3.14)^{f}	15.59 (4.01)^{po}	8.31
9	TKG 306	0.00 (0.71)^{a}	7.84 (2.89)^{fgh}	12.63 (3.62)^{lm}	13.33 (3.72)^{no}	8.45
10	TKG 307	0.00 (0.71)^{a}	9.20 (3.11)^{fghij}	6.43 (2.63)^{c}	16.53 (4.13)^{r}	8.04
11	TKG 308	0.00 (0.71)^{a}	7.63 (2.85)^{efg}	10.10 (3.26)^{g}	11.36 (3.44)^{l}	7.25
12	TKG 309	4.22 (1.68)$^{a-g}$	12.22 (3.57)^{jk}	11.65 (3.49)^{jk}	15.41 (3.99)^{po}	10.87
13	KMR 14	0.00 (0.71)^{a}	3.78 (2.07)^{abc}	5.49 (2.45)^{b}	5.69 (2.49)$_{cd}$	3.74
14	RT3 43	3.22 (1.51)$^{a-f}$	11.80 (3.51)^{ijk}	8.02 (2.92)^{de}	9.23 (3.12)^{j}	8.07
15	JCS 399	0.00 (0.71)^{a}	8.87 (3.06)^{fghij}	13.55 (3.75)^{n}	12.23 (3.57)^{m}	8.66
16	MT-19-03	5.33 (2.41)$^{d-i}$	9.07 (3.09)^{fghij}	9.17 (3.11)^{f}	12.69 (3.63)^{mn}	9.06
17	TMV 3	6.06 (2.56)^{ghi}	4.27 (2.19)^{bcd}	10.89 (3.38)^{i}	8.43 (2.99)^{i}	7.41
18	TMV 4	9.92 (3.23)^{hi}	14.64 (3.89)^{kl}	11.24 (3.42)^{hij}	6.85 (2.71)^{fg}	10.66
19	TMV 5	7.62 (2.85)^{hi}	20.96 (4.63)^{n}	11.53 (3.47)^{ijk}	7.52 (2.83)^{h}	11.90
20	TMV 6	12.65 (3.63)^{hi}	15.66 (4.02)^{lm}	12.59 (3.62)^{lm}	6.12 (2.57)^{de}	11.75
21	VRI 1	7.29 (2.79)^{fghi}	17.86 (4.28)^{lmn}	13.60 (3.75)^{n}	7.09 (2.75)^{gh}	11.46

Contd...

Table12. Contd...

Sl. No.	Genotypes	Per cent leaf damage				Over all mean
		10 DAS	20 DAS	30 DAS	60 DAS	
		(Mean of three replications of 5 observations each)				
22	VS 9701	3.92 (2.10)^{ghi}	6.51 (2.65)^{def}	6.41 (2.63)^{c}	10.34 (3.29)^{k}	6.79
23	KS 95010	17.00 (4.18)^{i}	11.89 (3.52)^{ijk}	11.56 (3.47)^{ijk}	7.49 (2.83)^{h}	11.98
24	RT 342	5.70 (2.49)$^{b-h}$	8.86 (3.06)^{fghi}	12.94 (3.67)^{mn}	9.48 (3.16)^{j}	9.24
25	UMA	3.33 (1.96)^{efghi}	3.88 (2.09)^{abc}	3.82 (2.08)^{a}	4.13 (2.15)^{b}	3.73
26	TC 25	12.84 (3.65)^{fghi}	19.28 (4.45)^{mn}	19.17 (4.44)^{o}	16.34 (4.10)^{qr}	14.15
27	SI 250	0.00 (0.71)^{a}	2.23 (1.65)^{a}	5.22 (2.39)^{b}	1.68 (1.48)^{a}	2.28
28	TKG 22	6.67 (2.68)$^{d-i}$	4.23 (2.17)^{bcd}	7.70 (2.86)^{de}	5.39 (2.43)^{cd}	5.99
29	ES 34	3.67 (2.04)$^{a-g}$	10.99 (3.39)^{hij}	9.33 (3.14)^{f}	7.63 (2.85)^{h}	7.90
30	IC 42549	0.00 (0.71)^{a}	11.33 (3.26)^{ghij}	10.73 (3.35)^{h}	8.47 (2.99)^{i}	7.63
31	ES 22	0.00 (0.71)^{a}	2.66 (1.77)^{ab}	6.00 (2.55)^{c}	1.67 (1.46)^{a}	2.58
CD (0.05)		1.22**	0.42**	0.09**	0.09**	
Overall mean		4.0	8.61	9.74	9.83	

*DAS-Days after sowing significant at p = 0.01 level significant at 0.05 level

*Values in parentheses are $(x+0.5)^{1/2}$ transformed values

Table 13. Flower bud and pod damage (%) by *A. catalaunalis* (Dup.) in sesame genotypes at different crop stages. (II Trial)

Sl. No.	Genotypes	(Mean of three replications of 5 observations each)			Over all mean
		Per cent flower bud damage	Per cent pod damage		
		45 DAS	60 DAS	80 DAS	
1	MACSS 1	11.22 (3.42)^{op}	10.07 (3.25)^{m}	3.41 (1.98) ^{kl}	8.23
2	LTK 4	11.69 (3.49)^{p}	10.24 (3.28)^{m}	3.50 (2.00) ^{l}	8.47
3	TKG 201	9.67 (3.19)^{jk}	7.23 (2.78)^{jk}	3.33 (1.96) ^{k}	6.74
4	TKG 356	10.71 (3.35)^{mno}	14.86 (3.92)^{n}	2.88 (1.84) $^{f-I}$	9.48
5	TCSI-94-20	11.72 (3.50)^{p}	7.62 (2.85)^{k}	2.76 (1.81) ^{fg}	7.36
6	YLM 66	5.31 (2.41)^{c}	1.25 (1.32)^{a}	1.94 (1.56) ^{b}	2.83
7	CST2001-3	8.34 (2.97)^{h}	5.32 (2.41)^{ef}	3.01 (1.87) ^{ij}	5.55
8	CST2001-5	11.02 (3.39)^{no}	6.51 (2.65)^{ij}	3.09 (1.89) ^{j}	6.87
9	TKG 306	10.25 (3.28)^{klm}	6.03 (2.55)^{fghi}	3.09 (1.90) ^{j}	6.46
10	TKG 307	7.11 (2.76)^{ef}	5.87 (2.52)^{fghi}	3.09 (1.89) ^{j}	5.35
11	TKG 308	10.75 (3.35)^{mno}	5.51 (2.45)^{efg}	2.58 (1.76) ^{d}	6.28
12	TKG 309	10.39 (3.30)^{mn}	4.27 (2.18)^{d}	2.60 (1.76) ^{de}	5.75
13	KMR 14	6.56 (2.66)^{d}	3.01 (1.87)^{c}	2.06 (1.60) ^{b}	3.87
14	RT 343	8.81 (3.05)^{hi}	4.45 (2.22)^{d}	2.28 (1.67) ^{c}	5.18
15	JCS 399	13.36 (3.72)^{r}	4.02 (2.13)^{d}	2.60 (1.76) ^{de}	6.66
16	MT-19-03	7.79 (2.88)^{g}	6.15 (2.58)^{ghi}	2.92 (1.85)^{hi}	5.62
17	TMV 3	10.15 (3.26)^{klm}	5.13 (2.37)^{e}	4.27 (2.18)^{n}	6.51
18	TMV 4	8.43 (2.99)^{h}	7.00 (2.74)^{jk}	3.10 (1.90)^{j}	6.17
19	TMV 5	6.40 (2.63)^{d}	6.22 (2.59)^{ghi}	2.79 (1.81)^{fgh}	5.13
20	TMV 6	12.37 (3.59)^{q}	7.21 (2.78)^{jk}	2.88 (1.84)$^{f-I}$	7.48
21	VRI 1	9.83 (3.21)^{klm}	6.27 (2.60)^{hi}	2.77 (1.81)^{fg}	6.29

Contd...

Table 13 Contd…

Sl. No.	Genotypes	(Mean of three replications of 5 observations each)			Over all mean
		Per cent flower bud damage	Per cent pod damage		
		45 DAS	60 DAS	80 DAS	
22	VS 9701	6.46 $(2.64)^{d}$	5.41 $(2.43)^{ef}$	2.51 $(1.73)^{d}$	4.79
23	KS 95010	7.53 $(2.83)^{fg}$	5.54 $(2.46)^{efg}$	2.74 $(1.80)^{ef}$	5.27
24	RT 342	7.55 $(2.84)^{fg}$	5.63 $(2.47)^{efgh}$	3.08 $(1.89)^{j}$	5.42
25	UMA	3.07 $(1.89)^{b}$	9.51 $(3.16)^{lm}$	2.03 $(1.59)^{b}$	4.87
26	TC 25	15.29 $(3.97)^{s}$	3.30 $(1.95)^{c}$	4.04 $(2.13)^{m}$	7.54
27	SI 250	5.57 $(2.46)^{c}$	1.34 $(1.36)^{a}$	1.29 $(1.34)^{a}$	2.73
28	TKG 22	6.89 $(2.72)^{de}$	2.15 $(1.63)^{b}$	2.32 $(1.68)^{c}$	3.78
29	ES 34	6.75 $(2.69)^{de}$	5.59 $(2.47)^{efgh}$	2.76 $(1.81)^{fg}$	5.03
30	IC 42549	9.21 $(3.12)^{ij}$	8.95 $(3.07)^{lm}$	2.91 $(1.85)^{ghi}$	7.02
31	ES 22	2.43 $(1.71)^{a}$	1.31 $(1.35)^{a}$	1.28 $(1.33)^{a}$	1.67
CD(0.05)		0.08^{**}	0.12^{**}	0.11^{**}	
Over all mean		8.8	5.9	2.77	

*DAS-Days after sowing significant at p=0.01 level significant at 0.05 level

*Values in parentheses are $(x+0.5)^{1/2}$ transformed values

Table14. Over all grading of sesame genotypes to sesame leaf webber *A. catalaunalis* (II Trial)

Sl. No.	Genotypes	Percent damage (Mean of three replications of 5 observations each)						Cumulative score	Grade	Reaction	Yield Kg ha^{-1}
		30 DAS	Score	45 DAS	Score	60 DAS	Score				
1	MACSS 1	6.36 $(2.62)^{c}$	1	11.22 $(3.42)^{op}$	5	10.07 $(3.25)^{m}$	9	5	7	S	197.70
2	LTK 4	8.22 $(2.95)^{de}$	1	11.69 $(3.49)^{p}$	5	10.24 $(3.28)^{m}$	9	5	7	S	295.70
3	TKG 201	8.43 $(2.99)^{e}$	1	9.67 $(3.19)^{jk}$	3	7.23 $(2.78)^{jk}$	7	3.6	7	S	297.30
4	TKG 356	13.08 $(3.69)^{mn}$	3	10.71 $(3.35)^{mno}$	5	14.86 $(3.92)^{n}$	9	5.6	9	HS	312.30
5	TCSI-94-20	12.12 $(3.55)^{kl}$	3	11.72 $(3.50)^{p}$	5	7.62 $(2.85)^{k}$	7	5	7	S	421.00
6	YLM 66	3.56 $(2.01)^{a}$	1	5.31 $(2.41)^{c}$	3	1.25 $(1.32)^{a}$	1	1.6	3	R	571.00
7	CST 2001-3	10.89 $(3.38)^{hi}$	3	8.34 $(2.97)^{h}$	3	5.32 $(2.41)^{ef}$	5	3.6	7	S	303.30
8	CST 2001-5	9.35 $(3.14)^{f}$	1	11.02 $(3.39)^{no}$	5	6.51 $(2.65)^{ij}$	7	4.3	7	S	360.30
9	TKG 306	12.63 $(3.62)^{lm}$	3	10.25 $(3.28)^{klm}$	5	6.03 $(2.55)^{fghi}$	7	5	7	S	282.30
10	TKG 307	6.43 $(2.63)^{c}$	1	7.11 $(2.76)^{ef}$	3	5.87 $(2.52)^{fghi}$	5	3	5	MR	346.70
11	TKG 308	10.10 $(3.26)^{g}$	3	10.75 $(3.35)^{mno}$	5	5.51 $(2.45)^{efg}$	5	4.3	7	S	232.00
12	TKG 309	11.65 $(3.49)^{jk}$	3	10.39 $(3.30)^{mn}$	5	4.27 $(2.18)^{d}$	5	4.3	7	S	265.00
13	KMR 14	5.49 $(2.45)^{b}$	1	6.56 $(2.66)^{d}$	3	3.01 $(1.87)^{c}$	3	2.3	5	MR	284.00

Contd..

Table14. Contd...

Sl. No.	Genotypes	Percent damage (Mean of three replications of 5 observations each)						Cumulative Score	Grade	Reaction	Yield Kg ha^{-1}
		30 DAS	Score	45 DAS	Score	60 DAS	Score				
14	RT 343	8.02 (2.92)^{de}	1	8.81 (3.05)^{hi}	3	4.45 (2.22)^{d}	5	3	5	MR	378.30
15	JCS 399	13.55 (3.75)^{n}	3	13.36 (3.72)^{r}	5	4.02 (2.13)^{d}	5	4.3	7	S	218.30
16	MT-19-03	9.17 (3.11)^{f}	1	7.79 (2.88)^{g}	3	6.15 (2.58)^{ghi}	7	3.6	7	S	373.30
17	TMV 3	10.89 (3.38)^{i}	3	10.15 (3.26)^{klm}	5	5.13 (2.37)^{e}	5	4.3	7	S	387.30
18	TMV 4	11.24 (3.42)^{hij}	3	8.43 (2.99)^{h}	3	7.00 (2.74)^{jk}	7	4.3	7	S	515.00
19	TMV 5	11.53 (3.47)^{ijk}	3	6.40 (2.63)^{d}	3	6.22 (2.59)^{ghi}	7	4.3	7	S	424.30
20	TMV 6	12.59 (3.62)^{lm}	3	12.37 (3.59)^{q}	5	7.21 (2.78)^{jk}	7	5	7	S	399.00
21	VRI 1	13.60 (3.75)^{n}	3	9.83 (3.21)^{klm}	3	6.27 (2.60)^{hi}	7	4.3	7	S	571.70
22	VS 9701	6.41 (2.63)^{c}	1	6.46 (2.64)^{d}	3	5.41 (2.43)^{ef}	5	3	5	MR	447.30
23	KS 95010	11.56 (3.47)^{ijk}	3	7.53 (2.83)^{fg}	3	5.54 (2.46)^{efg}	5	3.6	7	S	375.00
24	RT 432	12.94 (3.67)^{mn}	3	7.55 (2.84)^{fg}	3	5.63 (2.47)^{efgh}	5	3.6	7	S	390.70
25	UMA	3.82 (2.08)^{a}	1	3.07 (1.89)^{b}	1	3.30 (1.95)^{c}	3	1.6	3	R	515.00
26	TC 25	19.17 (4.44)^{o}	3	15.29 (3.97)^{s}	7	9.51 (3.16)^{lm}	9	6.3	9	HS	291.70
27	SI 250	5.22 (2.39)^{b}	1	5.57 (2.46)^{c}	3	1.34 (1.36)^{a}	1	1.6	3	R	285.00

Contd..,

Table14. Contd...

Sl. No.	Genotypes	Percent damage (Mean of three replications of 5 observations each)						Cumulative Score	Grade	Reaction	Yield Kg ha^{-1}
		30 DAS	Score	45 DAS	Score	60 DAS	Score				
28	TKG 22	7.70 (2.86)[de]	1	6.89 (2.72)[de]	3	2.15 (1.63)[b]	3	2.3	5	MR	408.30
29	ES 34	9.33 (3.14)[f]	1	6.75 (2.69)[de]	3	5.59 (2.47)[efgh]	5	3	5	MR	316.70
30	IC 42549	10.73 (3.35)[h]	3	9.21 (3.12)[ij]	3	8.95 (3.07)[lm]	9	5	7	S	265.70
31	ES 22	6.00 (2.55)[c]	1	2.43 (1.71)[a]	1	1.31 (1.35)[a]	1	1	1	HR	337.30
CD (0.05)		0.09**	0.34**	0.08**	0.34**	0.11**	0.90**				
Over all mean		9.74		8.8		2.77					

*DAS-Days after sowing significant at p = 0.01 level significant at 0.05 level

*Values in parentheses are $(x+0.5)^{1/2}$ transformed values

*R-Resistance, MR- Moderately Resistance, S- Susceptible, HS- Highly Susceptible

Table 15. Over all grading of sesame genotypes to sesame leaf webber *A. catalaunalis* based on damage intensity (Mean of three replications of 5 observations each)

Sl. No.	Genotypes	(%) Leaf damage	Score	Internal content of capsule fed (%)	Score	Mean Score	Grade	Reaction
1	PKDS 40	26.97 (31.29)^{df}	td	22.80 (28.52)^{l}	9	7	7	S
2	MACSS 1	22.82 (28.54)^{lmn}	5	37.76 (34.91)^{u}	9	7	7	S
3	LTK 4	10.89 (19.26)^{b}	3	18.72 (25.63)^{i}	7	5	5	MR
4	TKG 201	27.00 (31.30)^{p}	5	28.16 (32.05)^{p}	9	7	7	S
5	TKG 356	11.25 (19.59)^{bc}	3	23.88 (29.25)^{m}	9	6	7	S
6	TKG 314	16.00 (23.57)^{gh}	3	12.38 (20.59)^{d}	5	4	5	MR
7	TCSI-94-20	10.98 (19.33)^{b}	3	15.56 (23.23)^{f}	7	5	5	MR
8	MT-19-03	23.79 (29.18)^{o}	5	21.86 (27.87)^{k}	9	7	7	S
9	MT-20-03	20.40 (26.85)^{jk}	5	24.68 (29.79)^{n}	9	7	7	S
10	CST 2001-5	21.28 (27.46)^{lmn}	5	32.08 (34.49)^{t}	9	7	7	S
11	RT 341	23.43 (28.95)^{no}	5	32.84 (34.96)^{u}	9	7	7	S
12	RT 342	21.21 (27.42)^{klmn}	5	35.80 (36.75)^{v}	9	7	7	S
13	RT 343	20.27 (26.75)^{jkl}	5	31.88 (34.37)^{t}	9	7	7	S
14	TMV 3	21.21 (27.42)^{klmn}	5	28.12 (32.02)^{p}	9	7	7	S
15	TMV 4	21.77 (27.70)l^{mno}	5	30.90 (33.77)^{s}	9	7	7	S

Contd…

Table15. Condt…

Sl. No.	Genotypes	(%) Leaf damage	Score	Internal content of capsule fed (%)	Score	Mean Score	Grade	Reaction
16	TMV 5	21.62 (27.78)^{lmno}	5	26.06 (30.69)^{o}	9	7	7	S
17	TMV 6	23.16 (28.76)^{mno}	5	18.86 (25.74)^{i}	7	6	7	S
18	VRI 1	20.61 (26.99)^{klm}	5	30.18 (33.32)^{r}	9	7	7	S
19	VS 9701	21.15 (27.38)^{klm}	5	31.90 (34.39)^{t}	9	7	7	S
20	KS 95010	22.76 (28.49)^{mno}	5	32.82 (34.95)^{u}	9	7	7	S
21	KMR 14	12.89 (21.08)^{cde}	3	13.74 (21.75)^{e}	5	4	5	MR
22	KMR 85	19.59 (26.26)^{jkl}	3	17.10 (24.42)^{g}	7	5	5	MR
23	KMR 79	11.71 (20.00)^{bc}	3	18.86 (25.74)^{i}	7	5	5	MR
24	KMR 75	12.82 (20.98)^{cde}	3	19.28 (26.04)^{i}	7	5	5	MR
25	KMR 92	17.26 (24.53)^{hi}	3	18.02 (25.12)^{h}	7	5	5	MR
26	KMR 95	13.91 (21.89)^{def}	3	17.92 (25.04)^{h}	7	5	5	MR
27	YLM 66	14.19 (22.13)^{efg}	3	11.12 (19.48)^{c}	5	4	5	MR
28	JCS 399	11.56 (19.85)^{bc}	3	16.76 (24.16)^{g}	7	5	5	MR
29	TKG 306	14.13 (22.07)^{efg}	3	23.82 (29.21)^{m}	9	6	7	S
30	TKG 307	18.31 (25.33)^{ij}	3	22.12 (28.05)^{k}	9	6	7	S
31	TKG 308	15.28 (23.00)^{fg}	3	27.84 (31.84)^{p}	9	6	7	S

Contd…

Table15. Contd…

Sl. No.	Genotypes	(%) Leaf damage	Score	Internal content of capsule fed (%)	Score	Mean Score	Grade	Reaction
32	TKG 309	8.49 (16.94)[a]	1	24.98 (29.99)[n]	9	5	5	MR
33	TAC-89-309	13.86 (21.82)[def]	3	32.84 (34.96)[u]	9	6	7	S
34	MT-111	11.69 (19.98)[bc]	3	28.78 (32.44)[q]	9	6	7	S
35	CST 2001-3	9.39 (17.85)[a]	1	21.78 (27.82)[k]	9	5	5	MR
36	SI 250	9.28 (17.73)[a]	1	6.00 (14.18)[b]	3	2	3	R
37	TKG 22	12.26 (20.47)[bcd]	3	11.14 (19.49)[c]	5	4	5	MR
38	TC 25	20.22 (26.70)[jkl]	5	37.14 (37.55)[w]	9	7	7	S
39	DT-16	18.94 (25.79)[ijk]	3	28.84 (32.48)[q]	9	6	7	S
40	ES 22	9.33 (17.75)[a]	1	4.98 (12.89)[a]	1	1	1	HR
41	IC 42549	20.19 (26.69)[jkl]	5	32.06 (34.47)[t]	9	7	7	S
42	ES 34	11.63 (19.91)[bc]	3	17.80 (24.95)[h]	7	5	5	MR
43	UMA	9.42 (17.87)[a]	1	10.92 (19.29)[c]	5	3	3	R
CD (0.05%)		0.91**	0.56**	1.23**	0.42**			
Overall mean		16.85		23.16				

*DAS-Days after sowing significant at p=0.01 level significant at 0.05 level; Values in parentheses are arc sin transformed values

Table16. Ovipostional preference (in lab) and field reaction of sesame genotypes to *A. catalaunalis*

(Mean number of eggs in three replications)

Sl. No.	Genotypes	No choice condition No. of eggs ± SE	Field reaction
1	TKG 314	19.33 ± 2.03^{abcdef}	S
2	YLM 66	16.33 ± 2.40^{abcde}	S
3	TMV 3	18.67 ± 3.38^{cdef}	HS
4	TMV 4	$19.67 \pm 2.18b^{cdef}$	HS
5	TMV 5	22.00 ± 2.64^{defg}	HS
6	TMV 6	22.67 ± 2.02^{defg}	HS
7	VRI 1	23.33 ± 4.09^{efg}	HS
8	VS 9701	24.33 ± 5.23^{efg}	HS
9	KS 95010	19.00 ± 1.53^{abcdef}	HS
10	UMA	12.33 ± 2.33^{a}	R
11	TC 25	17.00 ± 0.58^{abcde}	HS
12	SI 250	13.67 ± 2.03^{abc}	R
13	KMR 14	14.67 ± 0.88^{abc}	MR
14	KMR 85	31.00 ± 1.73^{h}	HS
15	ES 22	16.33 ± 2.33^{abcde}	R
16	KMR 79	27.67 ± 4.91^{gh}	HS
17	KMR 95	25.33 ± 1.45^{fgh}	HS
18	KMR 75	23.00 ± 3.21^{efg}	HS
19	KMR 92	15.67 ± 1.45^{abcd}	HS
20	TKG 22	12.67 ± 2.40^{ab}	MR
21	LTK 4	19.00 ± 1.53^{abcdef}	HS
Overall mean		19.69	
CD (0.05)		7.05^{*}	

Table 17. Field reaction of sesame genotypes based on ovipositional preference (Mean number of eggs in three replications)

Sl. No	Reaction	No of entries	Name of the entries	Over all mean of egg laying /adult
1	R	3	SI2 50, ES 22, UMA	14.11
2	MR	2	KMR 14, TKG 22.	13.67
3	S	2	TKG 314, YLM 66.	17.83
4	HS	14	TMV 3, TMV 4, TMV 5, TMV 6, VRI 1, VS 9701, KS 95010, TC 25, KMR 85, KMR 79, KMR 95, KMR 75, KMR 92, LTK 4.	22.02

Table18. Trichomes density and field reaction of sesame genotypes to *A. catalaunalis*
(Mean of three replications of 5 observations each)

Sl. No.	Genotypes	No of trichomes / microscopic field Mean ± SE	Field reaction
1	TKG 314	21.66 ± 1.85^{g}	S
2	YLM 66	17.33 ± 2.18^{defg}	S
3	TMV 3	13.00 ± 0.57^{abcd}	HS
4	TMV 4	13.67 ± 1.76^{abcde}	HS
5	TMV 5	15.00 ± 1.99^{bcdef}	HS
6	TMV 6	14.67 ± 2.02^{bcdef}	HS
7	VRI 1	16.67 ± 0.66^{defg}	HS
8	VS 9701	19.33 ± 3.28^{efg}	HS
9	KS 95010	13.66 ± 0.88^{abcde}	HS
10	UMA	13.00 ± 1.15^{abcd}	R
11	TC 25	7.67 ± 1.15^{a}	HS
12	SI 250	9.00 ± 1.73^{ab}	R
13	KMR 14	10.00 ± 3.18^{abc}	MR
14	KMR 85	31.66 ± 2.02^{h}	HS
15	ES 22	11.33 ± 1.20^{abcd}	R
16	KMR 79	49.00 ± 4.93^{i}	HS
17	KMR 95	29.33 ± 1.85^{h}	HS
18	KMR 75	20.66 ± 3.28^{fg}	HS
19	KMR 92	13.66 ± 1.20^{abcde}	HS
20	TKG 22	15.00 ± 2.08^{bcdef}	MR
21	LTK 4	15.66 ± 1.33^{cdefg}	HS
Overall mean		17.69	
CD (0.05)		6.12^{*}	

Table 20. Growth index of *A. catalaunalis* on different sesame genotypes

Sl. No.	Genotypes	Larval duration (Days) (A)	Larval length (mm)	Larval weigh t(mg)	Pupation rate(%) (B)	Growth index (B/A)	Field reaction
		(Mean of three replication of 5 observation each)					
1	TKG 314	9.40 ± 0.42^{abc}	13.43 ± 0.14^{fg}	22.82 ± 1.57^{defgh}	71.42	7.59	S
2	YLM 66	9.70 ± 0.12^{bcde}	13.00 ± 0.17^{de}	21.08 ± 0.38^{cdef}	60.00	6.18	S
3	TMV 3	9.00 ± 0.27^{ab}	13.83 ± 0.12^{ghij}	25.64 ± 0.85^{hij}	73.33	8.14	HS
4	TMV 4	9.10 ± 0.29^{abc}	13.97 ± 0.03^{hij}	25.04 ± 0.61^{hij}	80.00	8.79	HS
5	TMV 5	9.00 ± 0.22^{ab}	14.03 ± 0.07^{ij}	24.14 ± 0.51^{fghi}	78.57	8.73	HS
6	TMV 6	9.00 ± 0.27^{ab}	14.17 ± 0.14^{j}	26.16 ± 0.99^{ij}	76.92	8.54	HS
7	VRI 1	9.30 ± 0.20^{abc}	13.62 ± 0.14^{fghi}	23.88 ± 1.39^{fghi}	73.33	7.88	HS
8	VS 9701	9.00 ± 0.22^{ab}	13.70 ± 0.25^{fghi}	23.90 ± 1.25^{fghi}	66.66	7.41	HS
9	KS 95010	9.10 ± 0.19^{abc}	14.04 ± 0.12^{ij}	25.18 ± 0.62^{hij}	71.42	7.84	HS
10	UMA	11.30 ± 0.20^{f}	11.24 ± 0.13^{c}	18.72 ± 1.66^{bc}	46.15	4.08	R
11	TC 25	8.70 ± 0.34^{a}	14.17 ± 0.06^{j}	23.24 ± 0.97^{efghi}	73.33	8.42	HS
12	SI 250	12.25 ± 0.19^{g}	10.27 ± 0.12^{b}	13.48 ± 0.24^{a}	35.71	2.91	R
13	KMR 14	10.40 ± 0.37^{e}	12.83 ± 0.03^{d}	20.14 ± 0.89^{cd}	58.33	5.61	MR
14	KMR 85	10.20 ± 0.33^{de}	13.53 ± 0.17^{fgh}	22.86 ± 1.13^{defgh}	66.66	6.53	HS
15	ES 22	11.50 ± 0.22^{fg}	9.83 ± 0.13^{a}	16.42 ± 0.28^{ab}	33.33	2.89	R
16	KMR 79	9.30 ± 0.41^{abc}	13.53 ± 0.20^{fg}	24.62 ± 1.18^{ghij}	64.28	6.91	HS
17	KMR 95	9.00 ± 0.27^{ab}	13.33 ± 0.22^{ef}	25.06 ± 1.10^{hij}	60.00	6.66	HS
18	KMR 75	9.50 ± 0.27^{bcd}	13.00 ± 0.11^{dc}	20.40 ± 1.21^{cde}	69.23	7.28	HS
19	KMR 92	9.80 ± 0.25^{cde}	12.83 ± 0.12^{d}	22.00 ± 1.06^{defgh}	76.92	7.85	HS
20	TKG 22	11.30 ± 0.25^{f}	10.23 ± 0.03^{b}	18.06 ± 0.97^{bc}	38.46	3.40	MR
21	LTK 4	9.30 ± 0.41^{abc}	13.50 ± 0.21^{fg}	21.74 ± 1.18^{defg}	66.66	7.17	HS
CD (0.05)		0.89^{*}	0.41^{*}	3.03^{*}			
Over all mean		9.76	12.95	23.35	63.84	6.70	

Table21. Antibiosis mechanism in the larval and pupae development of *A. catalaunalis* in sesame genotypes

Values in the parentheses are mean deviation over the highly susceptible reacted genotypes

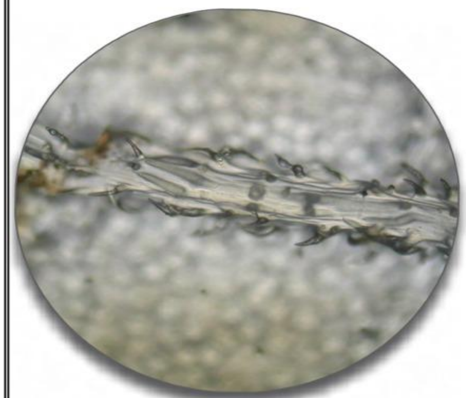
Sl. No.	Reaction in the field	No of entries	Name of the entries	Over all mean of larval duration(Days)(B)	Over all mean of larval length (mm)	Over all mean of larval weight (mg)	Pupation rate (%)(A)	Growth Index (A / B)
1	R	3	SI 250, ES 22, UMA	11.68 (+2.45)	10.44 (-3.22)	16.21 (-9.20)	38.39 (-32.85)	3.29 (-4.43)
2	MR	2	KMR 14, TKG 22.	10.85 (+1.62)	11.33 (-2.33)	19.10 (-6.32)	48.39 (-22.85)	4.51 (-3.21)
3	S	2	TKG 314, YLM 66.	9.55 (+0.32)	13.21 (-0.45)	21.95 (-3.47)	65.71 (-5.53)	6.88 (-0.84)
4	HS	14	TMV 3, TMV 4, TMV 5, TMV 6, VRI 1, VS 9701, KS 95010, TC 25, KMR 85, KMR 79, KMR 95, KMR 75, KMR 92, LTK 4.	9.23	13.66	25.42	71.24	7.72

Table 22. Total phenols in sesame genotypes at various crop stages

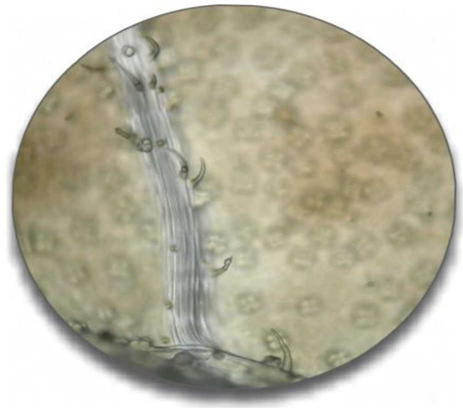
Sl. No.	Genotypes	Amount of total phenol present g/100g (Mean of three replications)			Reaction	Over all mean
		Leaf	Flower	Pod		
1	TMV 3	0.280	0.743	0.350	HS	0.457
2	TMV 4	0.533	1.483	1.093	HS	1.036
3	TMV 5	0.637	1.137	0.777	HS	0.850
4	TMV 6	0.217	1.487	1.227	HS	0.977
5	VRI 1	0.283	1.163	0.610	HS	0.685
6	VS 9701	0.607	0.923	0.623	HS	0.717
7	KS 95010	0.283	1.087	0.607	HS	0.659
8	SI 250	1.693	2.123	1.477	R	1.764
9	ES 22	1.907	2.187	1.803	R	1.965
10	TKG 22	1.623	1.917	1.450	MR	1.663
11	UMA	1.513	1.733	1.383	R	1.543
12	KMR 14	1.180	1.487	1.063	MR	1.243
13	TC 25	0.703	0.537	0.287	HS	0.509
14	YLM 66	0.733	0.953	0.483	S	0.723
Over all mean		0.870	1.276	0.945		
CD (0.05)		0.015**	0.010**	0.012**		

Table 23. Classification of sesame genotypes based on amount of phenol content

Sl. No.	Cumulative score	Reaction	No of entries	Name of the entries	Amount of total phenol recorded (mean of three replication)g/100g		
					Leaf	Flower	Pod
1	0-1	HR	NIL				
2	1.1-3	R	3	ES 22,SI 250,UMA	1.741	2.075	1.576
3	3.1-5	MR	2	TKG 22,KMR 14	1.346	1.61	1.223
4	5.1-7	S	1	YLM 66	0.733	0.953	0.483
5	7.1-9	HS	8	TMV 3, TMV 4, TMV5, TMV 6,VRI 1,VS 9701, KS 95010, TC 25.	0.442	0.934	0.696

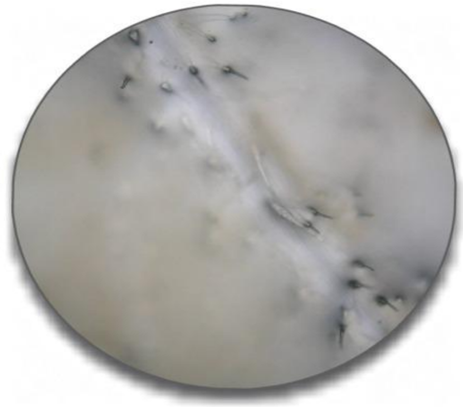


ES 22



ES 22

UMA



UMA

Plate 6. Leaf showing trichomes in sesame genotypes

TC 25

TC 25

SI 250

SI 250

Plate 5. Leaf showing trichomes in the resistant and susceptible check

Plate 4. No choice test for ovipositional preference of *A.catalaunalis* (Dup.) in sesame genotypes

Sesame leaf webber damage during early stage

Plate 3. Damage symptom caused by sesame leaf webber

Plate 2. Rearing cage with live plants for *A. catalaunalis*

Plate 1. Field layout for screening sesame genotypes against *A. catalaunalis*

SI 250

UMA

Plate 7. Resistant sesame genotypes