Original Research Article
Evaluation of exotic sesame germplasm for their resistance against *Antigastracatalaunalis*(Duponchel)

ABSTRACT

Aims: To evaluate 132 USDA germplasm for their resistance against sesame leaf webber *A. catalaunalis*
Study design: Randomized Block Design (RBD)
Methodology: Leaf webber incidence was recorded weeklyin two seasons (2023, 2024) and the percent leaf damage was calculated. The data was subjected to statistical analysis.The germplasm were categorized based on the percent leaf damage in both seasons using a 1-9 scoring methodology. The combined mean analysis was also carried out, to obtain unbiased results. the germplasm were also categorized based on the combined analysis.
Results: In season 1, leaf damage by sesame leaf webber ranged from 0% to 97.96%, with PI 170757, PI 223014,and PI 285170 being pest-free, while PI 170726 had the highest damage (97.96%). Germplasm were categorized as highly resistant (48), resistant (31), moderately resistant (25), susceptible (13) and highly susceptible (15). In season 2, damage ranged from 0% to 97.30%, with PI 152498, PI 158045, PI 170757, PI 223014,and PI 285170 being pest-free and PI 170726 again having the highest damage (97.30%). Germplasm were categorized as highly resistant (35), resistant (36), moderately resistant (33), susceptible (12)and highly susceptible (16). Based on combined mean value analysis, The germplasm were categorized as highly resistant (28), resistant (54), moderately resistant (21), susceptible (11),and highly susceptible (18).
Conclusion: The germplasm PI 170757, PI 223014, and PI 285170 were completely free from pest damage in bothseasons and also based on combined mean analysis. Thus these germplasm are highly resistant against sesame leaf webber.

Keywords: Sesame, Screening, Resistance, Germplasm

1. INTRODUCTION

Sesame (*Sesamum indicum* L.) is a significant oilseed crop belonging to the Pedaliaceae family. It is extensively grown in tropical and subtropical areas and is often referred to as the "Queen of Oilseeds" due to its superior polyunsaturated fatty acid content. Sesame oil contains natural antioxidants like sesamin, sesamolin, and sesamol, making it one of the most stable vegetable oils with an extended shelf life[1].The crop's origins can be traced back to East Africa and India[2]. The demand for sesame seeds has increased over the past two decades, driven by their high oil quality, protein content, antioxidant properties, and remarkable adaptability to extreme climatic and soil conditions[3]. Several biotic and abiotic factors are responsible for the yield loss in sesame[4]. Among the biotic factors, Sesame leaf webber or capsule borer, *Antigastracatalaunalis* is responsible for causing ayield loss of up to 72% [5]. Insecticides are widely employed to manage insect pests and to enhance the productivity of crops grown for food and fiber[6].While these chemicals can significantly increase crop yields, their overuse can have detrimental effects on environmental and public health[7].Hence,among the various pest management strategies, host plant resistance is an environmentally friendly and farmer-friendly method[8]. In the present study, a total of 132 exotic germplasm were procured from USDA and screened for their resistance against*Antigastracatalaunalis.*

2. MATERIAL AND METHODS

The present study was conducted at the research farm of the ICAR-Indian Institute of Oilseeds Research in Rajendranagar, Hyderabad, Telangana, India. The site is situated at an altitude of 540 meters, with coordinates 17º 19'17" N latitude and 78º 24'51" E longitudeand features a tropical agro-climate. A total of 132 USDA germplasm together with a resistant check (Swetha), anda susceptible check (Prachi) were screened under natural field conditions in season 1 (2023) and season 2 (2024).

2.1 Field experiments

Field experiments were conducted in Randomized Block Design for season 1 (2023) and season 2 (2024) with three replications.The field was prepared using a rotavator until the soil reached a fine tilth, promoting rapid germination. The net plot size was 2×5 m, with a row-to-row and plant-to-plant spacing of 40×15 cm. A seed rate of 5 kg per ha was used. Appropriate irrigation and other intercultural operations, including thinning and gap-filling, were carried out and the crop was raised following all recommended agricultural practices. No plant protection measures were implemented throughout the crop duration.

2.2 Observation

Observations on the incidence of leaf webber were recorded weekly from the third week of August to the third week of October in season 1 (2023) and from the third week of December to the third week of February in season 2 (2024). The number of infested leaves was recorded from 10 randomly selected plants per plot. During the early vegetative stage, the larvae webbed the top leaves together and bored into the tender shoots. The number of leaves webbed together was counted and the percentage of damage was [9].

Percent leaf damage = (number of damaged leaves/total number of leaves) × 100.

The performance of all germplasm against leaf webber was assessed using a 1-9 scoring methodologyas mentioned in Table 1 [10]. Based on the scores, the germplasm were categorized. Similarly, the combined mean value of the percent leaf damage was also calculated in both seasons and the germplasm were categorized.

Table 1. Methodology for categorizing sesame germplasm based on percent leaf damage by sesame leaf webber

Leaf damage	Grade	Category
0-10	1	Highly resistant
11-20	3	Resistant
21-30	5	Moderately resistant
31-40	7	Susceptible
>40	9	Highly susceptible

2.3 Statistical analysis

The data were analyzed statistically to evaluate the reaction of different germplasm against the leaf webber using a Randomized Block Design (RBD). The percentage of leaf damage was assessed through one-way analysis of variance (ANOVA) for various germplasm. This analysis was performed on the original values for both the 2023 and 2024 seasons using SPSS software (Version 26.0, IBM Corporation, Armonk, NY, USA).

3. RESULTS

3.1 Categorization of Sesame Germplasm Based on the Incidence of *Antigastracatalaunalis* in Season 1, 2023

In season 1, the percentage of leaf damage caused by the sesame leaf webber varied from 0 to 97.96 percent (Table2). Based on the percent leaf damage, the germplasm (n=132) were graded. Germplasm such as PI 170757, PI 223014, and PI 285170 were found to be completely free of pest incidence. PI 170726 exhibited the highest level of leaf damage, reaching 97.96%. Based on the percentage of damage, the 132 germplasm entries were classified as follows: highly resistant (48 germplasm), resistant (31 germplasm), moderately resistant (25 germplasm), and susceptible (13 germplasm), and highly susceptible (15 germplasm)(F=2,002.20, df=262, P<0.001).The resistant check, Swetha, recorded a damage incidence of 5.56%, while the susceptible check, Prachi, showed a damage incidence of 70.09% (Table 3).

3.2 Categorization of Sesame Germplasm Based on the Incidence of *Antigastracatalaunalis* in Season 2, 2024

In season 2, the percentage of leaf damage caused by the sesame leaf webber ranged from 0 to 97.30 percent (Table 2).Based on the percent leaf damage, the germplasm (n=132) were graded.Five germplasm entries—PI 152498, PI 158045, PI 170757, PI 223014, and PI 285170—were found to be completely free from pest incidence. The highest damage recorded was 97.30 percent in the germplasm PI 170726. Based on the percentage of damage, the 132 germplasm entries were classified into the following categories: highly resistant (35 germplasm), resistant (36 germplasm), moderately Resistant (33 germplasm), susceptible (12 germplasm)and highly Susceptible (16 germplasm)(F=1,448.88, df=262, P<0.001). The resistant check, Swetha, had a leaf damage percentage of 3.57%, while the susceptible check, Prachi, had a leaf damage percentage of 72.09% (table 4).

3.3 Categorization of Sesame Germplasm Based on the Combined Mean Value

The combined mean performance of the germplasm for their resistance against *A. catalaunalis*was analyzed. Percentage leaf values ranged between 0 to 97.63 (Table 2). The lowest damage of 0% was observed in PI 170757, PI 223014,and PI 285170. The germplasm were categorized based on combined mean values (Table 5). The combined mean value of the percent leaf damage in the resistant check, Swetha was 4.57% and the susceptible check Prachi combined mean percent leaf damage value of 71.41%. The germplasm were categorized as follows: highly resistant (28), resistant (54), moderately resistant (21), susceptible (11),and highly susceptible (18).

4. DISCUSSION

In the present investigation, three germplasm namely, PI 170757, PI 223014,and PI 285170 exhibited 0 percent leaf damage across both seasons and also based on the combined mean percent leaf damage analysis.

The germplasm consistently classified as highly resistant across both the seasons and combined mean percent leaf damage value include, PI 153400, PI 158038, PI 158043, PI 158045, PI 158054, PI 158064, PI 158774, PI 158902, PI 167115, PI 170725, PI 170730, PI 170757, PI 170759, PI 174353, PI 175907, PI 179487, PI 179986, PI 223014, PI 234455, PI 238435, PI 279535, PI 280810, PI 285170, PI 433868, PI 490265, PI 599457and PI 599471. The germplasm consistently categorized as resistant across both seasons and combined mean percent leaf damage values include, PI 158044, PI 158915, PI 158919, PI 173100, PI 179034, PI 182293, PI 195121, PI 214259, PI 231035, PI 238416, PI 238433, PI 238442,PI 238453, PI 276700, PI 298630, PI 490057. Germplasm consistently classified as moderately resistant across both seasons and combined mean percent leaf damage values includePI 238444,PI 233459, PI 250579, PI 250894, PI 258369, PI 275361, PI 279536, PI 279537, PI 279545, PI 280806, PI 280815, PI 285176, PI 285177.

Resistance in these germplasm against leaf webber might be due to antixenosis (undesirability) or antibiosis (unsuitability) mechanisms. Phenotypic traits such as trichome density, specific leaf weight, relative water content of sesame leaves, and the presence of defense enzymes and other biochemical components may affect resistance to the leaf webber in those germplasm categorized as highly resistant [11].

The germplasm consistently categorized as susceptible acrossboth seasons and combined mean percent leaf damage values includePI 158771, PI 170742, PI 246386, PI 263469, PI 263470, PI 292028, PI 320966, PI 433869,and PI 490068.

Germplasm categorized under highly susceptible category in both the seasons and also based on combined mean percent leaf damage analysis include, PI 170726, PI 179031, PI 179484, PI 186510, PI 189082, PI 195123, PI 205229, PI 250748, PI 269965, PI 285171, PI 343813, PI 490037, and PI 599476.

Several Indigenous sesame germplasm were also evaluated for their resistance against *A. catalaunalis*. Germplasm such as TKG 22 was observed to be moderately resistant [12]. DSK-1-A was categorized as moderately resistant [13].Previously, the genotype SI-3274 was identified as moderately resistant based on the percentage of flower damage and was also categorized as moderately resistant according to the percentage of capsule damage [14]. Indigenous Germplasm namely, DSK-1-A, EC-511212, EVC-101, I-15, IC-205201, IC-205520, IC-205630, IC-205775, IC-43177 were categorized under the highly resistant category in both the seasons (2023 and 2024) against sesame leaf webber[11].

Table 2.Percent leaf damage caused by *A.catalaunalis*in132 USDA germplasm during season 1(2023) and season 2(2024)

	Percent leaf damage		
Germplasm	**Season 1**	**Season 2**	**Combined mean**
PI159513	3.13	17.95	10.54
PI152498	17.64	0.00	8.82
PI153400	9.09	4.92	7.00
PI 158038	5.26	6.06	5.66
PI158040	18.61	5.26	11.94
PI158043	7.69	4.65	6.17
PI158044	11.91	17.31	14.61
PI158045	2.70	0.00	1.35
PI158054	7.14	9.38	8.26
PI158056	34.38	29.17	31.77
PI158064	8.33	6.45	7.39
PI158065	24.32	6.90	15.61
PI158073	2.22	25.00	13.61
PI 158771	35.14	33.33	34.24
PI 158773	6.67	17.24	11.95
PI158774	6.90	5.00	5.95
PI158900	19.36	4.76	12.06
PI158902	8.33	7.41	7.87
PI158915	17.24	16.67	16.95
PI158919	14.70	19.35	17.03
PI167115	6.45	7.41	6.93
PI170725	7.14	12.00	9.57
PI170726	97.96	97.30	97.63
PI170730	5.13	9.09	7.11
PI170742	35.49	34.48	34.99
PI170752	21.43	6.45	13.94
PI170757	0.00	0.00	0.00
PI170759	9.68	8.33	9.01
PI170769	4.65	17.39	11.02
PI173100	17.24	19.35	18.30
PI174353	6.06	6.25	6.16
PI175907	6.90	7.69	7.29
PI 177072	29.03	8.70	18.86

PI 177541	28.26	4.65	16.46
PI 179031	90.63	76.19	83.41
PI 179034	17.78	14.81	16.30
PI 179483	26.47	9.09	17.78
PI 179484	80.56	85.29	82.92
PI 179487	4.35	6.45	5.40
PI 179490	80.00	31.03	55.52
PI 179986	2.44	9.68	6.06
PI 182293	18.18	17.24	17.71
PI 184671	24.14	16.13	20.13
PI 186411	6.67	23.33	15.00
PI 186510	72.41	82.86	77.64
PI 189082	65.52	46.43	55.97
PI 195121	19.44	17.14	18.29
PI 195123	67.57	48.72	58.14
PI 200107	23.07	15.63	19.35
PI 200111	7.14	15.69	11.41
PI 205229	80.00	45.45	62.73
PI 210687	31.03	92.86	61.95
PI 214257	14.29	26.67	20.48
PI 214259	18.75	16.22	17.48
PI 223014	0.00	0.00	0.00
PI 224663	6.90	15.56	11.23
PI 227253	27.27	18.92	23.09
PI 231033	9.68	13.51	11.60
PI 231034	9.09	17.24	13.17
PI 231035	17.24	19.35	18.30
PI 234455	5.26	13.89	9.58
PI 238416	16.67	13.79	15.23
PI 238422	14.81	24.00	19.41
PI 238427	22.58	16.28	19.43
PI 238429	6.90	13.46	10.18
PI 238433	14.29	19.05	16.67
PI238435	2.38	4.76	3.57
PI 238437	7.41	15.63	11.52
PI 238442	15.00	14.63	14.82
PI 238444	22.22	22.50	22.36
PI 238447	9.09	17.95	13.52

PI 238449	15.79	21.21	18.50
PI 238453	15.79	17.24	16.52
PI 238458	24.00	17.07	20.54
PI 233459	28.00	22.58	25.29
PI 238461	8.33	16.67	12.50
PI 238485	17.86	74.36	46.11
PI 246386	34.88	38.64	36.76
PI 250579	23.53	29.03	26.28
PI 250626	13.64	23.81	18.72
PI 250748	74.07	56.52	65.30
PI 250888	8.33	29.03	18.68
PI 250889	16.13	20.69	18.41
PI 250894	25.00	21.21	23.11
PI 254702	6.25	27.59	16.92
PI 254703	13.04	29.03	21.04
PI 254705	5.88	25.93	15.90
PI 256525	5.56	28.13	16.84
PI 258369	22.73	24.44	23.59
PI 263463	4.76	26.47	15.62
PI 263469	33.33	39.13	36.23
PI 263470	36.67	35.48	36.08
PI 265521	14.29	25.71	20.00
PI 269965	82.61	70.73	76.67
PI 275360	4.00	22.73	13.36
PI 275361	29.41	27.59	28.50
PI 276700	19.23	16.67	17.95
PI 279535	9.09	6.90	7.99
PI 279536	22.22	25.00	23.61
PI 279537	21.21	21.62	21.42
PI 279541	17.95	29.03	23.49
PI 279545	23.26	22.22	22.74
PI 279546	6.38	26.47	16.43
PI 280806	29.41	21.95	25.68
PI 280808	14.89	6.06	10.48
PI 280810	6.25	7.41	6.83
PI 280815	24.44	24.44	24.44
PI 280816	44.44	31.91	38.18
PI 285170	0.00	0.00	0.00

PI 285171	60.61	32.65	46.63
PI 285176	26.19	28.57	27.38
PI 285177	25.00	28.21	26.60
PI 292027	18.75	27.66	23.20
PI 292028	31.71	31.25	31.48
PI 298630	14.82	22.95	18.89
PI 304259	6.90	27.27	17.08
PI 320966	38.71	34.21	36.46
PI 343813	74.36	62.79	68.58
PI 433868	3.57	11.54	7.55
PI 433869	30.77	35.71	33.24
PI 490037	48.78	72.97	60.88
PI 490057	14.29	12.50	13.40
PI 490068	35.48	31.03	33.26
PI 490252	36.11	65.85	50.98
PI 490265	7.50	7.69	7.60
PI 599458	17.24	9.09	13.17
PI 599457	9.68	6.90	8.29
PI 599461	34.38	73.08	53.73
PI 599471	9.76	5.88	7.82
PI 599476	85.29	92.86	89.07
PI 599485	16.13	27.27	21.70
PI 599494	16.67	6.90	11.78
Swetha	5.56	3.57	4.57
Prachi	70.73	72.09	71.41

Table 3. Categorization of 132 USDA germplasm based on percent leaf damage caused by *A. catalaunalis*under open field conditions during season 1 (2023)

Category	Capsule borer incidence (%)	Number of sesame germplasm	Name of the germplasm
Highly Resistant	0-10	48	PI 159513, PI 153400, PI 158038, PI 158043, PI 158045, PI 158054, PI 158064, PI 158073, PI 158774, PI 158902, PI 167115, PI 170730, PI 170759, PI 174353, PI 175907, PI 170757, PI 179487, PI 179986, PI 186411, PI 200111, PI 224663, PI 231034, PI 234455, PI 238429, PI 238435, PI 238437, PI 238449, PI 223014, PI 238461, PI 250888, PI 254702, PI 254705, PI 256525, PI 263463, PI 275360, PI 279535, PI 279546, PI 280810, PI 304259, PI 433868, PI 490265, PI 599457, PI 599471, PI 158773, PI

			231033, PI 285170, PI170725, PI170769.
Resistant	11-20	31	PI 152498, PI 158040, PI 158044, PI 158915, PI 158919, PI 173100, PI 179034, PI 182293, PI 195121, PI 214259, PI 231035, PI 238416, PI 238433, PI 238442, PI 238453, PI 238485, PI 250626, PI 250889, PI 254703, PI 265521, PI 276700, PI 279541, PI 280808, PI 292027, PI 298630, PI 490057, PI 599458, PI 599494, PI 214257, PI 238422, PI 599485.
Moderately Resistant	21-30	25	PI 158065, PI 158900, PI 170752, PI 177541, PI 177072, PI 179483, PI 184671, PI 200107, PI 238458, PI 227253, PI 238427, PI 238447, PI 233459, PI 250579, PI 250894, PI 258369, PI 275361, PI 279536, PI 279537, PI 279545, PI 280806, PI 280815, PI 285176, PI 285177, PI 238444.
Susceptible	31-40	13	PI 158056, PI 158771, PI 170742, PI 263469, PI 292028, PI 320966, PI 433869, PI 490252, PI 599461, PI 210687, PI 490068, PI 246386, PI 263470.
Highly Susceptible	>40	15	PI 170726, PI 179031, PI 179490, PI 189082, PI 195123, PI 205229, PI 250748, PI 269965, PI 343813, PI 490037, PI 599476, PI 179484, PI 186510, PI 280816, PI 285171.

Table 4. Categorization of 132 USDA germplasm based on percent leaf damage caused by *A. catalaunalis*under open field conditions during season 2 (2024)

Category	Capsule borer incidence (%)	Number of sesame germplasm	Name of the germplasm
Highly Resistant	0-10	35	PI 152498, PI 153400, PI 158038, PI 158040, PI 158043, PI 158045, PI 158054, PI 158064, PI 158065, PI 158774, PI 158900, PI 158902, PI 167115, PI 170752, PI 170730, PI 177541, PI 170759, PI 174353, PI 175907, PI 177072, PI 170757, PI 179483, PI 179487, PI 179986, PI 238435, PI 223014, PI 279535, PI 280808, PI 280810, PI 490265, PI 599458, PI 599457, PI 599471, PI 599494, PI 285170.
Resistant	11-20	36	PI 159513, PI 158044, PI 158915, PI 158919, PI 173100, PI 179034, PI 182293, PI 184671, PI 186411, PI 195121, PI 200107, PI 200111, PI 214259, PI 238458, PI 224663, PI 227253, PI 231034, PI 231035, PI 234455, PI 238416, PI 238427, PI 238429, PI 238433, PI 238437, PI 238442, PI 238447, PI 238449, PI 238453, PI 238461, PI 276700, PI 433868, PI 490057, PI 158773, PI 231033, PI170725, PI170769.
Moderately Resistant	21-30	33	PI 158056, PI 158073, PI 233459, PI 250579, PI 250626, PI 250888, PI 250889, PI 250894, PI 254702, PI 254703, PI 254705, PI 256525, PI

			258369, PI 263463, PI 265521, PI 275360, PI 275361, PI 279536, PI 279537, PI 279541, PI 279545, PI 279546, PI 280806, PI 280815, PI 292027, PI 285176, PI 285177, PI 298630, PI 304259, PI 214257, PI 238422, PI 238444, PI 599485.
Susceptible	31-40	12	PI 158771, PI 170742, PI 179490, PI 263469, PI 292028, PI 320966, PI 433869, PI 490068, PI 246386, PI 263470, PI 280816, PI 285171.
Highly Susceptible	>40	16	PI 170726, PI 179031, PI 189082, PI 195123, PI 205229, PI 238485, PI 250748, PI 269965, PI 343813, PI 490037, PI 490252, PI 599461, PI 599476, PI 179484, PI 186510, PI 210687.

Table 5. Categorization of 132 USDA germplasm based on percent leaf damage caused by *A. catalaunalis*under open field conditions based on combined mean value

Category	Capsule borer incidence (%)	Number of sesame germplasm	Name of the germplasm
Highly Resistant	0-10	28	PI152498, PI 153400, PI 158038, PI 158043, PI 158045, PI 158054, PI 158064, PI 158774, PI 158902, PI 167115, PI 170725, PI 170730, PI 170757, PI 170759, PI 174353, PI 175907, PI 179487, PI 179986, PI 223014, PI 234455, PI 238435, PI 279535, PI 280810, PI 285170, PI 433868, PI 490265, PI 599457, PI 599471.
Resistant	11-20	54	PI 159513, PI 158040, PI 158044, PI 158065, PI 158073, PI 158773, PI 158900, PI 158915, PI 158919, PI 170752, PI 170769, PI 173100, PI 177072, PI 177541, PI 179034, PI 179483, PI 182293, PI 186411, PI 195121, PI 200107, PI 200111, PI 214259, PI 224663, PI 231033, PI 231034, PI 231035, PI 238416, PI 238422, PI 238427, PI 238429, PI 238433, PI 238437, PI 238442, PI 238447, PI 238449, PI 238453, PI 238461, PI 250626, PI 250888, PI 250889, PI 254702, PI 254705, PI 256525, PI 263463, PI 265521, PI 275360, PI 276700, PI 279546, PI 280808, PI 298630, PI 304259, PI 490057, PI 599458, PI 599494.
Moderately Resistant	21-30	21	PI 184671, PI 214257, PI 227253, PI 238444, PI 238458, PI 233459, PI 250579, PI 250894, PI 254703, PI 258369, PI 275361, PI 279536, PI 279537, PI 279541, PI 279545, PI 280806, PI 280815, PI 285176, PI 285177, PI 292027, PI 599485.
Susceptible	31-40	11	PI 158056, PI 158771, PI 170742, PI 246386, PI 263469, PI 263470, PI 280816, PI 292028, PI 320966, PI 433869, PI 490068.
Highly Susceptible	>40	18	PI 170726, PI 179031, PI 179484, PI 179490, PI 186510, PI 189082, PI 195123, PI 205229, PI 210687, PI 238485, PI 250748, PI 269965,

	PI 285171, PI 343813, PI 490037, PI 490252, PI 599461, PI 599476.

5. CONCLUSION

Three germplasm namely, PI 170757, PI 223014, and PI 285170 were observed to be completely free from *A. catalaunalis* based on the percent leaf damage data obtained from both the seasons and also based on combined mean value analysis.

Disclaimer (Artificial intelligence)

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

NO AI tools have been used.

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