Plant Archives Vol. 24, No. 1, 2024 pp. 1557-1571 e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives

Journal homepage: http://www.plantarchives.org

DOI Url : https://doi.org/10.51470/PLANTARCHIVES.2024.v24.no.1.219

COMBINING ABILITY STUDIES FOR VARIOUS YIELD ATTRIBUTING CHARACTERS IN SESAME (*SESAMUM INDICUM* L.)

Naresh Chaudhary[1]*, P.K. Jagtap[2], V.B. Rana[1], V.B. Patel[3], Rutvik J. Joshi[1], D.P. Patel[1], M.R. Prajapati[1] and Hemali Pandya[1]

[1]Department of Genetics and Plant Breeding, N.M. College of Agriculture, Navsari Agricult. Univ., Navsari - 396 450, Gujarat, India.

[2]Niger Research Station, Navsari Agricultural University, Vanarasi - 396 580, Gujarat, India.

[3]Department of Basic Science, College of Forestry, Navsari Agricultural University, Navsari - 396 450, Gujarat, India.

*Corresponding author E-mail : nc69755@gmail.com

(Date of Receiving-12-11-2023; Date of Acceptance-23-02-2024)

ABSTRACT

The goal of the current study was to evaluate gene action and combining ability for seed yield and its component traits in sesame. Crosses were executed using diallel analysis, excluding reciprocal cross, involving eight parents and resulting in 28 F_1 hybrids. One standard check (GT-5) was included for evaluation. At the Research Farm of Niger Research Station, Navsari Agricultural University, Vanarasi, Tal. Vansda, Dist. Navsari, the trial was carried out in a Randomized Block Design (RBD) with three replications for the development of crosses during the *Rabi*-summer season of 2020–21. Subsequently, an experimental material was evaluated during the Rabi-summer season of 2021-22. For all the characters under study, the specific combining ability (SCA) was higher than the general combining ability (GCA), according to the mean sum of squares analysis. This indicates that non-additive gene activity is prevalent. A preponderance of non-additive gene effects was indicated by the ratio of σ^2gca/σ^2sca being less than unity for all the characters *viz.*, days to 50% flowering, days to maturity, plant height, number of effective branches per plant, number of capsules per plant, capsule length, leaf area, number of seeds per capsule, 1000-seed weight, oil content and seed yield per plant. Gene effects were shown to be both additive and non-additive, according to combining ability analysis. General combining ability effects suggested that parents AT-360 (1.247**) and JLS-2420 (1.077**) exhibited commendable general combining ability for seed yield per plant and related attributes. Notably, four crosses *viz.*, JLS-2420 × LT-15-28 (3.88**), AT-360 × ASRT-9 (3.32**), AT-338 × AT-360 (2.96**) and AT-360 × LT-15-28 (2.95**) demonstrated significant SCA effects for seed yield per plant.

Key words : Sesame, GCA,SCA, Seed yield.

Introduction

Sesame, an ancient and pivotal oil seed crop, holds a significant position in Indian agriculture and the economy. India stands prominently on the global oil seed map, leading both in total area under cultivation and production. Sesame cultivation is widespread throughout the country, encompassing *Kharif*, semi-*Rabi*, *Rabi* and *summer* seasons, either as a sole or mixed crop. The crop occupies approximately 19.47 lakh hectares, yielding a total production of 8.66 lakh tonnes and a productivity of 413 kg/ha. While sesame ranks sixth in production after soybean, cottonseed, groundnut, sunflower and mustard, its cultivation is notably distributed across key states such as West Bengal, Uttar Pradesh, Rajasthan, Madhya Pradesh, Andhra Pradesh, Orissa, Tamil Nadu, Gujarat, and Telangana. Gujarat dedicates about 1.94 lakh hectares to sesame cultivation, producing 0.97 lakh tonnes with a productivity of 395 kg/ha (Anonymous, 2021). Themajor sesame producing in districts like Amareli, Bhavnagar, Surendranagar, Rajkot, Jamnagar and Kutch. The advancement of improved high-yielding varieties or optimal hybrids for commercial cultivation necessitates a comprehensive genetic evaluation of parental lines for their combining ability. Combining ability, denoting a genotype's capacity to transmit superiority to its crosses, is a crucial aspect of developing successful hybrids. The analysis of combining ability aids in identifying parents with high General Combining Ability (GCA) and parental combinations with high Specific Combining Ability (SCA). Additionally, it sheds light on the gene action influencing various traits. Higher SCA values indicate a dominant gene effect, while higher GCA values imply a more significant role of additive gene effects controlling these traits. Employing this technique to estimate additive and non-additive gene actions is valuable in determining the potential for commercial exploitation of heterosis, guiding breeding programs to isolate pure lines among the progenies of successful hybrids. To investigate the genetic basis of trait inheritance and select superior parents for breeding programs, various mating designs are utilized. Among these, diallel analysis stands out as a systematic approach widely applied in crop plants. It is used to evaluate how well genotypes perform in hybrid combinations and to describe the type and extent of gene activities controlling quantitative traits (Griffing, 1956b). The aim of the study is to evaluate the overall combining ability impacts of parents and the combining ability effects of hybrids on seed yield and its contributing characteristics. Additionally, the research will investigate the kind and extent of gene activity involved in the inheritance of different features under investigation.

Materials and Methods

The research utilized a diverse set of nine parents, comprising eight specific varieties (AT-377, DS-10, AT-338, AT-360, JLS-2611, ASRT-9, JLS-2420, LT-15-28) and one check variety (GT-5), in addition to a set of 37 genotypes. This set included the eight parents, their 28 F1 hybrids, and the check variety GT-5. The experimental layout followed a Randomized Block Design (RBD) with three replications, conducted at the Research Farm of Niger Research Station, Navsari Agricultural University, Vanarasi, Tal. Vansda, Dist. Navsari during *Rabi*-summer, 2020-21 for the development of crosses and an experimental material was evaluated during *Rabi*-summer, 2021-22. Vanarasi -396580, India. The F_1 hybrid seeds were generated through the half diallel method, while parent seeds were obtained through selfing. Observations were meticulously recorded for 11 distinct traits, including days to 50% flowering, days to maturity, plant height (cm), effective branches per plant, capsules per plant, capsule length (cm), leaf area (cm^2), seeds per capsule, 1000-seed weight (g), oil content (%), and seed yield per plant (g). The mean values of these traits, derived from the plot-wise averages of five randomly selected plants, were used for subsequent statistical analyses. The performance of both parents and hybrids underwent thorough statistical scrutiny for each trait. Analysis of variance, following the methodology recommended by Panse and Sukhatme (1985) was conducted to assess the significance of each trait. Furthermore, the mean values of the 36 entries (comprising 8 parents and 28 F_1 hybrids) were subjected to combining ability analysis, utilizing Method-II as proposed by Griffing (1956a). This approach aims to unravel the genetic intricacies and interactions contributing to the observed traits, providing valuable in sights into the potential for successful hybrid development and breeding strategies.

Results and Discussion

For all the studied characters, the observed σ^2gca/σ^2sca ratios were less than unity, indicating a prevalence of non-additive gene effects. The general combining ability (GCA) effect facilitated the identification of promising parents. The parent AT-360 demonstrated strong general combining ability for traits such as leaf area, 1000-seed weight, oil content, and seed yield per plant. Similarly, JLS-2420 exhibited commendable general combining ability for effective branches per plant, capsules per plant, seeds per capsule and seed yield per plant. Other parents, namely AT-377, DS-10, AT-338, ASRT-9, LT-15-28 and JLS-2611, also displayed positive general combining ability for one or more yield-contributing traits. The results suggested that parents with desirable GCA for multiple components harbored a concentration of favorable genes for various traits. These parents should be strategically employed in multiple crossing programs to combine essential attributes and develop high-yielding sesame varieties. Parents exhibiting good GCA effects for different traits also demonstrated acceptable per se performance, implying that per se performance is a reliable criterion for selecting parents for hybridization. The estimations of Specific Combining Ability (SCA) effects revealed a significant effect of cross combinations on all evaluated variables. Cross combinations, including JLS-2420 × LT-15-28, AT-338 × AT-360, and AT-360 × LT-15-28, shown significant seed yield potential. Crosses with strong and significant SCA effects had at least one parent with a noticeable GCA effect. These crosses are expected to create attractive transgressive segregants in future generations, if additive genetic system present in good general combiner and the complementary epistatic effect in F_1 act in same direction to maximize the desirable plant attribute. Finally, the findings show that the material for seed yield and its components vary significantly. Non-additive genetic variations are essential to the inheritance

Table 1 : Analysis of variance for combining ability for various characters in sesame.

Source of variation	df	Days to 50% flowering	Days to maturity	Plant height (cm)	Effective branches/plant	Capsules per plant
GCA	7	16.181 **	37.377 **	83.937 **	0.578 **	239.320 **
SCA	28	5.279 **	11.558 **	60.086 **	0.398 **	207.508 **
Error	70	0.776	1.132	13.556	0.049	24.187
σ^2gca		1.090	2.582	2.385	0.018	3.181
σ^2sca		4.502	10.426	46.529	0.349	183.320
σ^2gca/ σ^2sca		0.242	0.248	0.051	0.052	0.017

Source of variation	df	Capsule length (cm)	Leaf area (cm^2)	Seeds per capsule(cm)	1000-seed weight (g)	Oil content (%)	Seed yield per plant (g)
GCA	7	0.036 **	11.662 **	50.733 **	0.040 **	7.922 **	9.009 **
SCA	28	0.029 **	4.811 **	34.556 **	0.037 **	7.459 **	4.924 **
Error	70	0.005	1.090	5.972	0.004	0.558	0.728
σ^2gca		0.001	0.685	1.618	0.0003	0.046	0.408
σ^2sca		0.023	3.721	28.584	0.034	6.901	4.197
σ^2gca/ σ^2sca		0.032	0.184	0.057	0.009	0.007	0.097

*Significant at 5% level, ** Significant at 1% level.

of every character under investigation. Heterosis breeding appears to be especially appropriate for enhancing these traits in sesame due to the prevalence of non-additive genetic variance in traits such as days to 50% flowering, days to maturity, plant height, effective branches per plant, capsules per plant, capsule length, leaf area, seeds per capsule, 1000-seed weight, oil content, and seed yield per plant.

Estimation of general combining ability effects

Days to 50% flowering : AT-377 (-0.788), DS-10 (-1.286) and LT-15-28 (-1.746) displayed significant and negative General Combining Ability (GCA) effects, establishing them as proficient general combiners for earliness in flowering—a desirable trait in sesame. Conversely, AT-338 (1.748), AT-360 (1.337) and JLS-2420 (0.938) exhibited highly significant and positive GCA effects, indicating their suboptimal performance as general combiners for this specific trait. Two other parents, namely ASRT-9 (-0.490) and JLS-2611 (0.288), showed non-significant GCA effects, suggesting their average performance as general combiners. These findings align with previous studies by Hassan and Sedeck (2015), Abd elaziz and Ghareeb (2018) and Deshmukh *et al.* (2019) concerning days to 50% flowering in sesame

Days to maturity : AT-377 (-1.779), DS-10 (-1.847), and LT-15-28 (-1.736) demonstrated significant and negative General Combining Ability (GCA) effects, earning recognition as proficient general combiners for earliness in maturity—a favorable trait in sesame. Conversely, AT-338 (2.130) and AT-360 (3.427) exhibited highly significant and positive GCA effects, indicating their suboptimal performance as general combiners for this specific trait. Three other parents, namely ASRT-9 (-0.454), JLS-2420 (-0.028) and JLS-2611 (-0.288), displayed non-significant GCA effects, signifying their average performance as general combiners. These findings are consistent with the observations of Bangar *et al.* (2010), Nayak *et al.* (2016) and Sikarwar *et al.* (2021) regarding days to maturity in sesame.

Plant height (cm) : Significant and positive GCA effects were evident in two parents, namely AT-338 (2.451) and JLS-2611 (5.522), designating them as proficient general combiners for the trait under consideration. Conversely, ASRT-9 (-3.598) and JLS-2420 (-2.464) exhibited significant and negative GCA effects, indicating their suboptimal performance as general combiners for plant height. AT-377 (0.678), DS-10 (-1.475), AT-360 (-0.417) and LT-15-28 (0.660) displayed average GCA effects. These outcomes align with the observations of Okello-anyanga *et al.* (2014), Abd-elsaber *et al.* (2019) and Anter (2020) regarding plant height in sesame.

Effective branches per plant : Three parental lines, namely JLS-2420 (0.198), LT-15-28 (0.143) and JLS-2611 (0.304), displayed highly significant and positive General Combining Ability (GCA) effects, earning

Table 2 : Estimation of general combining ability effect associated with each parent for various characters.

Parents	Days to 50% flowering	Days to maturity	Plant height (cm)	Effective branches per plant	Capsules per plant	Capsule length (cm)	Leaf area (cm^2)	Seeds per capsule	1000 seed weight (g)	Oil content (%)	Seed yield per plant (g)
AT-377	-0.788 **	-1.779 **	-0.678	-0.401 **	-4.521 **	-0.020	0.558	-1.535 *	-0.003	0.417	0.263
DS-10	-1.286 **	-1.847 **	-1.475	-0.030	-3.265 *	-0.105 **	-0.615 *	-2.881 **	-0.089 **	-1.085 **	-1.093 **
AT-338	1.748 **	2.130 **	2.451 *	-0.020	8.663 **	0.095 **	0.657 *	0.322	0.010	-0.747 **	0.187
AT-360	1.337 **	3.427 **	-0.417	-0.285 **	-3.101 *	-0.025	1.279 **	-0.629	0.040 *	0.810 **	1.247 **
ASRT-9	-0.490	-0.454	-3.598 **	0.091	-1.832	0.022	-1.530 **	0.415	-0.043 *	-1.273 **	-0.340
JLS-2420	0.938 **	-0.028	-2.464 *	0.198 **	6.185 **	0.016	-0.669 *	4.371 **	-0.027	0.290	1.077 **
LT-15-28	-1.746 **	-1.736 **	0.660	0.143 *	-3.051 *	0.049 *	-0.972 **	1.562 *	-0.009	0.719 **	0.130
JLS-2611	0.288	-0.288	5.522 **	0.304 **	0.922	-0.032	1.292 **	-1.625 *	0.123 **	0.870 **	-1.470 **
SE (gi)	0.257	0.313	1.082	0.065	1.445	0.022	0.311	0.716	0.017	0.220	0.249

*Significant at 5% level, ** Significant at 1% level.

Table 3 : Summary of general combining ability effects of the parents for various characters in Sesame.

Parents	Days to 50% flowering	Days to maturity	Plant height	Effective branches per plant	Capsules per plant	Capsule length	Leaf area	Seeds per capsule	100-seed weight	Oil content	Seed yield per plant
AT-377	G	G	A	P	P	A	A	P	A	A	A
DS-10	G	G	A	A	P	P	P	P	P	P	P
AT-338	P	P	G	A	G	G	G	A	A	P	A
AT-360	P	P	A	P	P	A	G	A	G	G	G
ASRT-9	A	A	P	A	A	A	P	A	P	P	A
JLS-2420	P	A	P	G	G	A	P	G	A	A	G
LT-15-28	G	G	A	G	P	G	P	G	A	G	A
JLS-2611	A	A	G	G	A	A	G	P	G	G	P

G = Good parent having significant GCA effects in the desired direction
A = Average parent having either positive or negative but non-significant GCA effects
P = Poor parent having GCA effect in the undesired direction.

recognition as proficient general combiners for effective branches per plant. In contrast, AT-377 (-0.401) and AT-360 (-0.285) exhibited significant and negative GCA effects, indicating their suboptimal performance as general combiners for this particular trait. The remaining parents were considered average general combiners due to their non-significant GCA effects. These findings align with the observations of Solanki *et al.* (2003), Rajaram and Kumar (2011), Nayak *et al.* (2016) and Abd-elsaber *et al.* (2019) regarding effective branches per plant in sesame.

Capsules per plant : Two parents, AT-338 (8.663) and JLS-2420 (6.185), displayed highly significant and positive General Combining Ability (GCA) effects, classifying them as commendable general combiners. In contrast, four parents, namely AT-377 (-4.521), DS-10 (-3.226), AT-360 (-3.101) and LT-15-28 (-3.051) were identified as poor general combiners due to their significant negative GCA effects on the number of capsules per plant. The non-significant GCA effects of ASRT-9 (-1.832) and JLS-2611 (-0.922) indicated their average combining ability effects. These findings align with prior research by Sankar and Kumar (2003), Mishra *et al.* (2009), Kumar *et al.* (2012) and Abd elaziz and Ghareeb (2018) concerning capsules per plant in sesame.

Capsule length (cm) : Two parental lines, AT-338 (0.095) and LT-15-28 (0.049), demonstrated noteworthy general combining ability, revealing significant and positive effects for this particular trait. In contrast, DS-10 (-0.105) exhibited significant and negative effects, designating it as a less effective general combiner for this characteristic. The remaining parents were considered average combiners due to their non-significant general combining ability effects. These results align with the findings reported by Hassan and Sedeck (2015), Rajput *et al.* (2017) and Abd-elsaber *et al.* (2019) concerning capsule length in sesame.

Leaf area (cm^2) : The General Combining Ability (GCA) effects were notably significant and positive for certain parents, specifically AT-338 (0.657), AT-360 (1.280) and JLS-2611 (1.292), indicating their commendable general combining ability. Conversely, DS-10 (-0.62), ASRT-9 (-1.53), JLS-2420 (-0.67), and LT-15-28 (-0.972) displayed significant and negative GCA effects, categorizing them as less effective general combiners for leaf area. AT-377 (0.558) exhibited average combining ability effects.

Seeds per capsule : Among the parents, JLS-2420 (4.371) and LT-15-28 (1.562) exhibited noteworthy and positive General Combining Ability (GCA) effects, establishing them as effective general combiners for seeds per capsule. In contrast, AT-377 (-1.534), DS-10 (-2.880) and JLS-2611 (-1.625) displayed significant and negative GCA effects, signifying their less favorable performance as general combiners for this trait. AT-338 (0.322), AT-360 (-0.629), and ASRT-9 (0.415) were categorized as average general combiners due to their non-significant GCA effects. These findings align with the results reported by Bangar *et al.* (2010), Rajput *et al.* (2017) and Kumar *et al.* (2012) regarding seeds per capsule in sesame.

1000-seed weight (g) : The assessment of General Combining Ability (GCA) effects revealed that two parents, AT-360 (0.040) and JLS-2611 (0.123), exhibited noteworthy general combining ability for test weight, with significant and positive GCA effects. In contrast, parent DS-10 (-0.089) and ASRT-9 (-0.043) displayed significant and negative GCA effects, indicating their less favorable performance as general combiners for this trait. The remaining parents were classified as average general combiners due to their non-significant GCA effects. These findings align with previous research by Mishra *et al.* (2009), Rajaram and Kumar (2011), Abd elaziz and Ghareeb (2018) and Anter (2020) concerning test weight in sesame.

Oil content (%) : The parents AT-360 (0.810), LT-15-28 (0.719) and JLS-2611 (0.870) displayed noteworthy and positive General Combining Ability (GCA) effects, positioning them as effective general combiners for oil content. Conversely, DS-10 (-1.085), AT-338 (-0.747) and ASRT-9 (-1.273) exhibited significant and negative GCA effects, suggesting their suboptimal performance as general combiners for this trait. AT-377 (0.417) and JLS-2420 (0.290) were categorized as average combiners due to their non-significant GCA effects. These findings align with the results reported by Mandal *et al.* (2010), Salunke and Lokesha (2012), Tripathy *et al.* (2016), Rajput *et al.* (2017) and Abd-elsaber *et al.* (2019) regarding oil content in sesame.

Seed yield per plant (g) : Two parents, AT-360 (1.247) and JLS-2420 (1.077), demonstrated significant and positive General Combining Ability (GCA) effects, categorizing them as commendable general combiners for seed yield per plant. Conversely, two parents, DS-10 (-1.093) and JLS-2611 (-1.470), exhibited significant and negative GCA effects, indicating their less favorable performance as general combiners for this trait. The remaining parents were classified as average general combiners due to their non-significant GCA effects. These results align with the findings reported by Raghunaiah *et al.* (2008), Gaikwad *et al.* (2009), Kumar and

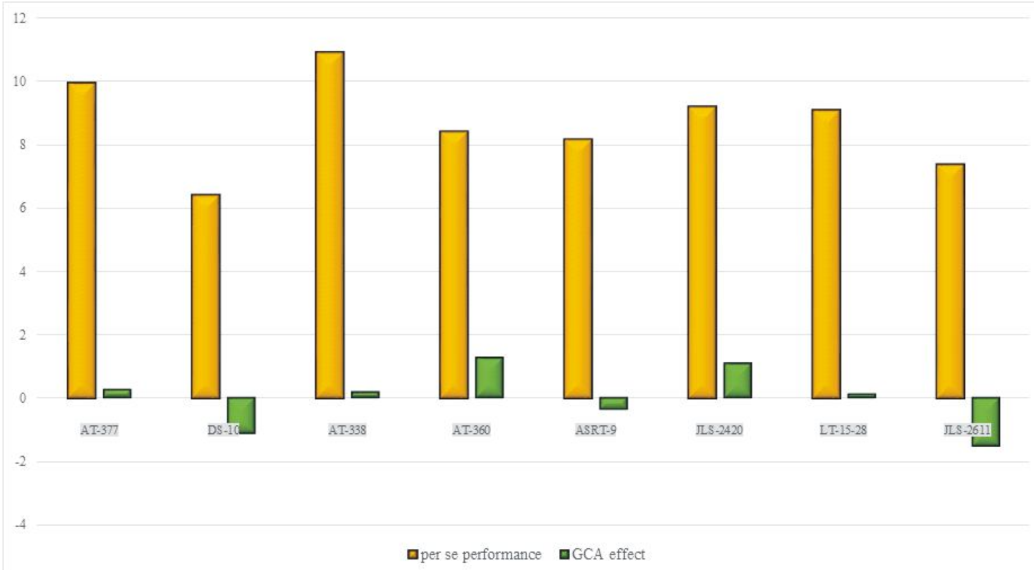

Fig. 1 : *Per se* performance and GCA effects of parents for seed yield in sesame.

Vivekanandan (2009), Yamanura *et al*. (2009), Mandal *et al.* (2010), Parameshwarappa *et al.* (2010), Kumar *et al*. (2012), Sarvaliya *et al*. (2013), Nayak *et al*. (2016), Raikwar *et al.* (2018), Anter (2020) and Ismail *et al*. (2020) concerning seed yield per plant in sesame.

Based on estimates of general combining ability effects, parents were categorized as good, average, or poor combiners across eleven characters. None of the parents exhibited superior combining ability for all studied traits concurrently. Parents identified as good general combiners for multiple characters hold promise for inclusion in breeding programs, allowing the combination of diverse traits with fewer parent involvement in crossing programs. Developing a population involving these parents in a multiple crossing program could lead to the isolation of desirable recombinants. Moreover, varieties or parents displaying favorable general combining ability for specific components can contribute to component breeding programs, effectively enhancing traits, and ultimately improving seed yield.

Estimation of specific combining ability effects

Days to 50% flowering : Among the 28 crosses evaluated, nine exhibited significant and negative Specific Combining Ability (SCA) effects for early flowering. The most pronounced and negative SCA effect was observed in the DS-10 × ASRT-9 cross (-3.60), followed by AT-360 × JLS-2611 (-2.90) and AT-377 × AT-360 (-2.83). These findings align with the results reported by Kumar *et al.* (2012), Hassan and Sedeck (2015) and Kumar *et al.* (2022) regarding days to 50% flowering in sesame.

Days to maturity : Out of the 28 crosses assessed, eight displayed significant and negative Specific Combining Ability (SCA) effects for days to maturity. The most pronounced and negative SCA effect was observed in the DS-10 × ASRT-9 cross (-6.14), followed by AT-360 × JLS-2420 (-5.75) and AT-377 × LT-15-28 (-4.14). These findings align with results reported by Nayak *et al.* (2016), Anter (2020) and Sikarwar *et al*. (2021) regarding days to maturity in sesame.

Plant height (cm) : The Specific Combining Ability (SCA) effects in hybrids exhibited a range from -15.34 (DS-10 × JLS-2420) to 11.10 (DS-10 × ASRT-9). Among the 28 crosses, seven hybrids demonstrated significant and positive SCA effects for these traits. Notably, the DS-10 × ASRT-9 cross (11.10) ranked highest, followed by JLS-2420 × LT-15-28 (9.16) for this characteristic. Conversely, three hybrids displayed significant and negative SCA effects, indicating less favorable general combinations. These results align with the findings reported by Anter (2020), Abd elaziz and Ghareeb (2018) and Abd-Elsaber *et al*. (2019) regarding plant height in sesame.

Effective branches per plant : The spectrum of Specific Combining Ability (SCA) effects in hybrids ranged from -1.09 (AT-338 × AT-360) to 0.80 (AT-360 × JLS-2420). Among the 28 crosses, nine combinations exhibited significant and positive SCA effects for effective branches per plant, with the highest SCA effects observed in AT-360 × JLS-2420 (0.80), followed by AT-360 × ASRT-9 (0.79). Conversely, five crosses demonstrated significant and negative SCA effects, indicating suboptimal cross combinations for the number of effective branches per plant. These findings align with the results reported by Sumathi and Muralidharan (2008), Nayak *et al.* (2016), and Abd-elsaber *et al*. (2019) regarding effective branches

Table 4 : Estimation of specific combining ability effect associated with each cross for various traits.

S. no.	Hybrids	Days to 50% flowering	Days to maturity	Plant height (cm)	Effective branches per plant	Capsules per plant	Capsule length (cm)
1.	AT-377 × DS-10	-1.02	1.78	-1.89	-0.87 **	-14.70 **	0.05
2.	AT-377 × AT-338	0.77	-2.18 *	-1.88	0.29	5.70	-0.20 **
3.	AT-377 × AT-360	-2.83 **	-0.89	-13.34 **	0.13	-21.37 **	-0.15 *
4.	AT-377 × ASRT-9	-1.93 *	0.32	8.94 **	-0.69 **	9.03 *	0.20 **
5.	AT-377 × JLS-2420	0.07	-0.20	7.77 *	0.33	2.88	0.00
6.	AT-377 × LT-15-28	-0.91	-4.14 **	-3.66	0.45 *	-5.32	0.08
7.	AT-377 × JLS-2611	0.24	-0.02	4.98	-0.93 **	2.24	-0.01
8.	DS-10 × AT-338	1.26	5.40 **	7.92 *	0.37	-1.19	-0.02
9.	DS-10 × AT-360	1.84 *	-1.87	3.35	-0.05	3.64	-0.17 *
10.	DS-10 × ASRT-9	-3.60 **	-6.14 **	11.10 **	-0.08	-10.26 *	-0.02
11.	DS-10 × JLS-2420	-0.26	2.11 *	-15.34 **	-0.06	-13.34 **	0.05
12.	DS-10 × LT-15-28	-1.39	-4.04 **	-1.99	0.71 **	10.96 *	0.34 **
13.	DS-10 × JLS-2611	0.56	0.35	3.71	0.41 **	30.09 **	0.04
14.	AT-338 × AT-360	5.71 **	6.75 **	-7.34 *	-1.09 **	16.61 **	0.11
15.	AT-338 × ASRT-9	0.82	1.05	8.11 *	0.57 **	18.04 **	-0.09
16.	AT-338 × JLS-2420	-1.97 *	-3.64 **	5.11	-0.23	-0.44	0.16 *
17.	AT-338 × LT-15-28	-0.28	-0.07	7.55 *	0.12	7.40	0.00
18.	AT-338 × JLS-2611	-1.32	-0.78	0.22	0.66 **	-10.11 *	0.01
19.	AT-360 × ASRT-9	-2.11 **	-2.54 **	6.48	0.79 **	9.01 *	-0.21 **
20.	AT-360 × JLS-2420	-2.20 **	-5.75 **	0.14	0.80 **	17.86 **	0.27 **
21.	AT-360 × LT-15-28	-1.85 *	5.59 **	1.98	0.19	4.73	0.08
22.	AT-360 × JLS-2611	-2.90 **	-4.10 **	6.06	0.17	-0.51	0.13
23.	ASRT-9 × JLS-2420	1.29	0.59	-13.28 **	0.73 **	23.99 **	0.16 *
24.	ASRT-9 × LT-15-28	-0.86	1.18	-2.94	-0.52 **	-11.11 *	0.01
25.	ASRT-9 × JLS-2611	1.76 *	4.04 **	-1.33	0.48 *	-17.01 **	0.15 *
26.	JLS-2420 × LT-15-28	0.20	-0.77	9.16 **	0.37	2.38	-0.46 **
27.	JLS-2420 × JLS-2611	1.70 *	3.11 **	3.74	0.02	7.70	-0.22 **
28.	LT-15-28 × JLS-2611	-2.13 **	-0.39	0.84	0.32	7.20	0.08
	SE(S_{ij})	0.80	0.96	3.34	0.20	4.46	0.07
	Range	**-3.60 to 5.71**	**-6.14 to 6.75**	**-15.34 to 11.10**	**-1.09 to 0.80**	**-21.37 to 30.9**	**-0.461 to 0.340**

* Significant at 5% level, ** Significant at 1% level

Table 4 continue…

S. no.	Hybrids	Leaf area (cm^2)	Seeds per capsule	1000-seed weight (g)	Oil content (%)	Seed yield per plant (g)
1.	AT-377 × DS-10	1.23	6.99 **	-0.09	1.10	1.72 *
2.	AT-377 × AT-338	2.79 **	1.77	0.13 *	2.33 **	-2.66 **
3.	AT-377 × AT-360	0.80	-0.24	0.16 **	1.81 **	2.01 **
4.	AT-377 × ASRT-9	-1.04	5.96 **	-0.30 **	-0.19	-1.07
5.	AT-377 × JLS-2420	-0.97	-3.59	0.19 **	2.86 **	-0.72
6.	AT-377 × LT-15-28	-3.93 **	-4.25	0.02	-2.00 **	0.56
7.	AT-377 × JLS-2611	2.24 *	-4.25	0.05	2.15 **	0.30
8.	DS-10 × AT-338	2.46 *	-0.22	-0.14 **	4.89**	-1.14

Table 4 continued...

Table 4 continued...

9.	DS-10 × AT-360	0.76	-11.79 **	-0.11 *	0.76	2.50 **
10.	DS-10 × ASRT-9	-0.07	7.42 **	0.16 **	-5.30 **	-1.04
11.	DS-10 × JLS-2420	-1.58	2.03	0.19 **	-1.82 **	1.01
12.	DS-10 × LT-15-28	-0.13	-1.15	0.08	1.09	-1.48
13.	DS-10 × JLS-2611	0.50	-1.87	0.17 **	-2.74 **	0.15
14.	AT-338 × AT-360	1.04	-6.16 **	-0.21 **	-2.11 **	2.96 **
15.	AT-338 × ASRT-9	-1.14	-1.23	0.21 **	-2.54 **	-0.56
16.	AT-338 × JLS-2420	0.88	0.93	-0.25 **	2.11 **	1.46
17.	AT-338 × LT-15-28	-2.33 *	3.79	0.17 **	-1.65 *	-1.03
18.	AT-338 × JLS-2611	-0.05	-3.96	0.33 **	-0.37	-1.13
19.	AT-360 × ASRT-9	-2.30 *	9.04 **	-0.23 **	-3.65 **	3.32 **
20.	AT-360 × JLS-2420	2.67 **	3.77	-0.05	3.30 **	-4.60 **
21.	AT-360 × LT-15-28	4.83 **	7.63 **	0.26 **	-0.35	2.95 **
22.	AT-360 × JLS-2611	-1.37	-3.71	0.21 **	3.02 **	-2.05 **
23.	ASRT-9 × JLS-2420	-0.55	-2.49	-0.15 **	1.30	1.72 *
24.	ASRT-9 × LT-15-28	4.38 **	-6.47 **	-0.07	4.79 **	-1.83 *
25.	ASRT-9 × JLS-2611	1.48	3.78	0.07	1.73 *	0.73
26.	JLS-2420 × LT-15-28	-2.40 **	10.25**	0.03	-1.01	3.88 **
27.	JLS-2420 × JLS-2611	-0.10	-3.12	0.03	-0.44	2.12 **
28.	LT-15-28 × JLS-2611	-0.41	6.77 **	0.25 **	-0.34	-1.77 *
SE(S_{ij})		0.95	2.22	0.05	0.68	0.77
Range		**-3.93 to 4.83**	**-11.79 to 10.25**	**-0.30 to 0.33**	**-5.30 to 4.89**	**-4.60 to 3.88**

* Significant at 5% level, ** Significant at 1% level.

Table 5 : Comparison of top four promising crosses on the basis of*per se* performance for yield per plant, SCA effect and significant for other traits.

Hybrids	***per se* performance**	**SCA effect**	**Significant for other traits**
JLS-2420 × LT-15-28	14.57	3.88 **	PH, CL, LA, SPC, SYP
AT-338 × AT-360	13.87	2.96 **	DFF, DM, PH, EFP, CPP, SPC, SW, OC, SYP
AT-360 × LT-15-28	13.80	2.95 **	DFF, DM, LA, SPC, SW, SYP
AT-360 × ASRT-9	13.70	3.32 **	DFF, DM, EFP, CPP, CL, LA, SPC, SW, OC, SYP

DFF: Days to 50% flowering; **DM:** Days to maturity; **SCA:** Specific combining ability
EBP: Effective branches per Plant; **CPP :** Capsules per Plant; **CL:** Capsule length (cm)
LA: leaf area (cm^2); **SPC:** seeds per capsule; **SW:** 1000-seed weight (g)
OC: Oil content; **SYP:** Seed yield per plant; **PH:** Plant height (cm)

per plant in sesame.

Capsules per plant : Among the 28 crosses, eight exhibited significant and positive Specific Combining Ability (SCA) effects. The most prominent and positive SCA effect was observed in the DS-10 × JLS-2611 cross (30.09), followed by ASRT-9 × JLS-2420 (23.99) and AT-338 × ASRT-9 (18.04) for this trait. Additionally, seven crosses displayed significant and negative SCA effects. These results are consistent with previous findings reported by Kumar *et al.* (2012), Abd elaziz and Ghareeb (2018), Abd-elsaber *et al.* (2019), Anter (2020) and Kumar *et al.* (2022) regarding capsules per plant in sesame.

Capsule length (cm) : Twelve hybrids exhibited significant Specific Combining Ability (SCA) effects for capsule length. Among them, six hybrids demonstrated positive and significant SCA estimates in a desirable direction, indicating their effectiveness as good specific combinations. Noteworthy examples include DS-10 × LT-15-28 (0.34), AT-360 × JLS-2420 (0.27) and AT-377 × ASRT-9 (0.20). Conversely, six hybrids displayed poor combinations due to negative and significant SCA effects. These results align with previous findings reported by Solanki and Gupta (2001), Hassan and Sedeck (2015) and Abd-elsaber *et al.* (2019) regarding capsule length in sesame.

Table 6 : Promising parents and F_1 for *per se* performance, combining ability effects for various characters in sesame.

Characters	*Per se* performance		Combining ability effects		Characters	*Per se* performance		Combining ability effects	
	Parents	F_1s	GCA	SCA		Parents	F_1s	GCA	SCA
Days to 50% flowering	DS-10 LT-15-28 AT-338	DS-10 × ASRT-9 DS-10 × LT-15-28 LT-15-28 × JLS-2611	LT-15-28 DS-10 AT-377	DS-10 × ASRT-9 AT-360 × JLS-2611 AT-377 × AT-360	Leaf area (cm^2)	JLS-2611 AT-377 JLS-2420	AT-360 × LT-15-28 AT-377 × JLS-2611 AT-377 × ASRT-9	JLS-2611 AT-360 AT-338	AT-360 × LT-15-28 ASRT-9 × LT-15-28 AT-377 × AT-338
Days to maturity	DS-10 LT-15-28 AT-377	DS-10 × ASRT-9 AT-377 × LT-15-28 DS-10 × LT-15-28	DS-10 AT-377 LT-15-28	DS-10 × ASRT-9 AT-360 × JLS-2420 AT-377 × LT-15-28	Seed per capsule	JLS-2420 AT-338 JLS-2611	JLS-2420 × LT-15-28 AT-360 × ASRT-9 AT-360 × LT-15-28	JLS-2420 LT-15-28 -	JLS-2420 × LT-15-28 AT-360 × ASRT-9 AT-360 × LT-15-28
Plant height (cm)	JLS-2611 AT-360 AT-377	AT-360 × JLS-2611 AT-338 × LT-15-28 AT-377 × JLS-2611	JLS-2611 AT-338 -	DS-10 × ASRT-9 JLS-2420×LT-15-28 AT-377 × ASRT-9	1000-seed weight (g)	AT-360 ASRT-9 JLS-2420	AT-338 × JLS-2611 AT-360 × JLS-2611 AT-360 × LT-15-28	JLS-2611 AT-360 -	AT-338 × JLS-2611 AT-360 × LT-15-28 LT-15-28 × JLS-2611
Effective branches per plant	JLS-2611 AT-377 DS-10	ASRT-9 × JLS-2420 AT-338 × JLS-2611 ASRT-9 × JLS-2611	JLS-2611 JLS-2420 LT-15-28	AT-360 × JLS-2420 AT-360 × ASRT-9 ASRT-9 × JLS-2420	Oil content %	LT-15-28 JLS-2611 AT-360	AT-360 × JLS-2611 AT-360 × JLS-2420 ASRT-9 × LT-15-28	JLS-2611 AT-360 LT-15-28	DS-10 × ASRT-9 ASRT-9 × LT-15-28 AT-360 × JLS-2420
Capsules per plant	AT-377 AT-338 JLS-2611	ASRT-9 × JLS-2420 DS-10 × JLS-2611 AT-338 × AT-360	AT-338 JLS-2420 -	DS-10 × JLS-2611 ASRT-9 × JLS-2420 AT-338 × ASRT-9	Seed yield per plant (g)	AT-338 AT-377 JLS-2420	JLS-2420 × LT-15-28 AT-338 × AT-360 AT-360 × LT-15-28	AT-360 JLS-2420 -	JLS-2420 × LT-15-28 AT-360 × ASRT-9 AT-338 × AT-360
Capsule length (cm)	AT-338 JLS-2420 LT-15-28	DS-10 × LT-15-28 AT-338 × JLS-2420 AT-360 × JLS-2420	AT-338 LT-15-28 -	DS-10 × LT-15-28 AT-360 × JLS-2420 ASRT-9 × JLS-2420					

Leaf area (cm^2) : The range of Specific Combining Ability (SCA) effects in hybrids varied from -3.93 (AT-377 × LT-15-28) to 4.83 (AT-360 × LT-15-28). The cross AT-360 × LT-15-28 exhibited the highest SCA effects (4.83), followed by ASRT-9 × LT-15-28 (4.38). Among the 28 crosses evaluated, six showed significant and positive SCA effects for leaf area.

Seeds per capsule : The range of Specific Combining Ability (SCA) effects in hybrids varied from -11.79 (DS-10 × AT-360) to 10.25 (JLS-2420 × LT-15-28). Among the 28 crosses, seven hybrids exhibited significant and positive SCA effects, designating them as effective specific combiners for seeds per capsule. Notable specific combinations included JLS-2420 × LT-15-28 (10.25), AT-360 × ASRT-9 (9.04) and AT 360 × LT-15-28 (7.63). Conversely, three crosses were identified as poor specific cross combinations due to significant and negative SCA effects. These results align with the findings of Kumar *et al.* (2012) regarding seeds per capsule.

1000-seed weight (g) : Estimates of Specific Combining Ability (SCA) effects in hybrids ranged from -0.30 (AT-377 × ASRT-9) to 0.33 (AT-338 × JLS-2611). Out of the 28 crosses, twelve hybrids were identified as favorable specific combinations, displaying significant and positive SCA effects for 1000-seed weight, while six hybrids were categorized as suboptimal specific combinations due to their significant and negative SCA effects. These observations align with previous findings by Kumar and Kannan (2010), Abd elaziz and Ghareeb (2018), Abd-elsaber *et al*. (2019), Deshmukh *et al*. (2019), Anter (2020) and Kumar *et al*. (2022) in relation to seed weight.

Oil content (%) : Among the 28 crosses, the estimates of Specific Combining Ability (SCA) effects in hybrids ranged from -5.30 (DS-10 × ASRT-9) to 4.89 (DS-10 × AT-338). Ten hybrids were identified as favorable specific combinations, exhibiting significant and positive SCA effects for oil content, while eight hybrids were categorized as suboptimal specific combinations due to their significant and negative SCA effects. These results align with the findings of Nayak *et al.* (2016), Tripathy *et al.* (2016) and Kumar *et al.* (2022) regarding

Table 7 : A summary table showing the best specific combination along with the APPENDIX - I.

Characters	Best specific combinations	*Per se* performance	SCA effects	GCA effects on the parents involved
Days to 50% flowering	DS-10 × ASRT-9	37.90	-3.60	G × A
	DS-10 × LT-15-28	38.84	-1.39	G × G
	LT-15-28 × JLS-2611	39.67	-2.13	G × A
Days to maturity	DS-10 × ASRT-9	87.74	-6.14	G × A
	AT-377 × LT-15-28	88.52	-4.14	G × G
	DS-10 × LT-15-28	88.56	-1.39	G × G
Plant height (cm)	AT-360 × JLS-2611	113.23	6.06	A × G
	AT-338 × LT-15-28	112.73	7.55	G × A
	AT-377 × JLS-2611	111.90	4.98	A × G
Effective branches per Plant	ASRT-9 × JLS-2420	4.22	0.73	A × G
	AT-338 × JLS-2611	4.14	0.66	A × G
	ASRT-9 × JLS-2611	4.07	0.48	A × G
Capsules per Plant	ASRT-9 × JLS-2420	98.63	23.99	A × G
	DS-10 × JLS-2611	98.03	30.09	P × A
	AT-338 × ASRT-9	95.17	18.04	G × A
Capsule length (cm)	DS-10 × LT-15-28	3.20	0.340	P × G
	AT-338 × JLS-2420	3.18	0.156	G × A
	AT-360 × JLS-2420	3.17	0.267	A × A
Leaf area (cm^2)	AT-360 × LT-15-28	45.57	4.83	G × P
	AT-377 × JLS-2611	44.52	2.24	A × G
	AT-377 × AT-338	44.43	2.79	A × G
Seeds per capsule	JLS-2420 × LT-15-28	76.00	20.25	G × G
	AT-360 × ASRT-9	68.64	9.04	A × A
	AT-360 × LT-15-28	68.37	7.63	A × G
1000-seed weight (g)	AT-338 × JLS-2611	3.59	0.33	A × G
	AT-360 × JLS-2611	3.49	0.21	G × G
	AT-360 × LT-15-28	3.41	0.26	G × A
Oil content %	AT-360 × JLS-2611	47.59	3.02	G × G
	AT-360 × JLS-2420	47.28	3.30	G × A
	ASRT-9 × LT-15-28	47.12	4.79	P × G
Seed yield per plant (g)	JLS-2420 × LT-15-28	14.57	3.88	G × A
	AT-338 × AT-360	13.87	2.96	A × G
	AT-360 × LT-15-28	13.80	2.95	G × A

Mean values of parents, hybrids and checks for different characters under study in Sesame.

oil content percentage in sesame.

Seed yield per plant (g) : Fourteen hybrids exhibited significant Specific Combining Ability (SCA) effects. Among them, nine hybrids displayed positive SCA effects, indicating their proficiency as specific combiners for higher seed yield per plant. Conversely, five crosses with negative SCA effects were deemed as suboptimal specific combinations. Notably, the hybrids JLS-2420 ×

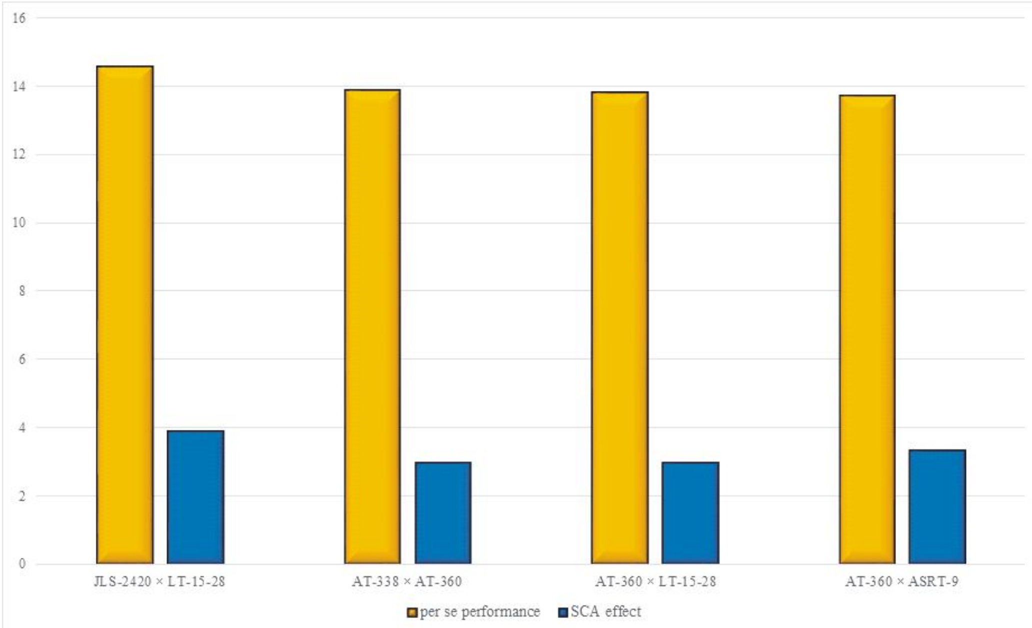

Fig. 2 : *Per se* performance of top four crosses along with SCA effects for seed yield in sesame.

Appendix I :

S. no.	Genotypes	Days to 50% flowering	Days to maturity	Plant height (cm)	Effective branches per plant	Capsule per plant	Capsule length (cm)
1	AT 377	44.49	95.28	100.26	3.03	72.02	2.89
2	DS 10	42.00	93.69	95.69	2.92	61.17	2.57
3	AT 338	44.27	97.18	97.14	2.80	69.61	3.12
4	AT 360	48.11	104.44	102.58	2.15	49.10	2.83
5	ASRT 9	44.59	96.02	86.34	2.73	55.78	2.86
6	JLS 2420	45.73	98.40	98.50	2.62	62.15	2.97
7	LT-15-28	43.38	94.03	97.92	2.66	56.07	2.95
8	JLS 2611	44.89	95.65	104.01	3.23	62.33	2.76
Parental Mean		**44.68**	**96.84**	**97.80**	**2.77**	**61.03**	**2.87**
9	AT 377 × DS 10	40.16	94.33	98.03	1.89	47.80	2.84
10	AT 377 × AT 338	44.99	94.34	101.97	3.06	80.13	2.79
11	AT 377 × AT 360	40.99	96.93	87.63	2.63	41.30	2.72
12	AT 377 × ASRT 9	40.06	94.27	106.73	2.19	72.97	3.11
13	AT 377 × JLS 2420	43.49	94.17	106.70	3.31	74.83	2.91
14	AT 377 × LT-15-28	39.82	88.52	98.40	3.39	57.40	3.02
15	AT 377 × JLS 2611	43.00	94.67	111.90	2.17	68.93	2.85
16	DS 10 × AT 338	44.98	101.86	110.97	3.51	74.50	2.88
17	DS 10 × AT 360	45.15	95.89	103.53	2.83	67.57	2.62
18	DS 10 × ASRT 9	37.90	87.74	108.10	3.17	54.93	2.81
19	DS 10 × JLS 2420	42.65	96.41	82.80	3.30	59.87	2.88
20	DS 10 × LT-15-28	38.84	88.56	99.27	4.01	74.93	3.20
21	DS 10 × JLS 2611	42.83	94.96	109.83	3.88	98.03	2.82
22	AT 338 × AT 360	52.06	108.48	96.77	1.80	92.47	3.10
23	AT 338 × ASRT 9	45.34	98.90	109.03	3.84	95.17	2.94
24	AT 338 × JLS 2420	43.98	94.64	107.17	3.14	84.70	3.18

Appendix I continued...

Appendix I continued...

25	AT 338 × LT-15-28	42.98	96.50	112.73	3.44	83.30	3.06
26	AT 338 × JLS 2611	43.98	97.82	110.27	4.14	69.77	2.98
27	AT 360 × ASRT 9	42.00	96.61	104.53	3.79	74.37	2.70
28	AT 360 × JLS 2420	43.34	93.83	99.33	3.90	91.23	3.17
29	AT 360 × LT-15-28	41.00	103.46	104.30	3.24	68.87	3.02
30	AT 360 × JLS 2611	41.99	95.79	113.23	3.39	67.60	2.98
31	ASRT 9 × JLS 2420	45.00	96.28	82.73	4.22	98.63	3.11
32	ASRT 9 × LT-15-28	40.17	95.16	96.20	2.90	54.30	3.00
33	ASRT 9 × JLS 2611	44.82	100.05	102.67	4.07	52.37	3.06
34	JLS 2420 × LT-15-28	42.65	93.64	109.43	3.90	75.80	2.52
35	JLS 2420 × JLS 2611	46.19	99.54	108.87	3.71	85.10	2.68
36	LT-15-28 × JLS 2611	39.67	94.33	109.10	3.96	75.37	3.01
Hybrid Mean		**42.86**	**95.99**	**103.29**	**3.31**	**72.94**	**2.93**
General Mean		**43.20**	**96.12**	**101.87**	**3.18**	**70.01**	**2.91**
37	**GT-5**	**41.02**	**94.04**	**94.52**	**2.75**	**60.06**	**2.73**
SEm±		**0.87**	**1.06**	**3.66**	**0.22**	**4.88**	**0.07**
CD		**2.45**	**2.98**	**10.31**	**0.62**	**13.77**	**0.21**
CV %		**3.49**	**1.91**	**6.22**	**11.97**	**12.08**	**4.37**

S. no.	**Genotypes**	**Leaf area (cm^2)**	**Seed per capsule**	**1000 seed weight (g)**	**Oil content (%)**	**Seed yield per plant (g)**
1	AT 377	40.99	55.55	3.04	39.68	9.93
2	DS 10	37.61	53.34	2.82	41.72	6.43
3	AT 338	39.92	63.00	3.02	40.06	10.90
4	AT 360	39.77	59.28	3.19	43.11	8.43
5	ASRT 9	36.99	52.64	3.19	42.26	8.17
6	JLS 2420	40.11	64.67	3.07	40.32	9.20
7	LT-15-28	38.48	54.65	2.98	44.06	9.10
8	JLS 2611	41.87	59.75	3.06	43.12	7.37
Parental Mean		**39.47**	**57.86**	**3.05**	**41.79**	**8.69**
9	AT 377 × DS 10	41.60	62.38	2.93	43.32	10.37
10	AT 377 × AT 338	44.43	60.37	3.26	44.88	7.27
11	AT 377 × AT 360	43.07	57.41	3.32	45.91	13.00
12	AT 377 × ASRT 9	38.41	64.65	2.77	41.84	8.33
13	AT 377 × JLS 2420	39.34	59.06	3.28	46.45	10.10
14	AT 377 × LT-15-28	36.08	55.59	3.13	42.02	10.43
15	AT 377 × JLS 2611	44.52	52.40	3.29	46.32	8.57
16	DS 10 × AT 338	42.93	57.04	2.90	45.94	7.43
17	DS 10 × AT 360	41.85	44.51	2.96	43.36	12.13
18	DS 10 × ASRT 9	38.21	64.77	3.15	35.22	7.00
19	DS 10 × JLS 2420	37.56	63.34	3.19	40.27	10.47
20	DS 10 × LT-15-28	38.71	57.35	3.10	43.61	7.03
21	DS 10 × JLS 2611	41.60	53.44	3.33	39.93	7.07
22	AT 338 × AT 360	43.40	53.35	2.96	40.83	13.87
23	AT 338 × ASRT 9	38.41	59.32	3.30	38.33	8.77
24	AT 338 × JLS 2420	41.30	65.43	2.85	44.53	12.20
25	AT 338 × LT-15-28	37.78	65.49	3.29	41.20	8.77

Appendix I continued...

Appendix I continued...

26	AT 338 × JLS 2611	42.33	54.55	3.59	42.63	7.07
27	AT 360 × ASRT 9	37.88	68.64	2.88	38.77	13.70
28	AT 360 × JLS 2420	43.71	67.32	3.08	47.28	7.20
29	AT 360 × LT-15-28	45.57	68.37	3.41	44.06	13.80
30	AT 360 × JLS 2611	41.63	53.85	3.49	47.59	7.20
31	ASRT 9 × JLS 2420	37.68	62.11	2.90	43.20	11.93
32	ASRT 9 × LT-15-28	42.31	55.33	3.00	47.12	7.43
33	ASRT 9 × JLS 2611	41.67	62.38	3.27	44.21	8.40
34	JLS 2420 × LT-15-28	36.39	76.00	3.12	42.87	14.57
35	JLS 2420 × JLS 2611	40.95	59.44	3.25	43.60	11.20
36	LT-15-28 × JLS 2611	40.33	66.52	2.98	44.13	6.37
Hybrid Mean		**40.70**	**60.37**	**3.14**	**43.19**	**9.70**
General Mean		**40.37**	**59.66**	**3.12**	**42.92**	**9.52**
37	**GT-5**	**38.28**	**3.00**	**44.38**	**11.20**	**11.20**
SEm±		**1.05**	**2.42**	**0.06**	**0.74**	**0.84**
CD		**2.97**	**6.83**	**0.17**	**2.09**	**2.37**
CV %		**4.52**	**7.03**	**3.28**	**3.00**	**15.30**

LT-15-28 (3.88) emerged as the best specific combinations, followed by AT-360 × ASRT-9 (3.32) and AT-338 × AT-360 (2.96). On the contrary, several cross combinations, such as AT-360 × JLS-2420 (-4.60), AT-377 × AT-338 (-2.66), and AT-360 × JLS-2611 (-2.05), were identified as poor specific combiners. These findings are consistent with previous research by Kumar *et al.* (2012), Sarvaliya *et al*. (2013), Hassan and Sedeck (2015), Nayak *et al.* (2016), Abd elaziz and Ghareeb (2018), Raikwar *et al.* (2018), Virani *et al*. (2018), Abd-elsaber *et al*. (2019) and Anter (2020) concerning sesame seed yield per plant.

The analysis of Specific Combining Ability (SCA) effects indicated that none of the crosses consistently excelled across all traits. Among the 28 crosses only four exhibited significant and positive SCA effects for seed yield per plant. Notably, the cross JLS-2420 × LT-15-28 demonstrated the highest SCA effects (3.88), followed by AT-360 × ASRT-9 (3.32), AT-338 × AT-360 (2.96), and AT-360 × LT-15-28 (2.95), establishing them as effective specific combiners. The findings from the present study offer valuable in sights for optimizing sesame breeding strategies. Noteworthy parents have been identified, each contributing distinct advantages. AT-338 exhibits a favorable General Combining Ability (GCA) for plant height, capsules per plant, capsule length, and leaf area. AT-360's desired GCA effects span leaf area, 1000-seed weight, oil content, and seed yield per plant. JLS-2420 showcases promising GCA effects for effective branches per plant, capsules per plant, seed per capsule, and seed yield per plant. LT-15-28 proves versatile with desired GCA effects for capsule length, effective branches per plant, days to maturity, days to 50% flowering, seed per capsule, and oil content. These identified parents hold great promise for practical exploitation in sesame plant breeding programs, offering a diverse array of positive traits to enhance overall crop performance.

Conclusion

The current findings highlight the presence of substantial variation in seed yield and its associated components within the studied material. Non-additive genetic variances emerged as significant contributors to the inheritance of all investigated traits. Particularly, a predominant influence of non-additive genetic variance was noted in the traits of days to 50% flowering, days to maturity, plant height, effective branches per plant, capsules per plant, capsule length, leaf area, seeds per capsule, 1000-seed weight, oil content and seed yield per plant. General combining ability effects suggested that parents AT-360 (1.247**) and JLS-2420 (1.077**) exhibited commendable general combining ability for seed yield per plant and related attributes. Top of Form Assessment of SCA effects identified four out of 28 crosses with significant and positive effects for seed yield per plant. Notably, the crosses JLS-2420 × LT-15-28 (3.88), AT-360 × ASRT-9 (3.32), AT-338 × AT-360 (2.96), and AT-360 × LT-15-28 (2.95) emerged as superior hybrids, warranting further large-scale testing and potential deployment in breeding programs. To capitalize on this, crosses demonstrating elevated seed and oil yield, should be strategically lever aged through the pedigree method. This approach aims to harness desirable transgressive segregants that not only exhibit high seed yield but also possess elevated oil content, contributing to the overall improvement of sesame varieties.

Conflict of interest

The authors do not have any conflict of interest.

Author contributions

Naresh Chaudhary, Dr. P. K. Jagtap and Dr. V. B. Patel conceived and designed the experiment. Naresh Chaudhary, V.B. Rana, Rutvik J. Joshi, A.V. Malaviya, and D. P. Patel collected the data. Naresh Chaudhary, M. R. Prajapati, Hemali Pandya and V.B. Rana performed the analysis. Naresh Chaudhary and M. R. Prajapati wrote the research article.

Acknowledgment

The authors are thankful to the advisory committee and Navsari Agricultural University, Navsari, Gujarat, India for providing the required guidelines and facilities to carry out the research experiment.

References

Abd elaziz, G.B. and Ghareeb Z.E. (2018). Gene action and combining ability for seed yield and its components in eight sesame genotypes diallel crosses. *J. Plant Prod.*, **9(8)**, 695-702.

Abd-elsaber, A., M.W. Sh. Mahmoud and M.A. Attia (2019). Heterosis and combining ability for seed yield and its components in sesame. *Egypt. J. Plant Breed*., **23 (5)**, 955– 969.

Anonymous (2021). *Directorate of economics and statistics*. Govt. of India.

Anter, A.S. (2020). The possibility of combining earliness with high seed yield in F_1 generation of sesame (*Sesamum indicum* L.). *Plant Archives*, **20(2)**, 2929-2933.

Bangar, N.D., Gawade S.A. and Meher B.B. (2010). Combining ability analysis for yield and yield components in sesame. *J. Mah. Agri. Uni*., **35(1)**, 52-56.

Deshmukh, A.S., Misal A.M., Tavadare P.L. and Dasari R. (2019). Combining ability analysis in sesame (*Sesamum indicum* L.). *Electr. J. Plant Breed*., **10(3)**, 1283-1291.

Gaikwad, K.B., Lal J.P. and Bhakre R.L. (2009). Combining ability and heterosis for seed yield and related traits in sesame (*Sesamum indicum* L.). *Annals Plant Phy*., **23(1)**, 57-61.

Griffing, B. (1956a). Concept of general and specific combining ability in relation to diallel crossing systems. *Aust. J. Biol. Sci*., **9**, 463-493.

Griffing, B. (1956b). A generalised treatment of the use of diallel crosses in quantitative inheritance. *Hered.*, **10**, 31-50.

Hassan, M.S. and Sedeck F.S. (2015). Combining ability and heterosis estimates in Sesame. *World App Sci. J*., **33(5)**, 690-698.

Ismail, S., Khan F.A., Mubarak S. and Kanwal B. (2020). Heterosis in relation to combining ability studies in sesame (*Sesamum indicum* L.) *J. Gen. Geno. Plant Breed.*, **4(2)**, 68-75.

Kumar, K.B. and Vivekanandan P. (2009). Studies on combining ability studies in sesame (*Sesamum indicum* L.). *Elect. J. Pl. Breed*., **1**, 33-36.

Kumar, P.S. and Kannan B. (2010) Studies on general and specific combining ability in sesame (*Sesamum indicum* L.). *Electr. J. Plant Breed*., **1(6)**, 1405-1408.

Kumar, P., Madhusudan K., Nadaf H.L., Patil R.K. and Deshpande S.K. (2012). Combining ability and gene action studies in inter-mutant hybrids of sesame (*Sesamum indicum* L.). *Karnataka J. Agric. Sci*., **25(1)**, 1-4.

Kumar, R., Patel J.A. and Joshi D.P. (2022). Identification of potential hybrids for heterosis breeding in sesame (*Sesamum indicum* L.) *Ann. Plant Soil Res*., **24**(2), 324-330.

Mandal, R.K., Suman S.J. and Ram Sohan (2010). Combining ability analysis for yield and its contributing characters in sesame (*Sesamum indicum* L.). *Envi. Ecol*., **28(4A)**, 2562-2567.

Mishra, H.P., Misra R.C. and Sahu P.K. (2009). Combining ability and nature of gene action in sesame (*Sesamum indicum* L.). *Indian J. Agric. Res*., **43(2)**, 119-123.

Nayak, A., Patel S. and Chaudhari B. (2016). Combining ability and gene action studies for seed yield and contributing characters in Sesame [*Sesamum indicum* L.]. *Adv. Life Sci*., **5**(23), 11064-11069.

Okello-anyanga, W., Rubaihayo P.R., Tukamuhabwa P. and Gibson P. (2014). Combining ability and gene action in a diallel cross of eight Sesame genotypes. *In Rufo. Fourth Bienni. Conf. Maputo, Mozambique*, Pp. 225-258.

Panse, V.G. and Sukhatme P.V. (1985). *Statistical methods for agricultural workers*. ICAR, New Delhi. Pp. 47.

Parameshwarappa, S.G., Salimath P.M. and Hussain A. (2010). Studies on combining ability and heterosis for yield and yield components in Sesame, (*Sesamum indicum* L.). *Green Farming*, **3(2)**, 91-94.

Raghunaiah, E., Kishan G.A. and Ansari N.A. (2008). Combining ability and heterosis for yield and yield components in sesame (*Sesamum indicum* L.). *J. Res. Angr*., **36**(2-3), 9-16.

Raikwar, R.S., Sharma D.T., Kale S.P. and Hariya M.S. (2018). Combining ability studies for assessment of yield and its components in sesame (*Sesamum indicum* L.). *Electr. J. Plant Breed*., **9**(2), 777-781.

Rajaram, S.R. and Kumar P.S. (2011). Combining ability studies in Sesame (*Sesamum indicum* L.). *Electr. J. Plant Breed.*, **2(2)**, 224- 227.

Rajput, S.D., Harer P.N. and Kute N.S. (2017). Combining ability analysis for yield and its component traits in sesame (*Sesamum indicum* L.). *Electr. J. Plant Breed*., **8(4)**, 1307-1309.

Salunke, D.P. and Lokesha R. (2012). Studies on general and specific combining ability studies in sesame (*Sesamum indicum* L.). *Inter. J. Pl. Sci*., **7(2)**, 391-394.

Sankar, P.D. and Kumar C.R.A. (2003). Combining ability studies on economic traits in sesame (*Sesamum indicum* L.). *Ind. J. Agri. Res*., **37**(3), 223-226.

Sarvaliya, V.M., Savaliya J.J., Sharma L.K., Pansuriya A.G. and Kelaiya D.S. (2013). Combining ability studies for yield and yield components in sesame (*Sesamum indicum* L.). *Progre. Res*., **8**, 560-563.

Sikarwar, R.S., Muwel K., Kushwah M.K. and Rathore J. (2021). Combining ability studies in sesame (*Sesamum indicum* L.). *J. Pharmc. Phytoc.* **10**(1), 1979-1981.

Solanki, Z.S. and Gupta D. (2001). Combining ability and heterosis studies for seed yield and its components in sesame. *Sesame Safflower Newsl. No*. **16**, 9-12.

Solanki, Z.S., Gupta D. and Verma R.M. (2003). Inheritance studies for seed yield in sesame. *Sesame Safflower Newsl*., **18**, 25-28.

Sumathi, P. and Muralidharan V. (2008). Study of gene action and heterosis in monostem/shy branching genotypes in sesame (*Sesamum indicum* L.). *Ind. J. Gene. Plant Breed.*, **68(3)**, 269-274.

Tripathy, S.K., Mishra D.R., Dash G.B., Senapati N., Mishra D., Nayak P.K. and Mohanty M.R. (2016). Combining ability analysis in Sesame (*Sesamum indicum* L.). *Intl. J. Biosci*., **9(3)**, 114-121.

Virani, M.B., Vachhani J.H., Kachhadia V.H., Chavadhari R.M. and Sharma S. (2018). Combining ability for seed yield and its components in sesame (*Sesamum indicum* L.). *Elec. J. Plant Breed.*, **9(1)**, 107-115.

Yamanura, K., Madhusudan K. and Nadaf H.L. (2009). Combining ability and gene action for yield and yield components in sesame (*Sesamum indicum* L.). *Kar. J. Agri*., **22(2)**, 255-260.