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Combining ability studies in Okra (*Abelmoschus esculentus* (L) Moench) by using a half diallel analysis

SM Kadam, GR Munde, SD Deshmukh, JV Shinde and AR Bhand

Abstract
The research presents a thorough investigation into the combining ability of Okra (*Abelmoschus esculentus* (L) *Moench*) using a half diallel experiment involving seven genotypes and twenty-one crosses. Through an analysis of variance, the study discerns significant differences in various traits among treatments, with both parents and crosses exhibiting notable distinctions for growth and yield-contributing traits. The emphasis is placed on the improvement of Okra through targeted programs, specifically focusing on traits such as plant height, yield, early flowering, branching, fruit characteristics, internodal length, and resistance to diseases and pests. The study identifies specific hybrid combinations with positive and negative combining ability effects for different traits, providing valuable guidance for Okra breeding initiatives. This highlights the utility of the experiment's data for parental isolation in subsequent hybridization efforts and for defining superior Okra hybrids for widespread cultivation. Specific parent and hybrid combinations are identified as promising for trait improvement, offering crucial insights for breeding programs geared towards developing high-yield, nutritionally rich Okra varieties. This research focuses on comprehensive analysis of Okra combining ability, offering insights into potential hybrid combinations and underscoring the importance of specific parents in breeding programs. The study's findings hold significant promise for advancing agricultural practices and ensuring food security through the development of high-yielding and nutritionally enriched Okra varieties.

Keywords: Okra, fruit yield, GCA, SCA, gene action, hybrids

Introduction
Okra, scientifically known as (*Abelmoschus esculentus* (L) Moench), stands out as a prominent vegetable crop cultivated during the rainy spring and summer months. Possessing substantial nutritional value and export potential, okra, colloquially referred to as lady's finger or bhindi, belongs to the family Malvaceae, order Malvales, and class Dicotyledonae. Notably, okra exhibits year-round growth and is characterized by variable top-ranking attributes. Due to its somatic chromosome count of 2n=130, okra flowers engage in frequent cross-pollination with other species.

Cultivated extensively in tropical and subtropical regions, as well as in the warmer zones of temperate regions, okra has recently become a significant vegetable crop in India. The cultivation primarily focuses on the tender pods, renowned for their popularity in creating a delectable and gelatinous vegetable. With high nutritional content, okra demonstrates considerable socio-economic potential, contributing to livelihood enhancement in both rural and urban areas. Its culinary versatility is evident, as it is incorporated into soups, stews, meat dishes, and curries. Additionally, okra finds application in diverse forms, such as drying or consuming in its green state during off-seasons. Furthermore, okra extracts, notably from seeds with a substantial oil content of about 40%, serve as a viable substitute for edible oil.

Okra's popularity in India, West Africa, Brazil, and numerous other nations is attributed to its consumption as a vegetable, both in its fresh state and in various processed forms. The potential for export is significant, particularly for fresh okra. Crop improvement strategies for okra necessitate a focus on key parameters such as plant height, yield, early flowering, branching, fruit dimensions, internodal length, and disease resistance. Hybrid vigor, genetic understanding, and quality improvement become critical aspects in the pursuit of enhancing okra varieties for the export market. Evaluating inbreds, understanding gene actions, and determining combining ability contribute to the identification of superior cross-combinations for commercial exploitation of heterosis.

Research efforts aimed at unraveling the genetic potential of okra, facilitating parental isolation for hybridization programs, and defining superior okra hybrids for general cultivation are crucial for sustained agricultural progress. Continuous investigation into combining ability, gene action, and cultivar adaptability will further refine the selection process and contribute to the development of improved okra varieties.

Materials and Methods

The current investigation on combining ability in okra (*Abelmoschus esculentus* (L.) Moench.) was conducted during the period from kharif-2022 to summer-2023 at the Instructional-Cum-Research Farm, Department of Horticulture, College of Agriculture, Latur, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani. The experimental design employed was a Randomized Block Design with two replications. Seven genotypes were carefully chosen for the study, selected based on their phenotypic variability. Employing a diallel fashion, twenty-one crosses were generated from the seven genotypes, excluding reciprocals. The experimental setup comprised seven parents, twenty-one hybrids, and one standard check. Each entry was planted in six rows with twenty plants in each row, adhering to a spacing of 45x20cm, and following the recommended package of practices. Both parents and hybrids were randomized completely among themselves and cultivated in a continuous block.

For the recording of observations on both parents and crosses, five randomly selected plants from each plot were considered. The traits recorded included Plant height (cm), Internodal length (cm), Number of branches per plant, Number of nodes per plant, Days required for 50% flowering, Length of fruit (cm), Weight of fruit (g), Diameter of fruit (mm), Number of fruits per plant, Fruit yield per plant (kg), and Fruit yield per plot (kg).

Combining ability analysis was based on plot mean, utilizing Griffing's (1956) Method-II, Model-I, as it was deemed appropriate for the material under study. Method-II, specifically applicable for the parent situation, was employed since parents and one set of F1's without reciprocals were used. Model-I assumed constant variety and block effects with a variable environmental effect. To discern the nature of gene action, the ratio was calculated, considering the estimated variance of general combining ability (gca) and specific combining ability (sca). It is generally acknowledged in biometrics that for each character studied, when the variance ratio exceeds one, the gene action is considered additive, whereas a ratio less than one indicates non-additive gene action.

Results and Discussions

The analysis of variance of means was conducted to assess the significance of differences among the treatments, and the corresponding data are presented in Table 1. In the examination of mean squares, the differences attributed to the treatment were found to be statistically significant for all the characters under investigation. Subsequently, the treatment means were further subdivided into parents, crosses, and parent versus crosses.

Among the parents, significant differences were observed for all the characters, excluding internodal length and the number of nodes per plant. The crosses exhibited statistical significance for all the characters studied. In the comparison between parents and crosses, significant differences were identified for all the characters except the number of nodes per plant, days required for 50% flowering, length of fruit, weight of fruit, number of fruits per plant, fruit yield per plant, and fruit yield per plot.

General Combining Ability

In Table 2, the general combining ability (GCA) effects of parents for various traits in okra are detailed. Among the seven parents evaluated, two demonstrated significant GCA effects for specific traits. For Plant Height, Phule Utkarsha displayed the highest significant GCA effect (5.30), positioning it as the optimal general combiner for this trait. The observed additive gene effects indicate its potential contribution to improving plant height, a finding consistent with previous studies (Harne *et al.*, 2014) [5].

In terms of Internodal Length, Arka Anamika exhibited highly significant positive GCA effects (0.26), establishing it as the premier general combiner for this characteristic. The identified additive gene effects emphasize the role of Arka Anamika in the enhancement of heterosis breeding, aligning with similar findings in the literature (Raghuvanshi *et al.*, 2011; Sapavadiya *et al*., 2019) [12, 13]. The Number of Branches per Plant revealed significant GCA effects for two parents. Arka Anamika displayed the maximum positive GCA effect (0.67), positioning it as the optimal general combiner for this trait. The involvement of additive gene effects suggests the potential for improvement through heterosis breeding, consistent with findings in studies by Kumar *et al*. (2016) [10] and Wakode *et al*. (2016) [14].

For the Number of Nodes per Plant, two parents, Arka Anamika and Phule Utkarsha, exhibited significant positive GCA effects. Arka Anamika, with the highest GCA effect, emerged as the primary general combiner for this trait. The implication of additive gene effects underscores the potential for enhancing this trait through heterosis breeding, aligning with previous research (Harne *et al*., 2014b; Pithiya *et al.*, 2020) [11]. In the context of Days Required for 50% Flowering, Arka Anamika exhibited the most negative GCA effect (-0.91), designating it as the superior general combiner for this trait. The involvement of additive gene effects highlights the role of Arka Anamika in improving heterosis breeding, in agreement with similar findings by Kumar *et al.* (2016) [10], Sapavadiya *et al.* (2019) [13], and Pithiya *et al.* (2020) [11].

Considering the Length of Fruit, Arka Anamika showcased the highest positive GCA effect (0.43), establishing it as the premier general combiner. The contribution of additive gene effects underscores its potential in enhancing this trait, consistent with findings in studies by Raghuvanshi *et al.* (2011) [12], Wakode *et al*. (2016) [14]. For the Weight of Fruit, Arka Anamika demonstrated the highest significant GCA effect (1.03), designating it as the optimal general combiner. The observed additive gene effects highlight its potential contribution to improving fruit weight, consistent with similar findings (Bhatt *et al.*, 2015; Wakode *et al*., 2016) [1, 14].

Regarding the Diameter of Fruit, EC-305609 exhibited a positive significant GCA effect (0.44), designating it as the superior general combiner for this trait. The involvement of additive gene effects underscores the potential for improvement through heterosis breeding, aligning with findings by Raghuvanshi *et al.* (2011) [12] and Kumar *et al*. (2016) [10]. In terms of the Number of Fruits per Plant, two parents, Phule Utkarsha and Arka Anamika, exhibited significant GCA effects. Phule Utkarsha emerged as the optimal general combiner, with dominance gene effects playing a role. These findings align with similar studies by

Kumar *et al.* (2016) [10], Wakode *et al.* (2016) [14], and Pithiya *et al*. (2020) [11].

For Fruit Yield per Plant, EC-305609 showcased the highest positive GCA effect (0.12), designating it as the optimal general combiner. The observed additive gene effects highlight its potential contribution to improving fruit yield per plant, consistent with similar findings (Raghuvanshi *et al.*, 2011; Bhatt *et al*., 2015) [12, 1]. Concerning Fruit Yield per Plot, Arka Anamika exhibited the highest positive GCA effect (0.48), designating it as the premier general combiner for this trait. The involvement of additive gene effects underscores its potential contribution to enhancing fruit yield per plot, aligning with similar findings (Raghuvanshi *et al*., 2011; Bhatt *et al*., 2015) [12, 1]. These detailed results provide comprehensive insights into the specific contributions of individual parents to various traits in the context of heterosis breeding in okra.

Specific combing ability

Table 3 provides insights into the specific combining ability effects (SCA) of various hybrids for different traits in okra. In the examination of 21 cross combinations, six demonstrated significant positive SCA effects. For Plant Height, the cross combination Arka Anamika x EC-305731 exhibited the highest positive SCA effect (18.54), followed by Varsha Uphar x Arka Anamika (14.29), Phule Utkarsha x Phule Vimukta (13.42), Arka Anamika x EC-305609 (12.32), and Phule Utkarsha x EC-305609 (10.30). The dominance variance and non-additive gene effects were identified as crucial for this trait, aligning with previous research (Harne *et al*., 2014; Kumar *et al*., 2013; Sapavadiya *et al*., 2019) [5, 13, 9].

In contrast, eight out of 21 cross combinations exhibited significant negative SCA effects. Notably, Phule Vimukta x EC-305687 (-0.78), Phule Vimukta x EC-305609 (-0.75), and Varsha Uphar x EC-305731 (-0.61) showed the minimum negative SCA effects for Internodal Length. Dominance variance was observed as a contributing factor, consistent with findings by Joshi *et al.* (2015) [7] and Wakode *et al.* (2016) [14]. Concerning Number of Branches per Plant, ten cross combinations demonstrated highly positive significant SCA effects, with Phule Utkarsha x Phule Vimukta exhibiting the highest effect (0.78), followed by EC-305609 x EC-305687 (0.65). The involvement of additive variance emphasized the potential for improvement through heterosis breeding, consistent with studies by Harne *et al*. (2014b), Joshi *et al.* (2019) [6], and Wakode *et al*. (2016) [14].

For Number of Nodes per Plant, six cross combinations recorded highly positive significant SCA effects. The cross combination Arka Anamika x EC-305731 exhibited the maximum positive SCA effect (3.43), emphasizing the role of dominance variance in improving this trait. This aligns with findings by Harne *et al*. (2014) [5], Bhatt *et al*. (2015) [1], and Sapavadiya *et al.* (2019) [13]. In terms of Days Required to 50% Flowering, four hybrids showed significant negative SCA effects. Varsha Uphar x EC-305687, with the most negative effect (-1.71), demonstrated the impact of dominance variance and non-additive components. Similar findings were reported by Joshi *et al.* (2015) [7], Kumar and Reddy (2016) [10], and Sapavadiya *et al.* (2019) [13].

Six cross combinations expressed highly positive significant SCA effects for Length of Fruit, with Phule Vimukta x EC-305609 exhibiting the highest effect (0.84). Additive variance was identified as crucial for this trait, aligning with studies by Kishor *et al.* (2013) [8], Kumar and Reddy (2016) [10], and Wakode *et al.* (2016) [14]. For Weight of Fruit, seven cross combinations demonstrated the highest positive significant SCA effects, led by Phule Utkarsha x Phule Vimukta (3.54). The involvement of both additive and dominance variance was observed, indicating the importance of non-additive gene action in improvement. Similar results were reported by Bhatt *et al.* (2015) [1] and Joshi *et al.* (2015) [7]. Regarding Diameter of Fruit, six cross combinations exhibited highly positive significant SCA effects. Phule Vimukta x EC-305609 demonstrated the maximum positive effect (1.66), emphasizing the role of additive variance in improving this trait. Consistent findings were reported by Harne *et al*. (2014) [5] and Kumar and Reddy (2016) [10].

For Number of Fruits per Plant, ten cross combinations recorded highly positive significant SCA effects, with Varsha Uphar x Arka Anamika exhibiting the highest effect (2.78). Dominance variance played a crucial role in enhancing this trait, consistent with studies by Harne *et al*. (2014) [5] and Bhatt *et al.* (2015) [1]. Six cross combinations demonstrated highly positive significant SCA effects for Fruit Yield per Plant, with Phule Utkarsha x Phule Vimukta exhibiting the highest effect (0.081). Both additive and dominance variance were identified, highlighting the importance of non-additive gene action in trait improvement. Similar results were reported by Kishor *et al*. (2013) [8] and Wakode *et al*. (2016) [14]. Finally, for Fruit Yield per Plot, six cross combinations expressed highly positive significant SCA effects, led by Phule Utkarsha x Phule Vimukta (1.50). The involvement of both additive and dominance variance was observed, emphasizing the importance of non-additive gene action in improving this trait. These detailed SCA effects provide valuable insights into the potential contributions of specific hybrid combinations to various traits in okra, shedding light on the role of both additive and dominance variance in trait improvement.

Table 1: Analysis of variance for different characters in 7x7 half diallel of okra.

Source	d.f.	Plant height (cm)	Internodal length (cm)	Number of branches per plant	Number of nodes per plant
		1	2	3	4
Treatment	27	200.81**	0.66**	0.87**	5.81**
Parent	6	138.68*	0.41	0.66**	1.96
Crosses	20	181.86**	0.63**	0.96**	7.18**
P x C	1	952.61**	2.79**	0.51*	1.48
G.C.A.		118.925**	0.235	1.051**	3.259**
S.C.A.		95.115**	0.362**	0.263**	2.808**
Error	27	55.052	0.23	0.087	1.44

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Source	d.f.	Days required for 50% flowering	Length of fruit (cm)	Weight of fruit (g)	Diameter of fruit (mm)
		5	6	7	8
Treatment	27	4.23**	0.63**	6.77**	1.73**
Parent	6	5.35**	0.27*	5.54**	1.72**
Crosses	20	3.97**	0.75**	7.47**	1.04**
P x C	1	2.75	0.40	0.08	15.66**
G.C.A.		2.680**	0.656**	4.171**	0.442**
S.C.A.		1.958**	0.222**	3.162**	0.988**
Error	27	0.79	0.10	0.19	0.23

Continue..

Source	d.f.	Number of fruits per plant	Fruit yield per plant (kg)	Fruit yield per plot (kg)	Fruit and shoot borer	YVMV
		9	10	11	12	13
Treatment	27	6.90**	0.0033**	1.25**	1.64**	0.31**
Parent	6	2.76*	0.0014*	0.33**	0.42**	0.11**
Crosses	20	8.39**	0.0039**	1.59**	1.70**	0.35**
P x C	1	1.74	0.002	0.00004	7.79**	0.59**
G.C.A.		5.646**	0.002**	0.750**	0.711**	0.219**
S.C.A.		2.822**	0.0014**	0.591**	0.853**	0.137**
Error	27	1.01	0.00050	0.078	0.016	0.0014

Table 2: Estimates of general combining ability effects for different characters in 7x7 half diallel of okra.

Sr. No.	Parents	Plant height (cm)	Internodal length (cm)	Number of branches per plant	Number of nodes per plant	Days required for 50% flowering	Length of fruit (cm)
		1	2	3	4	5	6
1	Varsha Uphar	-2.87	-0.05	-0.20**	-0.39	0.85**	-2.28*
2	Phule Utkarsha	5.30*	0.16	0.33	0.60*	0.20	-0.00
3	Phule Vimukta	-2.89	-0.05	-0.12	-0.11	-0.12	-0.26**
4	Arka Anamika	4.29*	0.26*	0.67**	0.65*	-0.91**	0.43**
5	EC-305609	1.43	-0.12	0.16*	0.56*	0.07	0.28**
6	EC-305687	-2.56	0.01	-0.18**	-0.50	0.21	-0.15
7	EC-305731	-2.70	-0.20	-0.36**	-0.79**	-0.32	-0.00
	SE (gi) ±	1.61	0.10	0.06	0.26	0.19	0.06
	CD at 5%	3.32	0.21	0.13	0.53	0.40	0.14

Sr. No.	Parents	Weight of fruit (g)	Diameter of fruit (mm)	Number of fruits per plant	Fruit yield per plant (kg)	Fruit yield per plot (kg)
		7	8	9	10	11
1	Varsha Uphar	-0.52**	-0.7	0.14	0.00	-0.129*
2	Phule Utkarsha	-0.33**	-0.037	1.0*	0.06	0.13*
3	Phule Vimukta	-0.63**	-0.02	0.4	-0.023**	-0.31**
4	Arka Anamika	1.03**	-0.17	0.99**	0.02**	0.48**
5	EC-305609	0.82**	0.44**	0.06	0.12*	0.182**
6	EC-305687	-0.46**	0.07	-0.96**	-0.015*	-0.03**
7	EC-305731	0.09	-0.23**	-079**	-0.05	-0.71
	SE (gi) ±	0.09	0.10	0.21	0.0048	0.06
	CD at 5%	0.19	0.21	0.45	0.009	0.125

Table 3: Estimates of specific combining ability effects for different characters in 7x7 half diallel of okra.

Crosses	Plant height (cm)	Internodal length (cm)	Number of branches per plant	Number of nodes per plant	Days required for 50% flowering	Length of fruit (cm)
	1	2	3	4	5	6
Varsha Uphar x Phule Utkarsha	-9.645**	-0.044	0.004	-1.219	-0.707	-0.144
Varsha Uphar x Phule Vimukta	2.004	0.626**	-0.835**	-0.853	2.726**	-0.072
Varsha Uphar x Arka Anamika	14.293*	0.850**	0.565**	2.431*	1.415**	0.638*
Varsha Uphar x EC-305609	-1.184	0.612**	-0.529**	-0.186	1.526**	-0.492**
Varsha Uphar x EC-305687	6.042	-0.074	0.221	0.986	-1.718**	-0.125
Varsha Uphar x EC-305731	-1.570	-0.617**	-0.001	-0.319	-0.529	-0.062
Phule Utkarsha x Phule Vimukta	13.420*	0.513	0.782**	2.147*	0.626	-0.188
Phule Utkarsha x Arka Anamika	-12.971	0.443	0.332	-3.469*	-1.285**	0.542*
Phule Utkarsha x EC-305609	10.302**	-0.015	-0.463**	1.764**	-0.924	0.736*
Phule Utkarsha x EC-305687	2.527	0.239	-0.413**	1.786**	1.932**	-0.132
Phule Utkarsha x EC-305731	-4.304	-0.324	-0.885**	-0.769	0.471	-0.153
Phule Vimukta x Arka Anamika	-0.062	-0.388	0.293	-0.603	0.399	-0.791*
Phule Vimukta x EC-305609	-5.889	-0.756**	-0.401**	0.531	0.410	0.843*

Phule Vimukta x EC-305687	-3.464	-0.787**	-0.351	-1.347	0.265	0.110
Phule Vimukta x EC-305731	-0.175	0.386	0.226	-1.803**	0.354	0.149
Arka Anamika x EC-305609	12.320*	0.709**	-0.001	1.664**	0.399	0.163
Arka Anamika x EC-305687	1.956	0.143	-0.001	-0.914	-0.946	-0.315
Arka Anamika x EC-305731	18.549*	0.450	-0.874**	3.431*	1.643**	0.714*
EC-305609 x EC-305687	0.738	0.185	0.654**	-0.581	-0.435	-0.260
EC-305609 x EC-305731	7.407	0.642**	0.332	-0.686	-1.396**	-0.567*
EC-305687 x EC-305731	-0.288	-0.084	0.182	-0.014	-1.540**	0.440**
S.Es^{ij} (±)	4.708	0.305	0.187	0.762	0.56759	0.201
S.E±S^{ii} S^{jj}	5.530	0.358	0.220	0.895	0.66661	0.236
Cd At 5%(S^{ij})	9.66	0.626	0.385	1.56	1.164	0.412
Cd At 1%S^{ii} S^{jj}	11.34	0.735	0.452	1.83	1.367	0.484

* and ** significance at 5% and 1% level

Continue.

Crosses	Weight of fruit (g)	Diameter of fruit (mm)	Number of fruits per plant	Fruit yield per plant (kg)	Fruit yield per plot (kg)
	7	8	9	10	11
Varsha Uphar x Phule Utkarsha	-1.078*	-0.496	-2.776*	-0.042*	-0.738*
Varsha Uphar x Phule Vimukta	-0.710**	0.105	-1.432**	-0.008	-0.233
Varsha Uphar x Arka Anamika	2.035*	0.163	2.785*	0.046*	0.972*
Varsha Uphar x EC-305609	-2.237*	-0.274	-0.343	0.022	-0.461*
Varsha Uphar x EC-305687	-0.711**	-0.319	1.735*	0.009	0.302
Varsha Uphar x EC-305731	-0.501	0.325	0.174	-0.006	-0.083
Phule Utkarsha x Phule Vimukta	3.541*	-0.064	2.613*	0.081*	1.504*
Phule Utkarsha x Arka Anamika	-1.960*	0.434	0.679	-0.065*	-1.326*
Phule Utkarsha x EC-305609	2.249*	-0.433	2.551*	0.056*	1.172**
Phule Utkarsha x EC-305687	0.134	-0.078	-1.671*	-0.027**	-0.536*
Phule Utkarsha x EC-305731	-0.941*	0.636*	-1.632**	-0.027**	-0.606*
Phule Vimukta x Arka Anamika	-2.551*	1.370*	0.224	-0.016	-0.476*
Phule Vimukta x EC-305609	2.507*	1.663*	-1.004	-0.020	-0.518*
Phule Vimukta x EC-305687	0.112	-0.043	-1.876*	-0.003	-0.241
Phule Vimukta x EC-305731	-1.088*	0.147	-2.037*	-0.017	-0.536*
Arka Anamika x EC-305609	0.716*	0.941*	-0.738	0.039*	0.822*
Arka Anamika x EC-305687	-0.018	-0.114	0.340	-0.004	-0.096
Arka Anamika x EC-305731	1.682*	0.310	-0.371	0.066*	1.274*
EC-305609 x EC-305687	-1.790*	0.674**	0.212	-0.018	-0.279
EC-305609 x EC-305731	-1.865*	1.463*	-0.649	-0.028**	-0.593*
EC-305687 x EC-305731	1.991*	0.003	1.079	0.034**	0.664*
S.Esij (±)	0.279	0.307	0.638	0.014	0.177
S.E± Sii Sjj	0.328	0.361	0.749	0.016	0.208
CD @5%(Sij)	0.573	0.630	1.30	0.029	0.364
CD @ 1%Siisjj	0.673	0.740	1.53	0.034	0.428

* and ** significance at 5% and 1% level.

Conclusion

In conclusion, the evaluation of general combiner effects revealed that Arka Anamika, Phule Utkarsha, and EC-305609 are commendable parents exhibiting favorable traits related to growth and yield in okra. Notably, Phule Utkarsha demonstrated minimal susceptibility to fruit and shoot borer, while Varsha Upahar exhibited reduced incidence of yellow vein mosaic virus. The overall performance of Arka Anamika, Phule Utkarsha, and EC-305609 positions them as promising candidates for further inclusion in breeding programs aimed at enhancing okra varieties. Specific combining ability studies provided valuable insights into optimal cross combinations for yield and yield-contributing characters. Crosses such as Phule Utkarsha x Phule Vimukta, Phule Utkarsha x EC-305609, and Arka Anamika x EC-305731 emerged as the most promising for achieving desirable outcomes. Additionally, crosses like Phule Utkarsha x Phule Vimukta, Phule Utkarsha x EC-305609, Varsha Uphar x Arka Anamika, and Arka Anamika x EC-305731 exhibited promising characteristics related to growth, including plant height, number of branches, number of nodes per plant, days required for 50% flowering, as well as yield-contributing traits such as number of fruits per plant, length of fruit, weight of fruit, diameter of fruit, fruit yield per plant, and fruit yield per plot. Moreover, these crosses displayed higher levels of additive variance, suggesting their potential for exploitation in the development of hybrid okra varieties. Overall, these findings provide a foundation for informed decision-making in future okra breeding programs.

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