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Combining ability studies for yield contributing traits in cucumber (*cucumis sativus L.*)

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Abstract
The present study on combining ability for yield and its contributing traits in cucumber (*Cucumis sativus L.*) was undertaken during 2019-20 at Department of Genetics and Plant Breeding, College of Horticulture, Mudigere and Agricultural and Horticultural Research Station, Bavikere. Twenty-eight hybrids derived by crossing of eight parents using half diallel mating design were evaluated along with parents and standard check in a randomized complete block design. The variances due to genotypes varied significantly for all the traits studied. The Parents malini and nungems were identified as good general combiners for overall characters studied. Similarly, crosses malini x sabra and malini x nungems were identified as good specific combiners. GCA to SCA ratio was found greater than unity for all the traits indicating the pre dominance of additive gene action which can improve through recurrent selection on heterosis breeding.

Keywords: cucumber, combining ability, half diallel mating design, gene action

Introduction
Cucumber (*Cucumis sativus* L.) is a popular vegetable grown in the hills and plains of India belonging to the Cucurbitaceae family, which is one of the genetically most diverse groups of plants, with 118 genera, and 825 species; about 34 genera, and 108 species of the family are found in India. The genus Cucumis comprises of about 30 species which are distributed over two distinct geographic areas like the African group and southeast of Himalayas group, out of this south-east of Himalayas is an important region of Asiatic group with basic chromosome number of x= 7 to which the cucumber belongs.

Cucumber fruit contains about 0.4 per cent of protein, carbohydrates (2.5%), iron (1.5 mg) and about two milligram of vitamin C per 100-gram fresh weight. Generally, cucumber is used as salad, pickles and also as cooked vegetable. In India cucumber is cultivated in a total area of 43.28 thousand hectares with the annual production of 678.15thousand tonnes (Anon., 2017) [1]. Cucumbers are found to be very sensitive to cold temperatures and may be killed at 1 ºC. About 16 ºC to 35 ºC is an optimum range of temperature required for seed germination and 26.4 ºC for growth and development (Peter and Pradeep kumar, 2008) [10].

The knowledge on the type of gene action helps in selecting breeding procedure to be followed. Diallel analysis has served as a most careful tool for the selection of parents for hybridization to build a population in order to determine the combining ability of these parents and crosses. Further developing promising hybrids therefore, it requires a knowledge of combing ability for carrying an appropriate breeding programme in cucumber. Information of general and specific combining abilities influencing yield and its components has become increasingly important to plant breeders in order to select appropriate parents for developing hybrid cultivars.

The present investigation was conducted to study the Combining Ability Studies for Yield contributing traits in Cucumber.

Material and Methods
The present investigation was carried out at the Department of Genetics and Plant Breeding, College of Horticulture, Mudigere, and Agricultural and Horticultural Research Station, Bavikere, University of Agricultural and Horticultural Sciences. Shivamogga during 2019-20. The experimental material for the study comprised of eight genotypes which were selected based on the diversity for various traits. These eight genotypes were crossed to obtain twenty-eight hybrids in half diallel fashion (without reciprocals) and one standard check. The parents, hybrids and check were randomized separately and sown using randomized complete Block Design (RCBD) with two replications during 2019-20. Garden pea seeds were sown in each replication with 150 cm × 75 cm spacing. Observations were recorded from five randomly selected plants in each replication for different traits *viz*., sex ratio, total number of fruits per vine, average fruit weight (g), fruit length (cm), fruit width (mm), fruit yield per vine (kg), fruit yield per hectare (t/ha).

Result and Discussion
The mean sum of squares for crosses was found significant for all the characters. Analysis of variance for combining ability for different characters revealed that the variance due to GCA was higher in magnitude than SCA for all the traits under study (Table.1) and variances from parents and crosses are also found

significant for all the traits under study. The variance of GCA for the parents, SCA for the hybrids and the ratio of the GCA to SCA was presented in table 2. GCA to SCA ratio was found greater than unity for all the traits under study indicating the pre dominance of additive gene action. Yadav *et al.* (2009), Rani *et al*. (2013) [11] and Devi *et al*. (2017) [4] found the similar results.

General and specific combining effects

The general combining ability (*gca*) effects and specific combining ability (*sca*) were estimated for eight parents and twenty-eight hybrids respectively. The evaluations for all the yield and attributing traits are presented in table 3 and discussed below.

Table 1: Analysis of variance (mean sum of squares) for yield parameters in cucumber.

Source of variation	Replications	genotypes	Parents	Hybrids	Parent Vs. Hybrids	Error
DF	2	35	7	27	1	70
Sex ratio	3.920*	2.819*	1.895*	2.624*	14.525*	0.002
Total number of fruits per vine	4.288*	2.682*	2.533*	2.748*	1.940**	0.002
Average fruit length (cm)	18.271**	1.872**	2.118**	1.857**	0.576*	0.003
Fruit width (cm)	0.821**	0.133**	0.226**	0.114**	0.007*	0
Fruit yield per vine (kg)	0.312*	0.418*	0.548*	0.400*	0	0
Fruit yield per hectare (tonnes)	24.816**	32.845*	41.346*	31.857**	0.001*	0.021
Average fruit weight (g)	3198.000*	2215.974*	2635.120*	2156.308*	892.927*	1.368

* - Significant at 5% level** - Significant at 1% level

Table 2: Variance due to general combining ability and specific combining ability for different characters in cucumber.

Sl. no.	Characters	GCA	SCA	GCA: SCA
1.	**Sex ratio**	2.35	1.17	2.01
2.	Total number of fruits per vine	2.53	1.04	2.43
3.	Average fruit length (cm)	1.67	0.75	2.22
4.	Fruit width (cm)	0.14	0.04	3.5
5.	Fruit yield per vine (kg)	0.57	0.11	5.18
6.	Fruit yield per hectare (tonnes)	45.27	9.20	4.92
7.	Average fruit weight (g)	2651.28	722.16	3.67

GCA – variance due to general combining ability
SCA – variance due to specific combining ability

Among the traits under study positive GCA or SCA is suitable for all the traits except character sex ratio for which negative values are favourable relating to the increased yield.

Five parents recorded significant negative *gca* effects for sex ratio except Malini, Nungems and Green long. Among the parents Banglore local (-0.501) showed the highest significant desirable negative value and act as a good general combiner for the trait and the cross Nungems × Mullu savathe (-0.85) showed highest negative sca effect act as a good specific combiner. The study confirmed with the results of Devi *et al*. (2017) [4].

For the trait total number of fruits per vine *gca* effects differed from -0.638 (Banglore local) to 0.96 (Malini). Among which Malini (0.96) and Nungems (0.453) showed significant positive *gca* effects in desirable direction indicates the role of additive gene action and Malini is considered as good specific combiner and cross Nungems × Green long (2.008) possessed highest significant *sca* effect which is considered as a good specific combiner for the trait. Significant gca effects for the trait average fruit weight was observed in parent Malini (21.42) is the good general combiner for the trait and cross Sabra × Mullu savathe (44.46) recorded highest sca value acts as a good specific combiner for the trait. The above results are in accordance with the findings Hanchinamani and Patil (2009) [6], Kushwaha *et al.* (2011) [9], Singh *et al.* (2012) [12], Airina *et al.* (2013) [2].

For the character fruit length, the positive significant gca value was observed in Green long (0.74) followed by Malini (0.321). Among the crosses Green long x Mullu savathe (1.79) followed by Malini × Nungems (1.32) showed highest positive significant *sca* values in desirable direction are identified as the good specific combiners for the trait. Whereas Positive significant gca effects for the trait fruit width was observed in only for three parents *viz.*, Malini (0.177), US 640(0.103) and Nungems (0.073) and cross Malini × Sabra (0.32) Posses highest sca value and act as good specific combiner for the trait. Similar results in cucumber also observed by Dogra *et al.* (2011) [5], Jat *et al.* (2015) [7] on fruit length. Yadav *et al*. (2009) and Verma *et al*. (2016) [13] on fruit width. For the trait fruit yield per vine among Eight Parents Malini (0.465), Nungems (0.206) and Green long (0.058) with significant positive gca values were found to be the good general

Table 3: Estimates of general combining ability effects of parents for different characters in cucumber.

characters	Parents										
	Malini	Sabra	Nungems	Green long	Mullu savathe	Hasan local	Banglore local	US640	S.Em. (±)	CD at 5%	CD at 1%
Sex ratio	0.913*	-0.397*	0.534*	0.037*	-0.145*	-0.246*	-0.501*	-0.195*	0.0088	0.021*	0.031*
Total number of fruits per vine	0.962*	-0.351*	0.453**	-0.039*	0.067*	-0.265*	-0.638*	-0.190*	0.0086	0.020*	0.030*
Average fruit length (cm)	0.321**	-0.290*	-0.032 *	0.741**	-0.324**	-0.293**	-0.404**	0.283**	0.012	0.029**	0.043**
Fruit width (cm)	0.177**	-0.094**	0.073**	0	-0.017**	-0.203**	-0.039**	0.103**	0.002	0.005**	0.007**
Fruit yield per vine (kg)	0.465*	-0.164*	0.206*	0.058*	-0.195*	-0.242*	-0.119*	-0.011*	0.003	0.008*	0.012*
Fruit yield per hectare (tonnes)	4.112**	-1.463**	1.833**	0.298**	-1.834**	-2.013**	-1.285**	0.352**	0.03	0.072**	0.107**
Average fruit weight (g)	21.422**	-5.896**	9.295**	1.040**	-30.046**	-14.226**	9.448**	8.964**	0.244	0.578**	0.856**

* - Significant at 5% level ** - Significant at 1% level

Combiners for fruit yield per vine and among twenty eight crosses, hybrid Sabra x Green long (0.693) followed by Nungems × Green long (0.691) with highest sca values were found to be the good specific combiners. For the trait fruit yield per hectare parent Malini (4.11) having significant highest gca was found to be the good general combiner and the crosses Nungems × Green long (6.37), Sabra × Mullu savathe (6.29) showed significant positive *sca* effects and are the good specific combiners for the trait. Similar findings were recorded by Kumar *et al.* (2010) [8], Singh *et al.* (2012) [12], Arya and Singh (2014) [3] and Devi *et al.* (2017) [4].

Conclusion

From the current investigation, it was found that the parent Malini was identified as best general combiner for most of the yield attributing traits like total number of fruits per vine, fruit length (cm), fruit width (mm), fruit yield per vine (kg) and fruit yield per hectares (tonnes)followed by nungems. These parents could be used in the further breeding programme. Among the crosses, Malini x Sabra identified as the best specific combiner for the traits sex ratio, total number of fruits per vine, fruit length (cm), fruit width (mm), fruit yield per vine (kg), fruit yield per hectares (tonnes)followed by the cross Malini x Nungems.

References

1. Anonymous. Indian Horticulture Database. National Horticulture Board, Ministry of Agriculture, Govt. of India, 2017, 279.
2. Airina KK, Pradeep kumar T, George TE, Sadhankumara PG, Krishna S. Heterosis breeding exploiting gynoecy in cucumber (*Cucumis sativus* L.). J Tropical Agri. 2013; 51(1-2):144-148.
3. Arya K, Singh DK. Exploitation of heterosis among Parthenocarpic and monoecious genotypes of cucumber (*Cucumis sativus* L.) under polyhouse. Int J Basic and applied Agri Resc. 2014; 12(1):68-71.
4. Devi ND, Mariappan S, Arumugam T, Anandakumar CR. Estimating combining ability for yield and yield contributing traits in snake gourd (*Trichosanthes cucumerina* L.). Int J Curr Microbiol App Sci. 2017; 6(2):795-800.
5. Dogra BS, Kanwar MS. Exploitation of combining ability in cucumber (Cucumis sativus L.). Res J Agril Sci. 2011; 2(1):55-59.
6. Hanchinamani EN, Patil MG. Heterosis in cucumber (*Cucumis sativus* L.). Asian J Hort. 2009; 4:21-24.
7. Jat GS, Munshi AD, Behera TK, Choudhary H, Dev B. Exploitation of heterosis in cucumber for earliness, yield and yield components utilizing gynoecious lines. Indian J Hort. 2015; 72(4):494-499.
8. Kumar J, Munshi AD, Kumar R, Surela AK. Studies on heterosis in slicing cucumber. Indian J Hort. 2010; 67(2):197-201.
9. Kushwha ML, Ram HH. Heterosis studies in cucumber (*Cucumis Sativus* L.). Veg Sci. 2011; 38(1):55-59.
10. Peter KV, Pradeepkumar T. Genetics and breeding of vegetable crops, (Eds. Trivedi, T. P., Varma, S. A., and Sharma, R. P.), Indian Council of Agric Res, New Delhi, 2008, 149-150.
11. Rani KR, Reddy KR, Raju SCH. Heterosis and combining ability for quantitative traits in bitter gourd (*Momordica charantia* L.). Curr Adv Agri Sci. 2013; 5(2):184-188.
12. Singh R, Singh AK, Kumar S, Singh BK. Heterosis and inbreeding depression for fruit characters in cucumber. Indian J Hort. 2012; 69(2):200-204.
13. Verma RS, Pratap N, Shekhar R, Singh RP, Vishnoi RK. Exploitation of heterosis for yield and its components in bitter gourd (*Momordica charantia* L.). Plant archives. 2016; 16(1):403-412.
14. Yadav M, Chaudhary R, Singh DB. Combining ability in bitter gourd (*Momordica charantia* L.*)*. Indian J Hort. 2008; 65(2):163-166.