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Agricultural Botany

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VIDYAPEETH, PARBHANI**

Title	- Stability analysis for yield and yield contributing traits in safflower (<i>Carthamustinctorius</i> L.)
Researcher	- Yadav, Sanjay P
Research Guide	- Mahajan, R.C.
Department	- Agricultural Botany
Subject	- Genetics and Plant Breeding
Degree	- M.Sc
Thesis No.	- 1705
Krishikosh link	- http://krishikosh.egranth.ac.in/handle/1/5810033111
Abstract	-

The present investigation entitled “Stability analysis for yield and yield contributing traits in safflower (*Carthamustinctorius* L.)” was conducted to study, G X E interaction and nature of stability of different genotypes in safflower. The field experiments comprising of twelve genotypes were conducted in R.B.D. with four replications at AICRP on Safflower Parbhani, Oil seeds Research Station Latur, Pulses Research Station Badnapur and ARS Somanathpur (Udgir). The observations were recorded on thirteen morphological characters *viz.*, days to 50 *per cent* flowering, days to maturity, plant height, number of primary branches per plant, number of secondary branches per plant, number of capitula per plant, number of seeds per capitulum, chlorophyll content, oil content, 100-seed weight, harvest index, seed yield per plot and seed yield plant. Stability and character association analysis was carried out as per model of Eberhart and Russell (1966) and analysis of variance indicated significant genotypic differences existed among all the genotypes for all the characters studied.

Mean performance indicated that genotypes PBNS-151 was high yielding followed by PBNS-128 and PBNS-12. According to environmental indices, environment E₁ (Parbhani) was found to be most favorable, followed by E₃ (Badnapur), E₂ (Latur) and E₄ (Somanathpur). The stability parameters indicated PBNS-128 was most stable for seed yield per plant. There was positive correlation between yield and number of primary branches, number of secondary branches, number of capitula per plant, number of seeds per capitulum, harvest index and seed yield per plot. Path analysis indicated the highest direct effect in E₁ environment was of seed yield per plot followed by plant height, in E₂ environment, seed yield per plot followed by number of capitula per plant, in E₃ environment, seed yield per plot followed by secondary branches per plant and E₄ environment seed yield per plot had highest direct effect followed by days to 50 *per cent* flowering.

Title	- Study on heterosis and combining ability for yield, its components and fibre characters in desi cotton (<i>Gossypium arboreum</i> L.)
Researcher	- Lokesh, K.M
Research Guide	- Borgaonkar, S.B.
Department	- Agricultural Botany
Subject	- Genetics and Plant Breeding
Degree	- M.Sc
Thesis No.	- 1715
Krishikosh link	- http://krishikosh.egranth.ac.in/handle/1/5810033150
Abstract	-

Cotton crop is mainly cultivated for its fibre quality and yield therefore fibre quality and lint yield are equally important in cotton production. Cotton crop is highly amenable to both heterosis and recombination breeding as it is often cross pollinated. Combining ability analysis is a powerful tool to discriminate between good and poor general combiners and for choosing appropriate parental lines to produce hybrids having high yield potential coupled with desirable fibre quality traits as well as to reckon the gene action involved in the inheritance of characters.

The present investigation entitled “Study on heterosis and combining ability for yield, its components and fibre characters in *desi* cotton (*Gossypium arboreum* L.)” was undertaken with the objectives to estimate the extent of heterosis and general combining ability effects of parents and specific combining ability effects of the cross combinations.

In present investigation six lines were crossed with four testers to obtain 24 hybrids in Line x Tester mating design. The sum total of twenty four crosses, ten parents with two checks were evaluated in a randomized block design with two replications during *Kharif* 2016 at Cotton Research Station, Mahboob Baugh Farm, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani. The observations were recorded on fourteen yield and yield contributing characters *viz.*, days to 50 per cent flowering, number of sympodia per plant, number of bolls per plant, boll weight (g), plant height (cm), day to maturity, lint index, ginning outturn(%), seed index (g), 2.5 per cent span length (mm), fibre fineness/micronaire value ($\mu\text{g}/\text{inch}$), fibre strength (g/tex), uniformity ratio and seed cotton yield per plant (g).

Analysis of variance for mean sum of squares revealed significant differences for all the fourteen characters studied. The magnitude of heterosis, heterobeltiosis and standard heterosis in the present study were found highly significant for all the characters studied. The magnitude of heterosis was highest for seed cotton yield per plant, which was recorded to the

extent of 53.52% over standard check PKV Suvarna in the cross PA832 x NDLA 3047, It was followed by plant height (51.27%) in the cross PA800 x ARBAS 1401 over standard check PKVDH 1.

Among females, PA785 was found good general combiner for two characters *viz.*, days to 50 per cent flowering and days to maturity with significant general combining ability effects (GCA). The female PAIG 62 was the best general combiner for two characters *viz.*, fibre fineness/micronaire and uniformity ratio. The female PA 778 was the best general combiner for seed cotton yield per plant, while PA 832 was found best general combiner for number of bolls per plant.

Among males, NDLA 3047 found best general combiner for days to 50 per cent flowering, number of bolls per plant, plant height, seed cotton yield per plant and number of sympodia per plant. Male parent ARBAS 1401 was found good general combiner for lint index, 2.5 per cent for span length, day's maturity and uniformity ratio. Male parent JLA 0716 found to be best general combiner for boll weight, seed index and fibre strength. Whereas, CNA 1013 for ginning outturn and fibre fineness.

There was close agreement between *per se* performance and general combining ability effects as well as specific combining ability effects for most of the characters. Observations on various characters indicated that the crosses showing high heterosis with high SCA effects had high *per se* performance and they involved at least one parent with good general combining ability effects (GCA).

The combinations PA 832 x NDLA 3047, PA 785 x ARBAS 1401, PA 778 x ARBAS 1401, PA 778 x JLA 0716 and PA 807 x NDLA 3047 exhibited significant and desirable specific combining ability effects for most of the yield and fibre quality traits studied, indicating potential for exploiting hybrid vigor in breeding programme.

Title	- Combining ability and heterosis for grain yield and its related traits in pearl millet (<i>Pennisetumglaucum</i> L.)
Researcher	- Badurkar, SubodhBhimrao
Research Guide	- Pole, S.P.
Department	- Agricultural Botany
Subject	- Genetics and Plant Breeding
Degree	- M.Sc
Thesis No.	- 1768
Krishikosh link	- http://krishikosh.egranth.ac.in/handle/1/5810033569
Abstract	-

The present investigation entitled “Combining ability and heterosis for grain yield and its related traits in pearl millet (*Pennisetumglaucum*L.)” was undertaken with the objective to study heterosis for yield and yield contributing characters and to study the combining ability effect for yield and yield contributing characters in 20 hybrids obtained by crossing 4 lines with 5 testers in line x tester design. 20 F₁, their 9 parents along with 2 standard checks were evaluated in RBD with two replications during late *Kharij*2016, at Experimental Farm, Department of Agricultural Botany, College of Agriculture, Latur. Data were recorded on 10 traits *viz.*, Days to 50 % flowering, Days to maturity, Plant height, Total number of tillers per plant, Number of effective tillers per plant, 1000 seed weight, Ear head girth, Ear head length, Fodder yield per plant and Grain yield per plant.

Considerable heterosis was observed for all the character but the magnitude was differed for different character. The highest mid parent heterosis was observed for plant height (59.92 %) followed by total number of tillers per plant (37.66 %) and ear head girth (37.35 %). The highest heterobeltiosis was observed for plant height (53.44 %), ear head girth (33.70 %) and total number of tillers (24.39 %). The highest standard heterosis over AHB 1666 was observed for plant height (66.02 %), effective tillers per plant (55.88 %) , 1000 seed weight (30.16 %) and the highest standard heterosis over MAHABEEJ-RB was found for total number of tillers (47.22 %), plant height (42.10 %), total number of effective tillers (47.24 %).

Analysis of variance (Table 3) for means revealed significant differences for all the characters studied. Line vs Testers interaction mean square (Table 6) was significant for all the characters except days to 50 per cent flowering, number of tillers per plant and effective tiller per plant. Parent vs crosses interaction analysis of variance for combining ability (Table 7) was significant for all the characters except number of tillers per plant and ear head length. Parent analysis of variance were significant for the characters like, plant height, effective tiller per plant, 1000 seed weight. Crosses analysis of variance were significant for all characters except ear head girth and fodder yield per plant indicating the sufficient amount of variability in parents and hybrids.

The parent R156, R 169, MS 92888 and MS 95111(Table 8) had showed good general combining ability and high heterotic response with respect to grain yield per plant and its related traits and can be exploited in further hybrid development programme in pearl millet. Furthermore, the cross combinations MS 95111 \times R 189, MS 93333 \times R 177 (Table.9) deserve consideration for their further exploitation as commercial hybrids as they produced higher heterotic and significant SCA effects coupled with high *per se* performance for grain yield per plant and most of the grain yield contributing characters.

Title - **Generation mean analysis in okra (*abelmoschuseaculentus*(L.)moench)**

Researcher - Jogi, SarangRavindra

Research Guide - Toprope, V.N.

Department - Agricultural Botany

Subject - Genetics and Plant Breeding

Degree - M.Sc

Thesis No. - 1769

Krishikosh link - <http://krishikosh.egranth.ac.in/handle/1/5810033571>

Abstract -

The present investigation, entitled “Generation mean analysis in Okra (*Abelmoschuseaculentus*(L.) Moench)” was undertaken using six generations viz., P₁, P₂, F₁, F₂, BC₁ and BC₂ derived from two crosses namely Pusa A4 x PhuleUtkarsha and ArkaBahar x IC 31032A. The material was evaluated in a Randomized Block Design with two replicates during *kharif*, 2016. The characters studied were days to 50 % flowering, plant height (cm), number of branches per plant, inter-nodal length (cm), number of nodes per plant, number of fruits per plant, fruit length (cm), fruit diameter (mm), fruit weight (g), powdery mildew severity (%), fruit borer infestation (%) and fruit yield per plant (g).

Analysis of variance for yield and yield components showed highly significant differences among the genotypes which indicated the presence of substantial variability in the material under study. Means and standard errors were worked out and used for calculating gene effects.

Among all the parents, PhuleUtkarsha showed good mean performance for most of the characters studied viz., plant height, intermodal length and number of nodes per plant. However, cross, ArkaBahar × IC 31032A exhibited superior mean performance for fruit diameter, plant height, intermodal length, number of nodes per plant, powdery mildew severity, fruit borer incidence and number of branches per plant.

Estimation of significant simple scaling tests and joint scaling tests indicated the presence of epistatic gene effects for fruit yield and its component characters in both the crosses. Both additive and non-additive components of genetic variations were found important for the fruit yield and its components with preponderance of non-additive gene actions. Among epistasis effects, all three types of non-allelic interactions contribute more with diminishing alleles of dominance x dominance (I) in most of the traits. Duplicate epistasis was preponderance in most of the characters.

None the F₁'s in both the crosses exhibited significant better parent heterosis except plant height in Pusa A4 x PhuleUtkarsha and inter-nodal length in both crosses. Whereas

both crosses exhibited high standard heterosis and inbreeding depression for fruit yield and its component characters under study.

High to medium narrow sense heritability exhibited by fruit yield per plant, number of fruits per plant, plant height and fruit diameter in both crosses. Thus these traits play an important role in selection of population for crop improvement in okra. Thus these traits might be improved through recurrent selection in bi-parental progenies that would help in exploiting the duplicate type of non-allelic interaction and allow recombination and concentration of gene having cumulative effects in population as this method is helpful in breaking up undesirable linkages.

Title	- Stability analysis for grain yield and its components in soybean (<i>Glycine max</i> (L.) merrill)
Researcher	- Jakhar, Ranjeet Singh
Research Guide	- Misal, A.M.
Department	- Agricultural Botany
Subject	- Genetics and Plant Breeding
Degree	- M.Sc
Thesis No.	- 1770
Krishikosh link	- http://krishikosh.egranth.ac.in/handle/1/5810033574
Abstract	-

The present investigation entitled "Stability analysis for grain yield and its components in soybean (*Glycine max* (L.) Merrill)" was undertaken to study the stability parameters for yield and yield components, to study genetic association of character for yield and yield components over the different environment. A study was made in 22 Soybean genotypes including five checks, which were evaluated in a R.B.D. with three replication during *Kharif*-2016 at Oilseed Research Station, Latur (E₁), Soybean Research Station, Parbhani (E₂) and Agriculture Research Station, Badnapur (E₃). The observations were recorded on 11 characters *viz.*, days to 50 % flowering, days to maturity, plant height, number of branches per plant, number of pods per plant, number of seeds per pod, 100 seed weight and grain yield per plant, grain yield per plot, oil content and protein content respectively collected and analyzed for analysis of variance, stability analysis, correlation and path analysis. The results obtained are summarized below.

The analysis of variance revealed significant differences among the genotypes for all traits studied over all environments, indicating sufficient amount of variability present. Environmental variances are found significant except number of branches, seeds per pod, oil and protein content. G X E interaction is highly significant for all character studied except plant height, pods per plant and oil content. Analysis of variance the variance due to Env + (G x E) highly significant for all the trait except number of pods per plant and oil content. Environment (linear) was highly significant for all traits except number of seeds per pod and oil content.

The correlation studies indicated grain yield per plant had significant positive correlation with number of branches per plant, number of pods per plant, number of seeds per pod, 100 seed weight, grain yield per plot and oil content at both level. Grain yield per plant exhibited negative correlation with days to 50% flowering, days to maturity, plant height and protein content at phenotypic and genotypic level. However, considering direct and indirect effect under various environments, the yield components such as, number of branches per plant, number of pods per plant, number of seeds per pod and 100 seed weight may be considered for improvement of soybean.

Estimates of environmental indices (I_j) indicated that E_1 was most favorable for yield and its components, followed by E_3 , and E_2 environments. Considering the nature of stability, two genotypes MAUS-740, MAUS-710 were found promising and they had stable performance over three environments for grain yield per plant while MAUS-614 was suitable for favorable environment. Genotype AMS-MB-5-19 had wider stability for days to 50 per cent flowering and KDS-921 had wider adaptability for days to maturity. For plant height genotype MACS-1543 showed superiority for average response and stability under all environments. For number of branches per plant two genotypes, KDS-980 and MACS-1460 showed superiority for average response and stability under all environments. For number of pod per plant three genotypes, KDS-1045, AMS-100-39-1 and MAUS-706 had stable performance in all three environments. The genotypes, MAUS-740, MAUS-614 had stable performance over three environments for 100 seed weight.

Use of genotype with wide (MAUS-740, MAUS-710) or specific stability (KDS-921, MACS-1543, AMS-MB-5-19, KDS-1045, AMS-100-39-1, MACS-1460, JS-93-05, MAUS-706)) in development of new varieties with desired nature of adaptability suggested.

Title	- Stability analysis for yield and quality traits in wheat (<i>triticumaestivum</i> L.)
Researcher	- Krupal, SumitMahadev
Research Guide	- Rathod, S.T.
Department	- Agricultural Botany
Subject	- Genetics and Plant Breeding
Degree	- M.Sc
Thesis No.	- 1771
Krishikosh link	- http://krishikosh.egranth.ac.in/handle/1/5810033578
Abstract	-

The present investigation entitled “Stability analysis for yield and quality traits in wheat” (*Triticumaestivum* L.) were undertaken with the objective to study the stability of different genotypes for yield and quality traits and to study correlation and path analysis for yield and quality traits in wheat. The eleven genotypes including two checks were evaluated in RBD with 3 replications in three environment viz., E₁ (08 Nov., 2016), E₂ (23 Nov., 2016) and E₃ (08 Dec., 2016) during *rabi*2016-17 at Experimental Farm, Department of Agricultural Botany, College of Agriculture, Latur. Data were recorded on 14 traits viz., plant height, days to heading, days to 50 per cent flowering, days to maturity, number of tillers per plant, length of panicle, number of spikelet’s per panicle, number of grains per spikelet, number of grains per panicle, test weight, harvest index, protein content, gluten content and yield per plant. The data was collected and analyzed for analysis of variance, stability analysis, correlation and path analysis. The results obtained are summarized below. The analysis of variance for all the fourteen character of eleven genotypes revealed significant differences among the genotypes studied over different environments, indicating sufficient amount of variability present. Environmental variances are found to be significant for all character. G X E interaction also significant for all characters except days to heading.

For yield per plant the genotypes, MACS-6222, PBN-3958 and GW-480 exhibited higher mean, bi near to unity and non significant deviation from regression line, that genotype was stable under all environments. However MP-1323 for number of tillers per plant, MP-1323 for harvest index (%), MACS-6222 for protein content (%) stable for all environment.

The genotypic correlation coefficients were found to be of higher magnitude than the corresponding phenotypic correlation coefficients in most of the cases.

The correlation studies indicated that importance of number of tiller per plant, (E₁, E₂ at both levels & E₃ at genotypic level), days to heading, days to 50% flowering, days to maturity, number of spikelet per panicle and number of grains per panicle in E₁ and harvest index in E₁ and E₃ at both genotypic and phenotypic level. Whereas strong positive and significant correlation also exhibited by plant height in E₂ at genotypic level. Days to heading days to 50%

flowering and days to maturity was significant and positively correlated with number of spikelet per panicle and number of grains per panicle in all environment at both levels.

The path coefficients analysis for E_1 environment revealed that the characters had positive direct effect of days to heading followed by number of grains per panicle, gluten content, number of grains per spikelet, harvest index, number of tiller per plant, plant height, and number of spikelet per panicle. For E_2 environment it shows positive direct effect via harvest index followed by days to heading, plant height, number of spikelet's per panicle, gluten content, protein content, number of tillers per plant, number of grains per panicle and length of panicle. For E_3 environment it shows positive direct effect via days to heading followed by test weight, length of panicle, number of spikelet per panicle, number of tiller per plant and days to 50% flowering.

Title	- Combining ability analysis involving monohead restorers in sunflower(<i>helianthus annuus</i> l.)
Researcher	- Salke, PoonamSubhash
Research Guide	- Toprope, V.N.
Department	- Agricultural Botany
Subject	- Genetics and Plant Breeding
Degree	- M.Sc
Thesis No.	- 1772
Krishikosh link	- http://krishikosh.egranth.ac.in/handle/1/5810033581
Abstract	-

The present investigation entitled “Combining ability analysis involving monohead restorers in sunflower (*Helianthus annuus* L.)” were undertaken to study combining ability effects of parents and hybrids in monohead restorer for yield and yield contributing traits and to study the heterosis in monohead restorer hybrids for yield and yield contributing traits. Eight diverse inbred lines (R lines) viz., EC-494430, EC-210309, TSG-104, CSFI-99, RHA-138-2, R-271-1, P-93-R, GP-6-263. These parents were crossed in half diallel design for producing 28 hybrids by hand emasculation and pollination during *kharif*, 2016 at Oilseeds Research Station, Latur and during *rabi*, 2017, 28 F₁, their parents along with standard checks SS-2038 and LSFH-35 were evaluated in Randomized Block Design with two replications. The observations were recorded on 12 characters viz., days to 50 % flowering, days to maturity, plant height, head diameter, seed filling percent, 100 seed weight, volume weight, hull content, oil content, pollen viability, pollen load and seed yield per plant respectively collected and analyzed for analysis of variance, combining ability and heterosis. The results obtained are summarized below.

The analysis of variance of parents and their hybrids for various characters under study revealed that the mean sum of squares due to genotypes were significant for all the characters. Mean sum of squares due to parents vs. hybrids were significant for days to 50 % flowering, plant height, head diameter, seed filling %, 100 seed weight, pollen load, hull content, oil content and seed yield per plant. Which indicates that mean performance of the parents was different from hybrids there by suggesting heterosis for these traits.

The GCA and SCA mean sum of squares were highly significant for all the traits which indicate that both additive and non additive gene action played important role for the inheritance of these traits.

The combining ability analysis revealed none of the parent found good general combiner for all the studied characters. However, restorer, CSFI 99 for plant height, seed filling, 100 seed weight, hull content, seed yield per plant, pollen viability and pollen load, RHA 138-2 for head diameter, seed yield per plant, volume weight, hull content, oil content, pollen load and P 93-R for dwarf plant height, head diameter, seed yield per plant, 100 seed weight and oil

content were good general combiner. Therefore, parents, CSFI 99, RHA 138-2 and P 93-R may be utilized for future breeding programme. Parental *per se* performance and GCA effects go in parallel direction.

SCA estimates revealed that none of the cross combinations found desirable sca effect for all the traits. Crosses, CSFI 99 x P 93-R, CSFI 99 x R 271-1 and EC 210309 x GP 6-263 exhibited significant and positive SCA effects for seed yield and its yield contributing traits. The top performing hybrids involve at least one good general combiner. The *per se* performance and gca effects should be taken into consideration for selecting specific combination.

Among the 28 cross combinations, CSFI 99 x R 271-1 exhibited desirable better parent and standard heterosis for seed yield per plant, oil content, volume weight, 100 seed weight and head diameter. The hybrid CSFI 99 x P 93-R also recorded significant heterosis for seed yield per plant, 100 seed weight and head diameter and both hybrids had significant SCA effects. Thus, these hybrids can be explained for heterosis breeding for these characters.

On the basis of GCA effects for yield and its components, the parents, P 93-R, RHA 138-2 and CSFI 99 could be used as restorers in heterosis breeding. The crosses, CSFI 99 x P 93-R, CSFI 99 x R 271-1 and EC 210309 x GP 6-263 exhibited high *per se*, significant SCA effects and heterosis for yield and yield contributing traits. Thus, these could be selfed to produce good restorer lines from advanced generation.

Title	- Combining ability analysis involving multihead restorers in sunflower (<i>helianthus annuus</i> L.)
Researcher	- Fesate, ChetanaGovindrao
Research Guide	- Ghodke, M.K.
Department	- Agricultural Botany
Subject	- Genetics and Plant Breeding
Degree	- M.Sc
Thesis No.	- 1773
Krishikosh link	- http://krishikosh.egranth.ac.in/handle/1/5810033584
Abstract	-

The present investigation entitled, “Combining ability analysis involving multihead restorers in sunflower” was undertaken with the objectives to study the combining ability and gene action in parents and hybrids of sunflower and to study the heterosis for seed yield and components traits in sunflower.

Six restorer lines were crossed with half diallel fashion to obtain 15 F₁s. The crosses and parents with two checks, were evaluated in a randomized block design with two replications during *Rabi* 2016 at Experimental farm at Oil seed research station, Latur. Data were recorded on 12 character viz., days to 50% flowering, days to maturity, plant height (cm), No. of branches/ heads per plant, Pollen load, seed filling (%), 100-seed weight (g), volume weight (g/ml), hull content (%), seed yield per plant (g), oil content (%) and pollen viability (%).

Analysis of variance for means revealed significant differences for all the twelve characters studied. Parents vs. hybrids interaction mean square were significant for plant height, 100 seed weight, days to 50% flowering, pollen load/plant, oil content(%), seed filling(%), volume weight and seed yield/plant. indicating the existence of sufficient amount of variability in parents and hybrids.

The magnitudes of heterosis over standard check for most of the characters in the present study were highly appreciable. Among the characters, the magnitude of heterosis for pollen load / pollen productivity measuring to the extent over both standard checks SS-2038 and LSFH-35 in cross EC-198099XMRHA-2 (57.39,39.23) followed by EC-601939XEC-601951(54.78, 36.92) and EC-601924XEC-601951(33.04, 17.69).and magnitude of heterosis is high in cross EC-601924XMRHA-2(20.00) and EC-198099XEC-601951(11.30) over the check SS-2038.

Among the parents MRHA-2 was good general combiner for 50% flowering, days to maturity, 100-seed weight (g), oil content (%), seed filling (%) and seed yield per plant (g) followed by EC-601766 is also found to be good general combiner for Plant Height (cm), Oil content (%), Hull content (%) and Volume weight (gm/100ml). A close agreement between GCA and *per se* performance of parent was observed for most of the characters studied.

There was close agreement between *per se* performance and GCA as well as SCA effects for most of the characters. Observations on various characters indicated that the crosses showing high heterosis and high SCA effects had high *per se* performance and they involved at least one high combining parent.

The cross EC-198099 x MRHA-2, EC-601924 x EC-601951, produced significant and desirable SCA effects for pollen load/per plant and cross EC-198099 x MRHA-2, EC-601939 x EC -601951, EC- 601924 x EC-601951 and EC- 601766 x MRHA-2 produced significant and desirable SCA effects for no. of branches per plant also had significant SCA for some other characters, indicating potential for exploiting elite restorer hybrid vigour in breeding programme.

Title	- Assessment of groundnut (<i>arachis hypogaea</i> L.) genotypes for yield and yield contributing characters and sucking pest resistance
Researcher	- Sonawane, Vijay Gorakh
Research Guide	- Misal, A.M.
Department	- Agricultural Botany
Subject	- Genetics and Plant Breeding
Degree	- M.Sc
Thesis No.	- 1774
Krishikosh link	- http://krishikosh.egranth.ac.in/handle/1/5810033586
Abstract	-

The present investigation entitled “Assessment of groundnut genotype for yield and yield contributing characters in groundnut and sucking pest resistance” were undertaken with the objective to study the extend of genetic variability, correlation and path analysis for yield contributing characters and study sucking pest resistance morpho-biochemical characters. Eighteen groundnut genotypes including three check viz., LGN-1, JL-24 and LGN-123 were evaluated at Oilseed Research Station, Latur during kharif 2016. The observations were recorded on selected five plants for seventeen characters viz., days to 50 percent flowering, days to maturity, number of pod per plant, test weight, shelling percent, harvest index, oil content, kernel yield per pant, pod yield per plant, phenol content, SCMR, total sugar, leaf water content, leaf thickness, trichome frequency.

The mean performance revealed that the genotype viz., LGN-176, ICGV-00203, ICGV-07408, LGN-123, ICGV-86699 and ICGV-07038 had high pod yield per plant and yield contributing characters like number of pods per plant, kernel yield per plant and test weight and ICGV-86699, TG-75, ICGV-07408, AK-335 and LGN-184 recorded sufficient amount of morpho-biochemical traits like phenol content, trichome frequency, leaf water content, total sugar with less sucking pest incidence.

The estimates of genotypic and phenotypic coefficient of variation indicate that maximum GCV and PCV were observed for number of pod per plant, kernel yield per plant, pod yield per plant, harvest index, total sugar, thrips incidence, trichome frequency, SMCR.

The estimates of variability were appreciably high for harvest index, number of pod per plant, kernel yield per plant and pod yield per plant, total sugar, trichome frequency. High to moderate heritability and low genetic advance as per cent of mean was being also observed for oil content, days to maturity, shelling per cent, SCMR, phenol content, leaf water content and leaf thickness.

The character association studies indicating that the characters like kernel yield per plant followed by number of pod per plant, test weight, days to maturity and SCMR exhibit significant positive association, whereas leaf thickness significantly negative with pod yield.

From path coefficient analysis studies, it is revealed that, kernel yield per plant, days to maturity, oil content, harvest index, leaf water content, SCMR, total sugar, thrips incidence, and phenol content exerted positive direct effect on pod yield and shelling per cent, test weight, days to 50% flowering, number of pod per plant, trichome frequency, leaf thickness and jassid incidence exerted negative direct effect on pod yield.

Title - **Combining ability analysis in sunflower (*Helianthus annuus* L.)**

Researcher - Borde, SubhashRamdas

Research Guide - Toprope, V.N.

Department - Agricultural Botany

Subject - Genetics and Plant Breeding

Degree - M.Sc

Thesis No. - 1782

Krishikosh link - <http://krishikosh.egranth.ac.in/handle/1/5810033660>

Abstract -

The present investigation entitled, “Combining ability analysis in sunflower (*Helianthus annuus* L.)” was undertaken with the objectives to study the combining ability and heterosis for seed yield and its components traits in sunflower

Twenty one F₁s derived from seven parents without reciprocal crosses along with parents and checks, Morden and SS 2038 were evaluated in RBD at Oilseed Research Station, Latur during *rabi*, 2016. Data were recorded on 10 characters *viz.*, days to 50% flowering, days to maturity, plant height (cm), head diameter (cm), seed filling (%), oil content (%) 100 seed weight (g), volume weight (g/100ml), hull content (%) and seed yield per plant (g).

Analysis of variances of genotypes, parents, hybrids and parents vs. hybrids revealed significant differences for all the characters except oil content and volume weight in parents vs. hybrids indicating the existence of sufficient amount of variability in materials.

Among the parents, SCG 107 was good general combiner for seed yield per plant, seed filling, 100-seed weight, volume weight, oil content, days to maturity, days to 50 % flowering, plant height and hull content. EC 304697 was also found to be a good general combiner for plant height, 100 seed weight, head diameter, seed filling and seed yield per plant.

The crosses, SCG 107 x EC 282345 (10.51), EC 494430 x EC 304697(8.54), SCG 44 x EC 282345 (6.27), EC 494430 x EC 180882 (4.28) and EC 585833 x SCG 44 (3.54) produced significant and desirable SCA effects for grain yield per plant and its component characters. The crosses, EC 585833 x EC 180882 and EC 282345 x EC 304697 exhibited significant negative SCA effect for hull content, but positive significant SCA effects for oil content.

The magnitude of heterosis over better parent and standard checks for most of the characters were highly appreciable. Crosses, SCG 44 x SCG-107 and SCG 44 x EC-304697 exhibited positive significant better parent and standard heterosis for seed yield per plant, seed

filling, head diameter and 100 seed weight. Negative significant heterosis were exhibited for days to 50% flowering and days to maturity by crosses, SCG 44 x SCG 107 and SCG 107 x EC 180882.

The crosses *viz.* SCG 44 x SCG 107, EC 494430 x SCG 44 for seed yield per plant, EC 494430 x SCG 107 for oil content and SCG 44 x SCG 107 for head diameter and SCG 44 x EC 304697 also for seed yield exhibited high *per se*, significant SCA effects, significant heterobeltiosis and standard heterosis for seed yield per plant, head diameter, 100 seed weight and seed filling.

There was close agreement between *per se* performance and GCA as well as SCA effects for most of the characters. Thus the lines, SCG 107 and EC 304697 can be directly used for conversion of CMS, while Crosses, SCG 44 x SCG 107 and EC 494430 x SCG 107 selfed to produce new maintainers in advanced generations.

Title	- Genetic variability, correlation and path analysis in desi cotton (<i>G. arboreum</i> L.)
Researcher	- Deshmukh, MonaliRangnathrao
Research Guide	- Deosarkar, D.B.
Department	- Agricultural Botany
Subject	- Genetics and Plant Breeding
Degree	- M.Sc
Thesis No.	- 1785
Krishikosh link	- http://krishikosh.egranth.ac.in/handle/1/5810033665
Abstract	-

The present studies on “**Genetic Variability, Correlation and Path Analysis InDesi Cotton (*G. arboreum* L.)**” involved the assessment of genetic variability, heritability, GCV and PCV, genetic advance, their associations and path effects. The experimental material consisted of 39 different elite genotypes of *desi* cotton along with three checks *viz.*, AKA-7, PA-08 and JLA-794.

A wide range of variation was found for almost all the characters. The phenotypic coefficient of variation (PCV) which measures the total variation was found to be greater than genotypic coefficient of variation (GCV). In the experiment all the characters showed very small difference between GCV and respective PCV, indicated that all the characters were least affected by environment. High heritability estimates coupled with high expected genetic advance were observed for the characters plant height, number of sympodia per plant, number of bolls per plant, lint index, harvest index, upper half mean length and seed cotton yield per plant indicating the presence of additive gene action and phenotypic selection may be more fruitful and effective for desired genetic improvement.

The lines FDK-260 (51.93 g), GAM-231 (50.22 g), PBD-17 (49.86 g), PAIG-363 (49.00 g) and KWA-1301 (48.70 g) showed higher seed cotton yield per plant over all three checks *viz.*, AKA-7 (37.74 g), PA-08 (44.09 g) and JLA-794 (48.00 g).

The genotypes PAIG-363, DWda-1502, GAM-231 and ARBa-1502 showed superiority for fiber quality traits.

The correlation studies revealed significant and positive genotypic and phenotypic correlation of number of bolls per plant, number of sympodia per plant, lint index, boll weight, plant height, ginning percent, seed index and harvest index with seed cotton yield per plant indicate the importance of these characters for improving seed cotton yield per plant.

The path analysis studies revealed that, the traits *viz.*, number of bolls per plant, boll weight, plant height, number of sympodia per plant, harvest index, days to 50 percent flowering, lint index, uniformity ratio and micronnaire exerted direct positive effect on seed

cotton yield. Therefore, these characters should be given due emphasis for making selection for high yielding genotypes in *desi* cotton.

Traits *viz.*, number of sympodia per plant, number of bolls per plant, plant height, boll weight, ginning percent, lint index, seed index, micronnaire and uniformity ratio were the most important characters for effective selection of superior genotypes of *desi* cotton as they expressed high heritability and significant positive correlation as well as direct effect on seed cotton yield.

Title	- Studies on genetic diversity, pathaanlysis and correlation in sesame (sesamumindicum l.)
Researcher	- Kante, Srikanth
Research Guide	- Ghodke, M.K.
Department	- Agricultural Botany
Subject	- Genetics and Plant Breeding
Degree	- M.Sc
Thesis No.	- 1793
Krishikosh link	- http://krishikosh.egranth.ac.in/handle/1/5810033677
Abstract	-

In the present investigation, sixty five genotypes of sesame which are selected on the basis of duration, suitable for *kharif* season and yield were evaluated to study the genetic diversity present in the experimental material for selection of the diverse parents, to estimate the genetic variability parameters among the genotypes for yield, and the extent of association between yield and its component characters including direct and indirect effects. The experiment was laid out in a Randomized Block Design with two replications at Research farm, Oilseeds Research Station during *kharif*, 2016.

Analysis of variance indicated the existence of significant genotypic differences among the genotypes for yield and its components for all characters. The genotypic coefficients of variation for all the characters studied were lesser than the phenotypic coefficient of variation indicating the effect of the environment. The high GCV and PCV values are observed for traits number of capsules plant⁻¹ and seed yield⁻¹.

High heritability coupled with high genetic advance as per cent mean was observed for number of capsules plant⁻¹, number of seeds capsule⁻¹, 1000-seed weight and seed yield plant⁻¹ indicating the influence of additive gene action, as such simple selection would likely to be effective for improvement of these traits.

Based on relative magnitude of D² values, the genotypes are grouped into four clusters. Clustering pattern of germplasm is not associated with the geographical distribution due to their morphological differences. Out of four clusters the cluster-I is the largest comprising of sixty genotypes followed by cluster-II comprising of three genotypes and remaining clusters III and IV were mono-genotypic clusters suggesting the ample amount of heterogeneity among the genotypes. Highest divergence occurred between the clusters I and IV followed by clusters I and II, II and IV, II and III and III and IV.

Based on the inter cluster distance, it is suggested that hybridization between the genotypes JLT-408 of cluster IV and Maduri of cluster III, JLT-408 of cluster IV and UKNM-1067, TKG 306 of cluster II, between Maduri of cluster III and UKNM-1067 of cluster II and between Maduri of cluster III and Sweta of cluster II are suggested to generate promising segregants for seed yield.

Seven characters 1000-seed weight, days to maturity, oil content, number of seeds capsule⁻¹, capsule length, seed yield plant⁻¹ and number of branches plant⁻¹ together contributed 90.74% towards the total divergence. The data means for four clusters indicated that the cluster IV is having highest mean value for days to 50% flowering, capsule length, number of capsules plant⁻¹, seed yield plant⁻¹, 1000 seed weight and oil content and cluster II for days to maturity, plant height and number of branches plant⁻¹ and cluster III for capsule width and number of seeds capsule⁻¹. The promising genotypes from these clusters with high mean values for different traits may be directly used for adaptation as parents in future hybridization.

The results revealed that the estimates of phenotypic correlation coefficients were higher than the genotypic correlation coefficients. Capsule length, plant height, number of capsules, number of seeds, 1000-seed weight and oil content (%) had high significant positive association with seed yield. This indicated that simultaneous selection of all these characters was important for yield improvement.

A critical analysis of the results by path coefficient analysis revealed that high positive direct effect of number of capsules, number of seeds, 1000-seed weight and capsule length with seed yield. Therefore simultaneous selection for these traits is suggested for improvement of seed yield in sesame. Hence, these traits were considered as important attributes in formulating selection criterion for achieving desired targets.

Title	- Germinative evaluation for physiological quality of seed in soybean genotypes (<i>Glycine max</i> (L.) Merrill)
Researcher	- Totewad, PrashantkumarGangadhar
Research Guide	- Kamble, B.G.
Department	- Agricultural Botany
Subject	- Genetics and Plant Breeding
Degree	- M.Sc
Thesis No.	- 1797
Krishikosh link	- http://krishikosh.egranth.ac.in/handle/1/5810033684
Abstract	-

One of the important basic needs for higher agricultural productivity is physiological quality of seed, which is characterized by viability and vigour. As soybean (*Glycine max* (L.) Merrill) is Soybean is classified as "poor storer" as it loses viability drastically under warm and humid conditions under hot and humid storage conditions. The present research study was conducted to evaluate soybean seed material with the objectives to relate field emergence and laboratory evaluation with respect to physiological quality of soybean, with special reference to germinative evaluation criteria, to study the effect of storage on vigour and viability on soybean seeds. Seeds of soybean variety, JS-9305, JS-335, JS-9752, MAUS-158, MAUS-162, MAUS-71, MAUS-81 stored in air tight plastic containers and kept under ambient laboratory conditions. Completely randomized block design was employed with four replications.

Various germinative criteria including imbibition rate, standard germination test and vigour indexes were studied. The storage of seeds resulted in deterioration of seed vigour as evident by decline in the various parameters investigated. Considering the field stand establishment (field emergence final count) as dependent parameter and various evaluation criteria as independent parameters the simple linear correlation and regression was done for individual parameters. The most rapid, easy and convenient criterion of seed vigour as reflected in terms of stand establishment (field emergence- final count) in soybean was imbibition rate after 16 hours ($R^2 = 0.445$). The other significant evaluation criteria for the prediction of seed vigour in soybean were laboratory germination (particularly final count) and vigour indexes.

Title	- Studies on combining ability and heterosis in sunflower (<i>Helianthus annuus</i> L.)
Researcher	- Bhagile, Parmeshwar Ganesh
Research Guide	- Ghodke, M.K.
Department	- Agricultural Botany
Subject	- Genetics and Plant Breeding
Degree	- M.Sc
Thesis No.	- 1799
Krishikosh link	- http://krishikosh.egranth.ac.in/handle/1/5810033686
Abstract	-

The present investigation entitled, “Studies on combining ability and heterosis in sunflower (*Helianthus annuus* L.)” was undertaken with the objectives to study the combining ability and gene action in parents and hybrids of sunflower and to study the heterosis for seed yield and components traits in sunflower

Six female lines were crossed with five male lines so as to obtained 30 F₁s. The crosses and parents with two checks, were evaluated in a randomized block design with two replications during *Rabi* 2016 at Experimental farm at Oil seed research station, Latur. Data were recorded on 11 character viz., days to 50% flowering, days to maturity, plant height (cm), head diameter (cm), seed filling (%), 100-seed weight (g), volume weight (g/ml), hull content (%), seed yield per plant (g), oil content (%) and pollen viability (%).

Analysis of variance for means revealed significant differences for all the eleven characters studied. Parents vs. hybrids interaction mean square were significant for all the characters except days to 50% flowering, days to maturity, 100 seed weight (g) and hull content (%) indicating the existence of sufficient amount of variability in parents and hybrids.

The magnitudes of heterosis over mid parent, better parent and standard check for most of the characters in the present study were highly appreciable. Among the characters, the magnitude of heterosis for seed yield per plant measuring to the extent of (228.97) over mid parent in cross CMS 2A x EC-623008 followed by CMS 103A x EC-623008 (206.56). Over better parent in the cross (202.87) CMS 2A x EC-623008 followed by CMS 127A x EC-601746 (195.18) and (34.33) CMS 243A x EC-512684 followed by CMS 2A x EC-623008 (30.18) over standard check LSFH-35 and CMS 243A x EC- 512684 (55.20) followed by CMS 2A x EC-623008 (50.40) over standard check LSFH-171.

Among the female parents CMS 2A was good general combiner for seed yield per plant, seed filling, 100-seed weight, volume weight and oil content followed by CMS 103A is also found to be good general combiner for plant height, 100 seed weight, volume weight and

pollen viability. The CMS 243A was good general combiner for seed yield per plant and pollen viability.

Among the male parents, EC-623008 identified as best general combiner for days to 50% flowering, days to maturity, head diameter (cm), 100 seed weight (g), seed yield/plant (g), seed filling %, volume weight (g/100ml) and pollen viability (%) followed by EC-512684 is also found good combiner for head diameter (cm), seed filling (%), seed yield/plant (g) , 100 seed weight (g) and pollen viability (%). A close agreement between GCA and *per se* performance of parent was observed for most of the characters studied.

There was close agreement between *per se* performance and GCA as well as SCA effects for most of the characters. Observations on various characters indicated that the crosses showing high heterosis and high SCA effects had high *per se* performance and they involved at least one high combining parent.

The cross CMS 243A x EC-512984, CMS 127A x EC-601746, CMS 207A x EC-601746, CMS 852A x TSG-104 and CMS 2A x EC-623008 produced significant and desirable SCA effects for grain yield per plant and also had significant SCA for some other characters, indicating potential for exploiting hybrid vigour so as to develop the hybrid.

Title	- Assessment of genetic variability, correlation and path analysis studies in safflower (<i>Carthamus tinctorius</i> L.)
Researcher	- Jadhav, Sachin Ashok
Research Guide	- Dhuppe, M.V.
Department	- Agricultural Botany
Subject	- Genetics and Plant Breeding
Degree	- M.Sc
Thesis No.	- 17100
Krishikosh link	- http://krishikosh.egranth.ac.in/handle/1/5810033687
Abstract	-

The present investigation entitled “Assessment of genetic variability, correlation and path analysis studies in safflower (*Carthamus tinctorius* L.)” was undertaken during **Rabi** 2017, at Experimental Farm of College of Agriculture, Latur with 32 genotypes of safflower including two checks *viz.*, A-1 and PBNS-12 with objectives to study the genetic variability parameters, correlation and path analysis for yield and yield contributing characters. The observations were recorded on selected five plants for ten yield contributing characters.

Analysis of variance indicated significant differences for all the traits under study, indicating the presence of wide genetic variability in the experimental material studied.

The magnitude of GCV and PCV was recorded to be high for seed yield per plant followed by number of seeds per capitulum, test weight, number of effective capitulum per plant. Higher broad sense heritability values were also associated with the character seed yield per plant and moderate heritability for the characters *viz.*, number of seeds per capitulum, test weight, plant height and number of effective capitulum per plant.

High heritability coupled with high genetic advance over mean as per cent of means observed for seed yield per plant, number of seeds per capitulum, test weight and days to maturity. The phenotypic coefficient of variation was marginally higher than genotypic coefficient of variation for all the characters.

It is recorded that the genotypic correlation coefficients were slightly higher than their respective phenotypic correlation coefficient for most of the characters. seed yield per plant was highly significant and positively correlated with days to maturity, number of effective capitula per plant, test weight and low in magnitude with plant height and harvest index. Whereas seed yield per plant showed negative correlation with hull content.

The path analysis indicated that the character days to maturity exerted the highest direct positive effect on seed yield per plant followed by harvest index and number of seeds per capitulum. The direct negative influence were observed for oil content, plant height, test weight and days to 50 per cent flowering.

The promising génotype accession *viz.*, GMU-15-2550 performed better for days to 50 per cent flowering, plant height and number of effective capitulum per plant, number of seeds per capitulum. The genotype GMU-15-2687 performed better for days to maturity, number of effective capitulum, test weight and hull content. The genotype SHARDA performed better for days to maturity, test weight and harvest index. The genotype GMU-15-2465 performed better for number of seeds per capitulum, harvest index and plant height. The genotype GMU-15-3395 performed better for number of effective capitulum, hull content.

Title	- Effects of micronutrients on growth and yield of soybean (<i>Glycine max L.</i>)
Researcher	- Bokse, ManojMaroti
Research Guide	- Bhadarge, H.H.
Department	- Agricultural Botany
Subject	- Plant Physiology
Degree	- M.Sc
Thesis No.	- 17105
Krishikosh link	- http://krishikosh.egranth.ac.in/handle/1/5810033721
Abstract	-

A field experiment entitled “Effects of micronutrients on growth and yield of soybean (*Glycine max L.*)” was conducted during *kharif* 2016 at Instructional Farm, Department of Agriculture Botany, VasantnaoNaikMarathwada Agriculture University, Parbhani. The experiment was laid out in randomized block design with three replications and ten treatments. The micronutrients, sulphur (22.22, 33.33 and 44.44 kg/ha), boron (11.11, 16.66 and 22.22 kg/ha), and zinc (1.111, 1.481 and 1.851 kg/ha) concentrations were applied as soil application at 30 DAS.

Application of micronutrients (sulphur, boron and zinc) increased the plant height. The number of branches increased significantly with micronutrients. The micronutrient treatments significantly increased number of leaves, leaf area, leaf dry weight, dry weight of stem with pod, total dry weight and days to 50% flowering. The growth parameters *viz.*, AGR, RGR, NAR, and LAI increased significantly due to micronutrients application. Biochemical parameters *viz.*, total chlorophyll content (50.15%), protein (42.00%) and oil content (21.00%) were significantly higher with the application of boron (22.22 kg/ha). The number of pods per plant, number of grains per plant (70.33), seed yield per plant (8.44 g), seed yield per plot (0.832 kg), seed yield per hectore (33.00 q), hundred seed weight (12.00 g), straw per plant (18.56 g) and harvest index (45.50 %) increased significantly due to micronutrients application at concentration (boron 22.22 kg/ha). The application of boron (22.22 kg/ha) recorded significantly highest seed yield in the soybean genotype MAUS-158.

Title	- Studies on physiological and biochemical changes during seed storage in soybean (<i>glycine max l. merrill</i>)
Researcher	- Bhullarkar, Sony Balchander
Research Guide	- Dalvi, D.G.
Department	- Agricultural Botany
Subject	- Plant Physiology
Degree	- M.Sc
Thesis No.	- 17134
Krishikosh link	- http://krishikosh.egranth.ac.in/handle/1/5810033877
Abstract	-

An investigation entitled “Studies on physiological and biochemical changes during seed storage of Soybean (*Glycine max* L. Merrill)” was undertaken in view of the objectives i.e. (1) to study the effect of genotypes on yield and seed storability in soybean, (2) to study the physiological changes during seed storage and (3) to study the biochemical changes during seed storage. The experiment was carried out in different during July 2016 to May 2017 at VasanthraoNaikMarathwadaKrishiVidyapeeth, Parbhani. To study the effect of genotype four soybean cultivars *viz.*, MAUS - 71, MAUS - 81, MAUS - 158 and MAUS -162 were sown in five replication as per recommendation in *Kharif* 2016 and observed for different growth and yield characters. The results revealed that the variety MAUS-158 and MAUS-162 followed by were found to be the most ideal for yield and storability. The variety MAUS-81 was found most unstable nature for yield performance.

To study the physiological changes during seed storage and to study the biochemical changes during seed storage, the soybean seed of varieties MAUS - 71, MAUS - 81, MAUS - 158 and MAUS -162 were stored in cloth bag, gunny bag and High Density Poly Ethylene bags. The monthly observations for different seed quality parameters were taken during storage.

Among the varieties, It was also seen that the variety MAUS - 162 followed by MAUS - 158 and MAUS - 71 were better stored than the variety MAUS - 81. It was also noticed that the storage of seed in High density Poly Ethylene bag had significantly increased the storability of soybean seed over the seed stored in gunny bag and cloth bags. The physiological and biochemical components i.e. germination, root-shot length, vigour index, dry matter content viability as tested by TZ test, protein content, oil content were found to be decreased, whereas moisture content and electrical conductivity increased during storage, as the storage period advances irrespective of the varieties and storage containers. In general it could be stated that the germination above Minimum Seed Certification Standard (70%) was maintained upto 10, 9, 9, and 6 months in variety MAUS -162, MAUS -158, MAUS -71 and MAUS -81 respectively. However, the seed

stored in HDPE bag and gunny bag was successfully maintained one month more MSCS than the seeds stored in cloth bags irrespective of varieties.

Title	- Heterosis and combining ability for fruit yield and its contributing characters in okra (<i>Abelmoschus esculentus</i> (L.) Moench)
Researcher	- Chaure, S.L.
Research Guide	- Pole, S.P.
Department	- Agricultural Botany
Subject	- Genetics and Plant Breeding
Degree	- M.Sc
Thesis No.	- 17194
Krishikosh link	- http://krishikosh.egranth.ac.in/handle/1/5810034122
Abstract	-

The present investigation entitled “Heterosis and Combining ability for fruit yield and its contributing characters in okra (*Abelmoschus esculentus*(L.) Moench)” were undertaken with the objective to study the heterosis, combining ability effects and gene action in parents and hybrids of okra. To study the heterosis for yield and yield components in okra in 24 hybrids obtained by crossing 4 x 6 genotypes in L X T fashion and their 10 parents and 2 standard checks were evaluated in RBD with 2 replications during *Kharif*2016-17 at Experimental Farm, Department of Agricultural Botany, College of Agriculture, Latur. Data were recorded on 11 traits *viz.*, Plant height, number of nodes per plant, Inter nodal length, Number of branches per plant, fruit length, Fruit weight, Fruit diameter, Number of fruits per plant, Fruit yield per plant, Incidence of fruit borer and Powdery mildew severity .

Considerable heterosis was observed for all the character but the magnitude was differed for different characters. The highest mid parent heterosis was observed for fruit yield per plant (46.08 %) followed by fruit diameter (43.30 %). The other characters which showed considerable amount of heterosis were inter nodal length (-11.71 %), number of branches (37.14%), fruit weight (39.73 %), plant height (25.96 %) and fruit length (22.38 %). The significant negative heterosis over mid parent was observed for incidence of fruit borer (-61.36 %), powdery mildew severity (-18.92%) and inter nodal length (-11.71 %).

The parents *v/s* crosses interaction mean sum of squares was significant for plant height, number of nodes per plant, fruit weight, number of fruit per plant and incidence of fruit borer. It indicated the presence of sufficient variability in parents and hybrids. Combining ability studies indicated the preponderance of non-additive gene action for all the characters except inter nodal length and number of branches per plant. There was close agreement between *per se* performance and GCA as well as SCA effects for most of the characters. The best crosses based on heterosis, SCA effect and *pre se* performance were Phuleutkarsha x Arkabahar and Phuleutkarsha x Pusa A4 were identified as the best cross combination for further exploitation.