Studyofgeneticvariabilityamongsomepetunia hybridsatChhattisgarhplains.

ABSTRACT

Thepresent investigationentitled "Studyof geneticvariabilityamongsomepetunia hybrids at Chhattisgarh plains" was carried out during the year 2022 at the HorticulturalResearchcumInstructional farm,CollegeofAgriculture,IndiraGandhi KrishiVishwavidyalayaRaipur(C.G.). The experimentwaslaidout ina Completely RandomizedDesign inthree replications usingten 10 genotypes,viz.,Daddy,Eagle, Dreams,Success 360,Mirage,Supercascade,TrituniaCrimsonStar,DoubleDuo, Double PirouetteRose, andDouble Glorious.Theanalysis of variance revealed significantdifferencesforallthecharacters.Thevariabilitywasstudied amongthese different genotypes. Thehighest range aswellasthe highest GCVandPCVwasfoundin the numberofflowers perplant. High heritability(>60%)wasfoundin almost allcharacters. Highheritabilitycoupledwitha highgeneticgainwasalsoobserved insomecharacters indicating thatthesecharacters aremostsuitableforselectivebreeding.

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Keywords-pPetunia,variability,GCV, PCV, heritability.

INTRODUCTION

Petuniaisoneofthe mosteconomicalornamentalplantsworldwideusedinurbanlandscaping.Their versatility,diversity,andvaryingflowercoloursarethereasonswhypetunias(*Petuniaxhybrida*)are amongthe mostpopularbeddingplantsintheworld.Theycanbeusedforcolourmasses,borders, containers,hangingbaskets,oras aseasonalgroundcoverandalsoused inthe privategarden,andbuilding decoration.Thecrucialroleplayedbythegenu Petunia inbothhorticultureandbiologicalresearch isundeniable. Insomecases cases,petuniahasbeenusedtodetecttheacidityofthesoil. The anthocyaninpetuniachangesitspetalcolourtoreddishreddish-purpleinacidicsoiland violetinbasicsoils. Consideringthemultipurposeroleitplaysandthelackofcareitrequires,itiscontinuouslyoninademand. So,thisobligesthegrowersforprocuring varietieswithmorenoveltiesthathavegoodacclimatizationin varied agro--climaticand ecologicalconditions,aswell assuitabilityforspecific purposes.

Petuniaalsoshowsa considerableamountofvariation whichdemands thestudyofgeneticvariabilityfora successfulbreedingprogram.Geneticparameterssuchasmean,range,GCV,PCV,heritability,and geneticadvanceneedtobepartitionedinordertounderstandwhichcharacterswouldbemoreefficient forselection.

MATERIALSANDMETHODS

Tengenotypesofpetuniahybrids,*viz*.,Daddy,Eagle,Dreams,Success 360,Mirage, Supercascade,TrituniaCrimson Star,Double Duo,Double PirouetteRose,and Double Glorious,were evaluatedattheHorticulturalcumInstructionalfarm,COA,IGKV,Raipur(C.G.)to estimate theamountof variabilityforvegetativeandfloweringcharactersamongthem. Theanalysisof variance (Table 1) indicatedhighlysignificantdifferencesamongthegenotypesformostofthecharacters,butthe analysis of varianceitselfisyetnotsufficientanddeterminativeinexplainingalltheinherentgenotypicvariancein thegenotypes.Onesimplewayofassessingthevariabilityofthesecharactersisthroughasimplestudy ofthegeneticparameters.

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Theparameterofgeneticvariability*viz*.range,PCV,GCV,heritability(broadsense),geneticadvance,andgeneticadvanceaspercentofthe meanaresummarizedinTable2,andresultsobtainedarediscussed asfollows.

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RESULTSAND DISCUSSION

AnalysisofVariance

The meansumofsquaresrevealedsignificantdifferences inallthecharacters.Thehighestmeansumof squarevaluewas recordedinthe numberofleaves at90days (502.88) followedbythe numberofleaves at75 days(418.80).Thisindicatedthepresenceofsufficientvariabilityforallthecharactersinthegenotypes and genetic improvement inthesegenotypesispossible based onselectionthrough thesetraits.

Table1.Analysisfordifferentcharactersin~~ten~~ 10genotypesof*Petuniaxhybrida.*

l. No.	Characters	MSS	
		Treatment d.f.(9)	Error d.f.(20)
1	Plantheightat15 days	0.53**	0.06
2	Plantspread at15 days	4.47**	0.32
3	Numberof leavesat 15 days	52.04**	11.15
4	Plantheightat30 days	1.51**	0.09
5	Plantspread at30days	5.77**	1.57
6	Numberofbranchesat30 days	1.89**	0.10
7	Numberof leavesat 30 days	28.77**	0.08
8	Stemlengthat 30 days	1.41**	0.35
9	Internodaldistanceat30 days	0.27**	0.04
10	Plantheightat45 days	12.61**	0.13
11	Plantspread at45days	9.91**	2.03
12	Numberofprimarybranchesat45 days	1.13**	0.12
13	Numberofsecondarybranchesat45 days	11.89**	0.12
14	Numberof leavesat 45 days	9.18**	0.14
15	Plantheightat60 days	21.10**	0.39
16	Plantspread at60 days	60.01**	5.35
17	Numberofprimarybranchesat60 days	3.36**	0.11

18	Numberofsecondarybranchesat60 days	12.35**	0.12
19	Numberof leavesat 60 days	189.41**	0.11
20	Stemlengthat 60 days	19.51**	0.10
21	Internodaldistanceat60 days	0.33**	0.04
22	Plantheightat75 days	19.56**	0.11
23	Plantspread at75 days	46.32**	7.47
24	Numberofprimarybranchesat75 days	9.07**	0.09
25	Numberofsecondarybranchesat75 days	18.48**	0.13
26	Numberof leavesat 75 days	418.80**	0.04
27	Plantheightat90 days	23.45**	0.10
28	Plantspread at90 days	28.74**	7.06
29	Numberofprimarybranchesat90 days	5.48**	0.06
30	Numberofsecondarybranchesat90 days	13.42**	0.12
31	Numberof leavesat 90 days	502.88**	0.09
32	Stemlengthat 90 days	112.39**	0.19
33	Internodaldistanceat90 days	0.28**	0.08
34	Flowerdiameter	1.79**	0.11
35	Numberofdaystakenforfirst flowering	48.29**	2.19
36	Leafwidth	0.61**	0.15
37	Leafarea	19.65**	4.56
38	Longevityof floweron plant	3.61**	0.57
39	Numberof flowers perplant	250.38**	19.19

**-significant at1%
Valuesin ~~parenthesis~~parenthesesindicatedegreesoffreedom

Geneticparameters

1. Mean and Range

~~Range~~The rangeofvariationobserved forallthetraitsinthepresentstudy(Table2)depictedthepresenceof a sufficientamountof variationamong thegenotypesforallthecharactersstudied.The rangein thevalues reflectstheamountofphenotypicvariability which isnot very reliable sinceit includesgenotypic, environmental,andgenotype xenvironmentalinteractioncomponentsanddoesnotreveal~~as~~which componentisshowinga higherdegreeof variability**.**Thehighestmean valuewasrecordedinthe numberof leavesat90daysandthelowestmeanvalue in the internodaldistanceat30days (2.13).The highestrange wasfoundinthe numberofflowersperplant(48.90to11.53)andthelowestrangeinintermodaldistanceat60 days(2.60 to1.12).

2. CoefficientsofVariability

ThevPCVandGCVvalueswereclassified,accordingto Sivasubramanian~~&~~andMenon(1973),aslow(0–10%), moderate(10–20%),andhigh(>20%). WhenPCVishigherthanGCV,itsuggeststhattheobserved variabilityinaparticulartraitisinfluencedtoagreaterextentbyenvironmental factorsratherthangenetic factors.Inotherwords,thephenotypicdifferencesareprimarilyduetovariationsingrowingconditions, culturalpractices,orothernon-geneticfactors.Thissituationcould ariseinflowercropswhenthegenetic diversitywithinthepopulationisrelativelylimitedorwhen theenvironmentalconditions have a substantial impactontheexpressionoftraits.Factorssuch as temperature, lightintensity,nutrientavailability,water availability, andmanagement practicescan significantly influencetheobserved phenotypicvariation.

When PCVexceedsGCV,itimpliesthattheselection ofplantsbasedsolelyonphenotypicperformance maybe lessreliableoreffective.Insuchcases,breedingstrategiesthatemphasize improving environmentalconditionsordevelopingcultivarsbetteradaptedtospecificgrowingconditionsmaybe moresuitable.

Fromtheanalysis,theestimatesforthe phenotypiccoefficientofvariation(PCV)werefoundtobehigher thanthegenotypiccoefficientofvariation(GCV) forallthecharacters studied.Similarresultswere documentedby Kumar(~~2012~~2013) ingerberaandPrakash*etal.*(2017)inchrysanthemum.Thehighest magnitude of GCV and PCVwas observed for the number of flowers per plant (28.64 and 30.73, respectively).~~Similar~~A similarresult wasobtainedbyBennurmath*etal.*(2022)in chrysanthemum. The GCVwasfound tobe subsequentforleafarea (25.15)followedbystem lengthat90 days(19.94).The PCVvaluesforthe number offlowers perplantwere followedbyleafarea (29.81) and longevityof floweron the plant(21.02).The restof thecharactersshowedmoderateGCVaswellas PCV.The lowestmagnitudeofGCVandPCVwere observed forthe numberofleavesat45days(1.29and1.31respectively).Thisresultissimilartodocumentationmade bySahu (2012)forchrysanthemum.

The differencebetween GCVandPCV~~were~~ wasfound tobeveryminuteand thevaluesforbothwerealmost thesame forallthecharactersstudied.Thisexplainsthelittleinfluenceofthe environmentontheexpression ofvariouscharacters.ItisimportanttonotethatGCVandPCVarestatisticalmeasuresandshouldbe usedinconjunctionwithotherbreeding techniquesandconsiderations,suchasheritabilityestimates, selection indices,andspecificbreedinggoals,tomake informeddecisions inflowercrop improvement programs.Thenarrow differencebetweenGCVandPCValsoindicatestheirsuitabilityforselection programs. It alsosuggeststhepresenceof sufficient geneticvariability,whichcanbeexploitedby practicingpure lineselection.Theresultsare inconformitywith the findingsofBaskaran*etal.*(2009)in chrysanthemum.

3. Heritability

Selectionissaid tobe efficacious notonlydepending on theamount of variability butratheron thedegree towhichthevariabilityisinheritedinthenextgeneration. Soestimationof heritabilitybecomesan importantaspect.Itiscategorizedaslow (<30%),moderate(30–60%),andhigh(>60%)(Robinson*etal.,* 1949).Theconceptofheritability in thebroadsenseprovidesabroaderperspectiveon thegenetic contributions tophenotypic variation,encompassingbothadditiveandnon-additivegeneticeffects (Falconer,1981).

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Heritabilityestimateswerehighformostofthestudiedtraits.Theheritabilityrangedbetween48.74to 99.97percent.Heritabilitywasfoundtobethelowestforplantspreadat90days(48.74%~~percent~~) followedbyplantspreadat30days(49.88%~~percent~~).Thesetwoparametershada mediumlevelof heritability(30-60%~~percent~~).Thehighestheritabilitywas foundinthe numberofleaves at75days (99.97%~~per cent~~),followedbythe numberofleavesat90days(99.94%~~percent~~)andthe numberofleavesat30days(99.22%~~percent~~). High heritabilitywasalso observed in othercharacterssuch asthe numberofbranches,numberof flowersperplant,flowerdiameter,andnumberofdays takenforfirstflowering.Similar findingswere reportedbyHusseinandMisiha(1979)inpetunia.Thepresenceofhighheritabilityinmostofthe charactersstudieddepictsa lowerlevelofenvironmentalinfluence.

Ali*et al.* (2002),and Najeeb*et al.* (2009)foundthathighheritabilitymaynotalwaysassociatewithlargegeneticadvances. Sinceheritabilitydoes notalways indicateahighgeneticgain,heritabilityis recommendedtobe considered in associationwithgeneticadvance topredicttheeffectofselecting superiorcropsvarieties. (Ogunniyan*et al.,* 2014)

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4. Geneticadvanceand Geneticadvanceaspercentofmean

Thehighestmagnitudeof geneticadvancewasrecordedforthe numberof leavesat90days(26.66) followedbynumberofleavesat45days(24.33),stemlengthat90days(12.57),andnumberofleavesat 60days (12.12).The lowestmagnitudewas recorded in internodaldistanceat90days (0.38)followedby internodaldistanceat30 days(0.49)andinternodaldistanceat60 days(0.54).

TheGeneticadvanceaspercentofmean values~~were~~wasgroupedintolow (10%),moderate(10-20%),and high(>20%)categories,as suggestedbyJohnson*etal*.(1955).Thehigher values ofgeneticadvanceas percentofthe meanwererecordedinleafarea(43.69)followedbystemlengthat90days(40.97)and the numberofsecondarybranches at90 days (39.23).The lowestvalue~~was~~ recordedwas forthe numberof leavesat 30 days(5.85).

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5. High heritabilitycoupled with high geneticgain

High heritabilitycoupled witha high geneticgainwasobserved in characterssuchasinternodaldistanceat 30days,numberofsecondarybranchesat45days,plantheightat60days,numberofsecondary branchesat60 days,stemlengthat60 days,internodaldistanceat60days,plantheightat75 days, numberofprimarybranchesat75days,plantheightat90days,numberofsecondarybranchesat90 days,stemlengthat90days,leafareaandnumberofflowers perplant(Henny*etal.,*2021,in chrysanthemum). Thisindicatesthepresence ofadditivegenesand the directselection ofsuch characterscan be gratifying.

CONCLUSION

Theresearchfindings providecompellingevidenceforthecharacters,*viz*.,plantheight,plantspread, numberofbranchesperplant,numberofleavesperplant,stemlength,andflowerlongevity,thathavetobetakenintoc onsiderationformaximizingflowerproductioninChhattisgarhconditions.Theresultsof this~~thesis~~paper contributetoadeeperunderstandingofthe morphologicalstudyofdifferentpetuniahybrids and havewide-rangingimplications forplantbreeding,horticulture,taxonomy,ecology,education,and research,contributingtoadvancements inunderstanding,utilizing,andconservingthesepopular ornamentalplants.

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Table2. Mean,Range, GCV,PCV,Heritability,Genetic advanceandGeneticadvanceas percentofmeanforall characters ofPetuniaxhybrida.

Sl. No.	Characters	Mean	Range		GCV	PCV	Heritability (%)	Genetic advance	Genetic advance as per centof mean
			Max.	Min.					
1	Plantheightat15 days	7.26	8.53	6.43	5.45	6.44	71.59	0.69	9.50
2	Plantspread at15 days	14.05	16.10	10.34	8.35	9.32	80.24	2.16	15.40
3	Numberof leavesat 15 days	56.37	64.50	46.67	6.51	8.88	53.82	5.55	9.84
4	Plantheightat30 days	9.56	10.97	8.48	7.17	7.90	82.30	1.28	13.40
5	Plantspread at30 days	23.71	27.40	21.32	5.06	7.17	49.88	1.75	7.36
6	Numberofbranchesat30 days	13.20	14.83	12.00	5.91	6.24	89.55	1.52	11.51
7	Numberof leavesat 30days	108.49	113.33	104.00	2.85	2.86	99.22	6.35	5.85
8	Stemlengthat 30 days	15.55	16.82	13.07	3.90	5.30	54.03	0.92	5.90
9	Internodaldistanceat30 days	2.13	2.92	1.58	13.14	15.46	72.28	0.49	23.02
10	Plantheightat45 days	11.81	14.78	9.02	17.28	17.51	97.46	4.15	35.15
11	Plantspread at45 days	29.27	33.72	25.66	5.60	7.28	59.08	2.59	8.86
12	Numberofprimarybranchesat 45 days	14.32	15.83	13.00	4.15	4.58	81.94	1.11	7.73
13	Numberofsecondarybranches at45 days	11.99	15.83	8.17	16.52	16.77	97.14	4.02	33.55
14	Numberof leavesat 45 days	133.32	136.83	131.00	1.29	1.31	95.91	3.46	2.59
15	Plantheightat60 days	15.90	19.75	12.50	15.33	15.47	98.13	4.94	31.28
16	Plantspread at60 days	38.41	49.63	30.62	11.06	12.74	75.29	7.59	19.76
17	Numberofprimarybranchesat 60 days	14.76	16.80	13.00	7.05	7.42	90.25	2.04	13.79
18	Numberofsecondarybranches at60 days	13.51	16.00	9.00	14.96	15.16	97.48	4.11	30.43
19	Numberof leavesat 60 days	161.08	170.67	132.17	4.65	5.94	61.43	12.12	7.51
20	Stemlengthat 60 days	21.25	27.97	19.00	11.97	12.07	98.27	5.19	24.44
21	Internodaldistanceat60 days	1.76	2.60	1.12	17.68	20.88	71.73	0.54	30.85
22	Plantheightat75 days	18.88	22.75	15.20	13.49	13.59	98.46	5.21	27.57
23	Plantspread at75 days	38.91	49.02	30.07	9.20	11.62	61.86	5.80	14.90
24	Numberofprimarybranchesat	14.66	17.60	12.17	11.80	11.99	96.92	3.51	23.93

	75 days								
25	Numberofsecondarybranches at75 days	13.34	16.83	9.00	18.53	18.74	97.76	5.04	37.74
26	Numberof leavesat 75 days	179.50	192.33	161.33	6.58	6.58	99.97	24.33	13.56
27	Plantheightat90 days	21.97	25.88	17.63	12.70	12.79	99.00	5.71	25.91
28	Plantspread at90 days	40.44	48.62	35.27	6.59	9.43	48.74	3.83	9.47
29	Numberofprimarybranchesat 90 days	12.69	14.40	10.00	10.58	10.78	96.33	2.72	21.39
30	Numberofsecondarybranches at90 days	10.96	14.50	8.00	19.24	19.43	98.00	4.30	39.23
31	Numberof leavesat 90 days	190.36	203.50	169.67	6.80	6.80	99.94	26.66	14.01
32	Stemlengthat 90 days	30.68	44.48	24.45	19.94	19.98	99.54	12.57	40.97
33	Internodaldistanceat90 days	1.98	3.02	1.51	13.22	18.75	49.71	0.38	19.20
34	Flowerdiameter	7.27	8.81	5.81	10.33	11.15	85.81	1.43	19.71
35	Numberofdaystakenforfirst flowering	80.30	88.50	73.17	4.85	5.21	86.49	7.49	9.98
36	Leafwidth	2.75	4.25	1.70	14.25	19.89	51.37	0.58	21.05
37	Leafarea	9.55	16.75	4.80	25.15	29.81	71.15	4.17	43.69
38	Longevityof floweron plant	5.93	8.00	4.00	17.10	21.02	66.19	1.70	28.66
39	Numberofflowersperplant	31.12	48.90	11.53	28.64	30.73	86.88	1.71	54.99

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