

GENETIC VARIABILITY IN CHILLI  
(*Capsicum annuum* L.)

**Thesis**

Submitted to the

G.B. Pant University of Agriculture & Technology,  
PANTNAGAR-263 145 (U.S. Nagar), Uttarakhand, INDIA



By

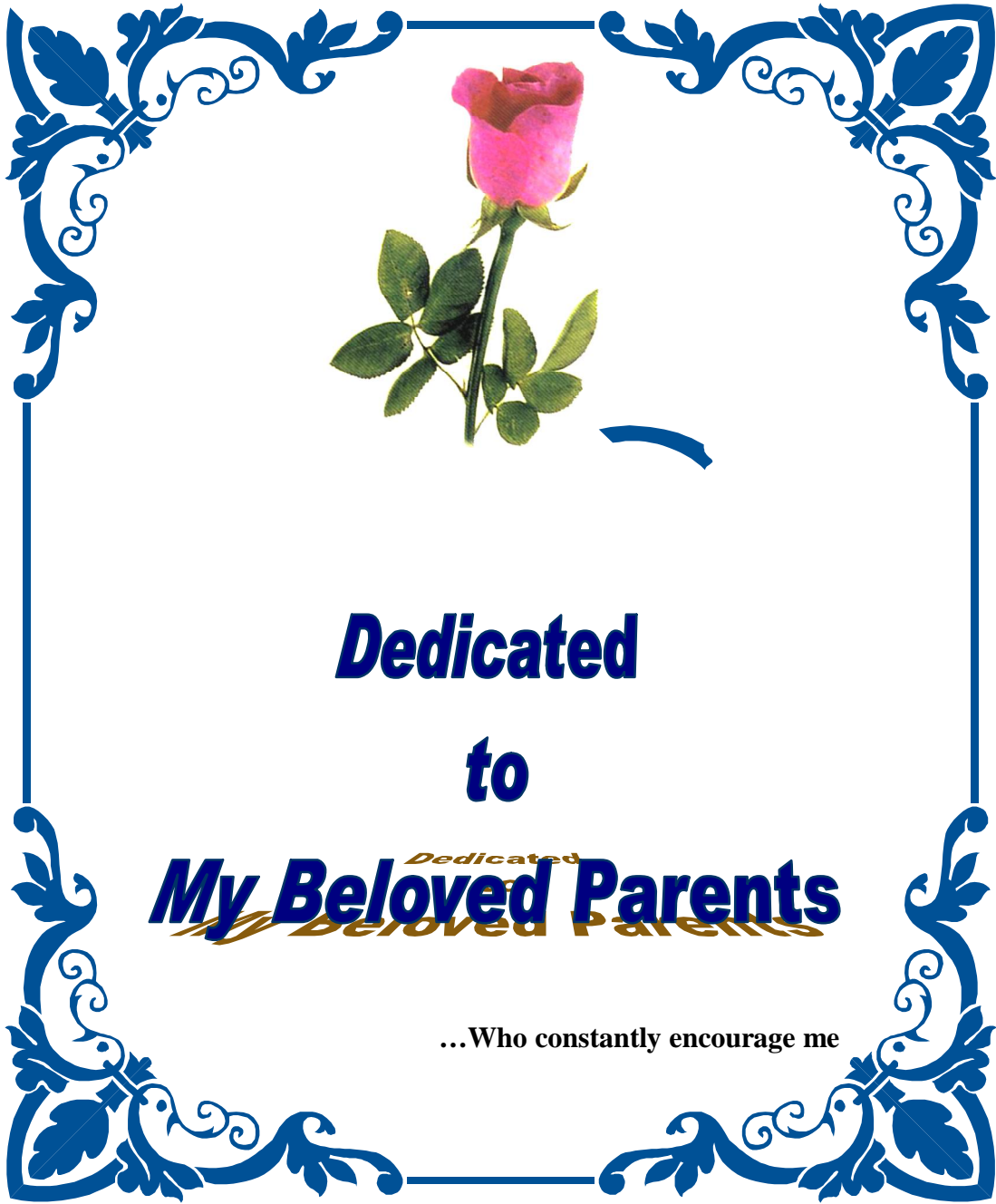
**GEETA GAUR**

*IN PARTIAL FULFILMENT OF THE REQUIREMENTS  
FOR THE DEGREE OF*

*Master of Science in Agriculture*  
**(VEGETABLE SCIENCE)**

JUNE, 2008

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**Dedicated  
to**

***Dedicated  
to  
My Beloved Parents***

**...Who constantly encourage me**

## ACKNOWLEDGEMENT

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*With limit less huminity, I would like to praise and thank “lord Vishnu” the almighty the merciful compassionate who bestowed me with favorable circumstances to go through this crucial juncture.*

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*July, 2008  
Pantnagar*

*(Geeta Gaur)  
Author*

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Dr. Durvesh K. Singh  
*Professor of vegetable science*



Deptt. of Vegetable Science  
College of Agriculture  
G.B. Pant Univ. of Agric. & Tech.,  
Pantnagar - 263 145  
*Distt.- U.S. Nagar*  
*Uttarakhand, INDIA*

## C E R T I F I C A T E

This is to certify that the thesis entitled “ GENETIC VARIABILITY IN CHILLI (*Capsicum annuum* L.)” submitted in partial fulfillment of the requirements for the degree of MASTER OF SCIENCE IN AGRICULTURE with major in VEGETABLE SCIENCE & minor in HORTICULTURE of the College of Post-Graduate Studies, G.B. Pant University of Agriculture and Technology, Pantnagar, is a record of *bona fide* research carried out by Miss GEETA GAUR, Id. No.27279, under my supervision, and no part of the thesis has been submitted for any other degree or diploma.

The assistance and help received during the course of this investigation and sources of literature have been duly acknowledged.

June, 2008  
Pantnagar

(Durvesh Kumar Singh)  
Chairman  
Advisory Committee

## C E R T I F I C A T E

We, the undersigned, members of the Advisory Committee of Miss GEETA GAUR, Id. No. 27279, a candidate for the degree of MASTER OF SCIENCE IN AGRICULTURE with major in VEGETABLE SCIENCE, & minor in HORTICULTURE agree that the thesis entitled “GENETIC VARIABILITY IN CHILLI (*Capsicum annum* L.)”, may be submitted in partial fulfilment of the requirements for the degree.

(Durvesh Kumar Singh)  
Chairman  
Advisory committee

(K.K.Misra)  
Member

(S.N. Vishwakarma)  
Member

(J.P. Singh)  
Member

(M. P. Singh)  
Member

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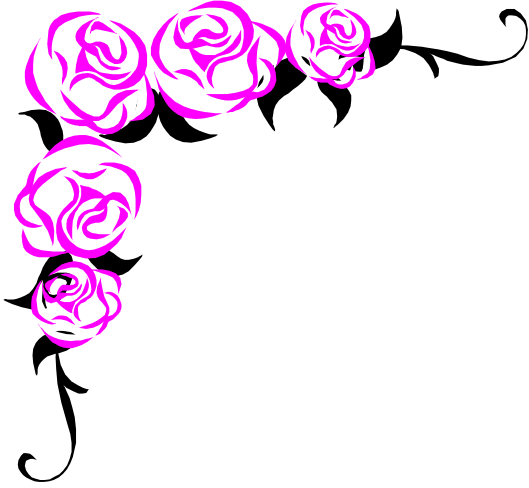
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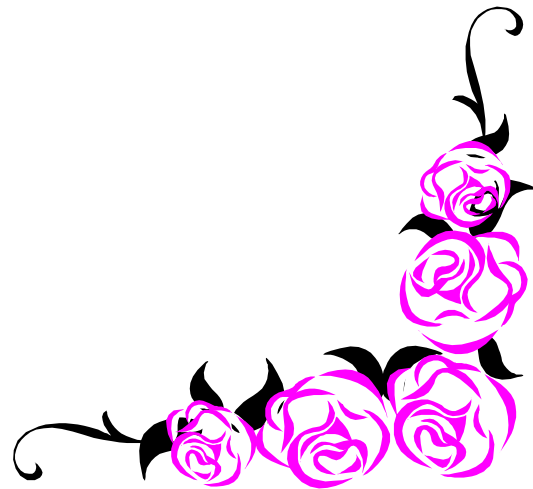
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# *INTRODUCTION*



Chilli (*Capsicum annum var accuminatum L.*) belongs to the family solanaceae. It is very important spice and condiment crop, also used for vegetable purpose. Historians agree on the new world origin of capsicum, dried pod's discovered from burial tombs in Peru are believed to be more than 10000 year old. Peppers were unknown in the old world until sixteenth century. This has been introduced into Spain by Columbus on his return trip in 1493. Cultivation spread from the Mediterranean region, Europe to England by 1548 and central Europe by close of the sixteenth century. Chilli, also known as hot pepper, was introduced into India from Brazil during 1584 by the Portuguese (Thamburaj and Singh, 2003). The word 'Chilli' is Mexican origin and is still under use in India (Sunderaraj and Thulasidas, 1976). Chilli crop performs well in warm humid tropical and subtropical regions extending from equator 45° latitude on both southern and Northern hemisphere. It can do well up to an altitude of 2000 meter above sea level.

A frost free period of about 130-150 days with temperature range of 25-35° C is optimum for chilli cultivation. It thrives in areas having a moderate rainfall with in the range of 60-120 cm. chilli crop is grown on practically all types of soils except on salty land provided

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the soil is well drained and well aerated. Chilli is an indispensable condiment crop, commonly used both green as well as dry for culinary and spicing purposes. It is estimated that World wide one out of four adult eat chilli every day, in every house. The pungency is due to the presence of oleoresins “capsaicin” which is volatile alkaloid and acidity is due to crystalline acid substance, capsaicin. It has a very good medicinal value too. Its paste is externally used as a rubefacient and as a local stimulant for the tonsils in tonsillitis.

In case of diphtheria, its application is said to hasten the separation of false membranes. Against cholera, it is very useful when used with a safetida and camphor. In food and beverage industries, chilli is being used in the form of oleoresin which permits better distribution of colour flavour in food. Capsaicin is used in the preparation of balms, where as the colour extracts find use as colour additives in food industry, poultry and brawn feed industry. A non conventional use of chilli is in self defense spray which is gaining popularity in USA. Its pungency not only adds to the taste of different preparations but also improves their keeping quality. The green chillies are the rich source of vitamin ‘C’ and vitamin ‘P’ (Rutin) which has immense pharmaceutical need. It also contains high amount of vitamin A (292 IU) and Vitamin C (111 mg) (Singh *et al.*, 1995 and Joshi, 1998).

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According to FAO Statistics, the total area harvested under this crop in our country during 2005 was about 5.50 thousand ha with annual production of 50.50 thousand tonnes of green chillies and 1100 thousand tonnes of dry chillies and yielding 9,181.8 kg/ha. Among various spices grown in the country, chilli is the most widely grown spice. The major chilli growing states are Andhra Pradesh, Karnataka, Maharashtra, Orissa, Tamil Nadu and West Bengal in the order and account for more than 80% of total area and production, with Andhra Pradesh leading both in area and production. The importance of this crop is increasing with increase of export of dry fruits and powder. India is one of the important chilli producing countries in the world having sizeable earnings from the export of dry chilli particularly to middle-east countries and to other parts of the world. About 9.83 thousand tonnes of green chillies and 121.24 thousand tonnes of dry chillies were exported from India in the year 2005. The importance of this crop is increasing with increase of export of dry fruits and powder. Presently, India is the largest chilli exporter of the world and very large quantity is being exported to different countries. During 2006-07 the export of chilli was 3.75 lac tonnes having value of 8.07 caror (Anonymous, 2007).

Success of breeding programme is largely depends on the extent of genetic variability present in the population of evolving promising

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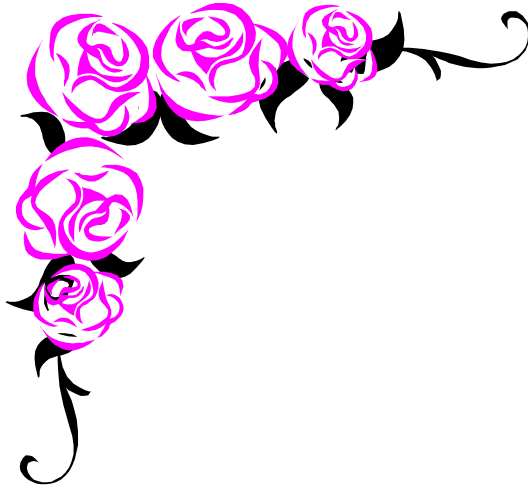
and desired type. A detailed study of extent of variability in different characters associated with the yield and knowledge of their heritability in relation to the contribution towards yield is the prime requisite for an efficient plant breeding programme. The genetic variability in conjunction with total variability can be used in predicting the gain for a given selection intensity. It was established fact in most of the crop plants that selection for yield would not be as effective as selection for yield components. Correlations are helpful to ascertain the real component of yield which is a complex character. Correlation coefficient analysis measure the mutual relationship between various plant characters on which selection can be based for improvement in yield. Variability in genetic resource, since time immemorial has always played a key role in the development of promising line and ultimately the yield improvement, further estimate of heritability and genetic advance expected after selection indicate the possibility and extent to which improvement is possible through selection.

Like any other crop, the formulation of appropriate and effective breeding programme for the improvement of chilli necessitates a comprehensive knowledge regarding the genetic variability available in different characters. A large number of genotypes are available in cultivation but all are varying in their different characters such as plant type, plant size, fruit size ranging from 0.5 cm to 20 cm, foliage

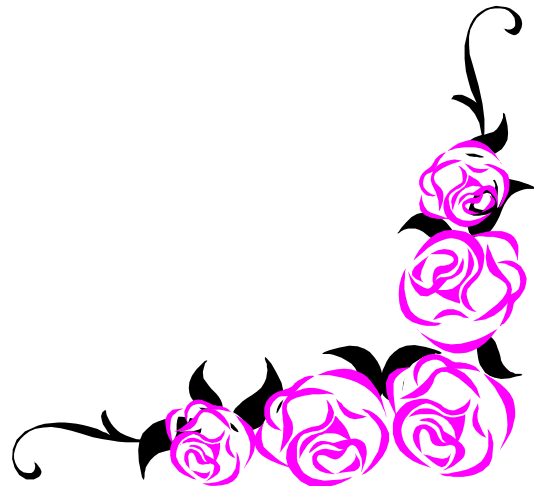
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colour, flower colour, fruit colour at green and red ripen stages and their performance is also different from season to season and place to place due to the genetic constitution of the genotypes. All the genotypes showed variable performance at a particular region or place. Therefore, it is essential to know the performance of a particular genotype in a particular region and to select a good performing genotype or types for Tarai region of Uttarakhand for higher production capacity. Several lines or germplasm of chilli introduced at V.R.C., Pantnagar from NBPGR Bhowali and AVRDC, Taiwan but all the genotypes do not performed well, so it is essential to select a best performing germplasm line for this region. Keeping in view, it is necessary to find out most suitable genotypes/ germplasm lines for Indian climatic conditions (Tarai region). Therefore it was considered to select most suitable and best genotypes with good performance with the following objectives:

1. To study the qualitative characteristics of chilli genotypes.
  2. To study the quantitative characteristics of chilli genotypes.
  3. To identify the most suitable and high yielding genotypes for fruit and seed yield to the region.
  4. To study the heritability, genetic advance and correlation coefficient in chilli genotypes.
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# *REVIEW OF LITERATURE*



## Chapter 2

## REVIEW OF LITERATURE

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This chapter deals with the pertinent studies that is the studies related to the aspect of growth, yield and yield attributing characters in *Capsicum annum*. *Var* *accuminatum* sp. L. The research communications are briefly reviewed in this chapter, under the following heads:

### 2.1 Growth, Yield and Yield attributes

- Plant growth characters
- Number and weight of fruits per plant
- Fruit and seed yield
- Quality attributes
- Disease infestation
- Correlation
- Genetic variability, heritability and genetic advance

#### 2.1.1 Plant Growth Characters

Ramkumar *et al.* (1981) carried out trial on twelve genotypes of chilli, They found maximum plant height in CA (P) 247(56.2cm) followed by G -4, while K-2 showed the lowest plant height among all the cultivars later on.

Khurana *et al.* (1987) evaluated seven chilli cultivars at Hisar during 1982-85 and they reported that K-2 had the highest values for weight of stem, leaves and number of branches per plant and leaf area.

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Kawarkhe *et al.* (1989) studied sixteen chilli cultivars and found maximum plant height in Malkapur local (62.7cm) and minimum in Pusa Jwala(44.3cm).These workers also reported that PusaJwala produced significantly more number of branches/plant as compared to rest of the genotypes.

Singh and Kaur (1990) reported that Pant C-1 ranked first in plant height, fresh root weight and shoot diameter, during winter season than NP 46-A and Pusa Jwala.

Pandita *et al.* (1991) studied thirty six lines of chilli for different characters. They recorded maximum plant height in HC-255 and the maximum number of branches/plant in new strain 76  $\neq$  241-1 genotype.

Singh and Lal (1994) reported that Pant C-1 had shortest plant height, maximum leaf area and higher fruit set than NP 46-A and Pusa Jwala.

Singh *et al.* (1995) evaluated 10 cultivars of chilli during 1988 and 1989 at G.B.P.U.A&T, Pantnagar. They reported highest plant height in Sel-1 and lowest in TC-2 during both the years.

Sachan (1997) evaluated 11 cultivars of chilli under Pantnagar conditions. He observed maximum plant height in chilli cultivar G-4 followed by LCV-312 and Punjab Gucchadar, and maximum branches/plant in Punjab Gucchadar and Punjab Surkh as compared to Pusa Jwala.

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Revanappa *et al.* (1998) evaluated green chilli cultivars viz., Pusa Jwala, Nagavi, Kadrolli at Dharwad, Karnataka. Nagavi had the highest root weight and Pusa Jwala had the longer roots.

Mohanty (2003) evaluated eight chilli cultivars and reported that G-4 had maximum plant height (80.87cm), highest branches per plant (17.33cm) and shortest days to harvest (102.40days).

Gupta (2003) studied the performance of 30 chilli genotypes. He observed maximum plant height in ACS-2000-03 (146.6cm) and minimum in KA-2 (43cm), primary branches/plant recorded maximum in AC-510 (11.16) and minimum in LCA-206 (5.16). Maximum stem diameter was exhibited by AC 515-2(3.35cm) and it was minimum in ACS 92-4 (1.37cm).

Singh *et al.* (2004) evaluated 25 genotypes of chilli for growth and yield attributes. They found significant variations among all the characters which were studied. The range of plant height varied from 65.5 to 93.2cm. Maximum primary branches per plant were recorded in AC-543(18.8).

Singh and Jain (2004) evaluated 15 cultivars of chilli for growth and yield characters during spring-summer season. They found significant differences among the cultivars for all the characters. The range of plant height varied from 56.1 to 92.9cm. It was maximum in RHRC -16-5.

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Pramila (2005) studied 40 exotic and indigenous genotypes of chilli and found that Pant Sel-13, EC 519638, Pant Sel-20 were the taller than rest of the genotypes. The maximum number of primary branches/plant was recorded in Pant sel-13, where as maximum stem diameter was obtained in EC 519630 (2.38cm) and it was minimum in PC-2064 (1.43).

### 2.1.2 Number and weight of fruits/plant

Ram kumar *et al.* (1981) evaluated twelve genotypes of chilli for various characters. They found highest number of fruits/plants in the cultivar “Cross-197” (85.00) and lowest in Pant C-2(1875).

Kawarkhe *et al.* (1989) evaluated sixteen chilli cultivars under Vidarbha conditions and they found that genotype CA-960 recorded more fresh and dry weight of fifty fruits. The lowest fresh weight of fifty fruits was recorded in G-3 and CA-1068.

Singh *et al.* (1995) studied the performance of 10 cultivars for six different characters in two years. They reported that the more pod/ plant was noted in Pant C-1 followed by G-4, LCA-206 and chilli Sel-1.

Sachan (1997) obtained more number of fruits/plant in AC-458 (128.9) and minimum in LCA-301 (12.3) among all the 11 genotypes.

Singh *et al.* (1999) studied 12 cultivars for eight characters, for a period of two years and found maximum number of fruits/plant in Pant C-1 followed by LCA-206 and G-4 as compared to Pusa Jwala (check).

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Kumar *et al.* (1999) evaluated 10 genotypes of *Capsicum annum L.* under North Indian agro-climatic conditions. He exhibited highly significant differences for sixteen growth and yield characters. Among all the genotypes tested, AN-11 recorded the highest number of fruits /plant and maximum fruit weight was found in Hissar Sakti followed by HC Sel-6.

Khokhar *et al.* (2001) evaluated four exotic chilli cultivars for number and weight of fruits/plant, fruit size, single fruit weight but a commercially grown local chilli cultivar Peshwar Selection produced maximum number of fruits /plant (268).

Mohanty (2003) evaluated eight chilli cultivars and reported that X-235 had highest number of fruits/plant (233.97), where as CO-2 showed the highest weight of green fruits (45.90g).

Gupta (2003) studied the performance of 30 genotypes and he found more number of fruits in KA-2(300.43/plant), followed by Pant Chilli-3 (268.31g/plant) and Pant Chilli-4 (248.24/plant).

Singh and Jain (2004) reported that out of fifteen genotypes of chilli, the more number of fruits per plant was harvested from Pant C-1; it was lowest in LCA 206. They also reported that highest fruit weight per plant was found in Pant C-1 followed by JCA-283, HC-28 and RHRC-16-5.

Singh *et al.* (2004) reported that out of 25 genotypes, more number of fruits/plant was noted in AC 516 (324) followed by AC 543 (305.3) and AC 427 (278.0) then check variety, JCA 283 (133.8). Highest fruit weight per

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plant was noted in AC 542 (642 g) followed by AC 517(575.7g) and AC 465(562.7g) as compared to check genotype JCA 283 (230g).

Pramila (2005) studied 40 exotic and indigenous genotypes of chilli and found that EC 519649 (234.8) followed by Pant sel-20 had highest number of fruits per plant while EC 519637 followed by Pant Sel-20 had highest weight of fruits/plant.

Singh *et al.* (2005) evaluated 9 local chilli cultivars along with one control cultivar (G-3) for yield and yield attributes. Significant differences for fruits/plant, yield/plant were observed, inferring local chilli cultivars MM-4 and MM-1 may be recommended for Parasite areas to maximize chilli production.

### 2.1.3 Quality Attributes

Ram Kumar *et al.* (1981) tested twelve varieties of chilli for various characters. They observed maximum fruit girth in G5 (4.65cm) followed by pant C -1. Among all the cultivars longest and smallest of fruits were obtained in NP46-A, and AC 37, respectively.

Kawarkhe *et al.* (1989) reported that out of sixteen cultivars of chilli. The maximum fruit length was recorded in Pusa Jwala (9.6 cm.) and fruit breadth in Bhiwapur local (1.46cm.).

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Tiwari (1991) reported multi purpose perennial chilli cultivar “Pusa Sadabahar” having 6.8cm. Fruit length and 3.5-4.0 cm. fruit width.

Natranjan *et al.* (1994) studied the performance of six chilli cultivars under summer dry conditions and recorded maximum fruit length (3.83cm) and girth (6.71cm) in CO-2 and CA-PM-18, respectively.

Singh *et al.* (1995) evaluated ten cultivars of chilli during 1988-89 at G.B.P.U.A&T, Pantnagar. The maximum pod length was observed in Pusa Jwala and lowest in Pant C-1. Thicker fruits were harvested from KCS-1 followed by TC-2, X-235 and TC-2 and chilli Sel-1 during 1989. Thin fruits were harvested from TC-1 during both the years.

Sachan (1997) observed that fruit length was maximum in Pusa Jwala followed by Utkal-Ragini and JCA-283. The maximum fruit circumference was observed in LCA-312 (4.4cm) while it was minimum in LCA-324. Utkal Ragini showed the highest fruit stalk length (3.82cm) followed by Punjab Guchchedar (2.97cm) and JCA-283 (2.85cm).

Singh *et al.* (1999) studied twelve cultivars for eight characters for a period of two years. Maximum fruit length was observed in TC-2 (9.35cm) and TC-1 (8.22cm) while maximum fruit thickness was recorded in X-235 followed by Sel-1 and Pant C-1.

Verma and Pant (1999) evaluated 119 germplasm accessions of chilli and they reported that P 207 had maximum fruit length and uniform fruiting and appealing colour.

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Dipendra and Gautam (2002) evaluated 52 chilli genotypes and found that they varied significantly for all the parameters. Chilli cultivar Jayanti recorded the greatest fruit length (9.71cm) and Tupura Jalakia the greatest fruit diameter (1.83cm).

Mohanty (2003) evaluated eight chilli cultivars and reported that Pusa Jwala had the highest fruit length as compared to rest varieties.

Gupta (2003) studied the 30 genotypes of chilli. He found that Pant chilli-3 followed by LCA-357 and JCA-283 exhibited maximum fruit length and also observed maximum fruit periphery in LCA-357(4.10cm) while the fruits of TMS-1, (Pant Sel-18) showed minimum fruit circumference.

Singh and Jain (2004) evaluated 15 cultivars of chilli for growth and yield attributes. They found maximum fruit length in Pusa Jwala followed by Punjab Surkh and HC-28. On the other hand, periphery ranged from 3.31-4.86cm, and it was highest in Punjab Surkh and minimum in Sel-1 (Arka Lohit).

Singh *et al.* (2004) evaluated 25 genotypes of chilli for growth and yield attributes. They found maximum fruit length in AC-423 (11.7cm) and it was lowest in AC-422 (3.2cm). On the other hand, fruit periphery ranged from 1.60-4.36 cm. Thicker fruits were obtained in AC-456 and thinner fruits in AC 512.

Pramila (2005) studied 40 exotic and indogenous genotypes of chilli and found that PC- 2057 followed by EC-519630 and EC-519640 had the

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longest fruits. The incidence of anthracnose ranged from 8.3% to 100%. The highest infection was observed in EC 519633 and lowest in EC 519645(8.3%).

#### 2.1.4 Yield and Yield attributes

Ram Kumar *et al.* (1981) reported that out of twelve varieties of chilli, “Cross-206” produced significantly higher yield than rest of the cultivars. These workers also reported that G-5 gave highest no. of seeds per fruits (82.75).

Khurana *et al.* (1987) evaluated seven cultivar at Hissar during the year 1982- 85 , BR- red gave the highest mean yield of fresh red fruits(12.63t/ha) where as Musalwadi gave lowest (8.34 t/ha).

Kawarkhe *et al.* (1989) reported that out of sixteen cultivars of chilli CA- 960 produced significantly highest yield of dry chilli and seed content in 50 fruits than rest of cultivars.

Singh and Kaur (1990) reported that Pant C-1 ranked first in no. of fruits per plant and total fruit yield per hectare during winter season than NP 46-A and Pusa Jwala.

Tiwari (1991) reported a multipurpose perennial chilli cultivar Pusa Sadabahar and found 80-100 seeds per fruits.

Pandita *et al.* (1991) studied 36 lines of chilli in two years of study programme and found that a new strain 76#242-1 gave significantly more yield than HC-260 and HC-266.

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Natranjan *et al.* (1994) studied the performance of six chilli cultures in semi dry conditions and obtained the maximum yield of dry chilli in culture CA-PM-27 (2.56 t/ha).

Singh and Lal (1994) reported that Pant C-1 had more no. of fruits and fruit yield per plant than NP 46-A and Pusa Jwala whereas NP 46-A showed minimum number and weight of fruits/plant and weight of seeds/fruit.

Singh *et al.* (1995) evaluated ten cultivars of chilli during 1988 and 1989 at G.B.P.U.A & T., Pantnagar. The highest mean yield was recorded in Pant C-1 followed by G-4 and LCA 206 which produced 64.5%, 37.5%, and 28.4%, higher fruit yield over check cultivar Pusa Jwala, respectively.

Rani (1995) evaluated 73 chilli genotypes and reported that the genotypes namely JCA-154, JCA-232, Guntur chilli and Dwale, gave 118.7, 85.1, 83.1 and 79.7 per cent increased yield over the standard check Pusa Jwala, respectively.

Rani (1996) evaluated 73 genotypes of chilli and reported that 'Gowri Bidnur' had the highest seed weight/fruit (0.698 g) and the highest number of seeds/fruit (132.5).

Lal and Singh (1997) reported after two years of studies, that out of 10 cultivars, Pant C-1 followed by G-4 and LCA-206 gave maximum pod yield per hectare as compared to Pusa Jwala.

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Sachan (1997) obtained the highest red ripen fruit yield per plant and per hectare in Punjab Surkh and AC-458. They yielded 97.5 and 87.7 per cent more than the standard cultivar Pusa Jwala, respectively, whereas AC-458, Punjab Surkh and Utkal Ragini in descending order had highest yield of dry chilli per plant. He also observed that maximum number of seeds per fruit was recorded in Punjab Surkh and minimum in LCA-324. The seed weight per fruit was also found higher in Punjab Surkh than the check variety. He also noted that 100-seeds weight was highest in LCA-312 and Punjab Surkh.

Kumar *et al.* (1999) evaluated 19 genotypes of *capsicum annum L.* under North Indian agro-climatic conditions. Among the tested genotypes, An-11 recorded highest fresh red ripen fruit yield per plant followed by Hissar Shakti, Punjab Shakti and HC Sel-6.

Singh and Jain (1999) reported that out of the nine genotypes, Pant Chilli-3, JCA-283 and Pant C – 1 were top yielder for pod yield/ha, dry pod yield/plant as compared to Arka Lohit.

Singh *et al.* (1999) studied twelve cultivars for eight characters for a period of two years. It was found that LCA-206, Pant C-1 and CA-586 produced higher fruit yield/ plant as well as per hectare.

Mohanty (2003) studied eight chilli cultivars and reported X-235 the most superior cultivar regarding green fruit yield of 144.36 q/ha.

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Gupta (2003) studied the performance of 30 genotypes. he found that out of 30 genotypes, Pant Chilli-5, KA-2, Pant Chilli- 3 and Pant Chilli-4 were top yielder than rest of the genotypes.

Singh and Jain (2004) reported that out of fifteen genotypes,the fruit yield/ha was found higher in Pant C-1(79.0 q/ha) followed by JCA- 283 (71.69 q/ha), HC-28 (70.64 q/ha) and RHRC- 16-5 (65.33 Q/ha ) which was 75.6,57.0,57.71 and 45.02 % higher over national check LCA-206, respectively.

Singh *et al.* (2004) reported that out of 25 genotypes the fruit yield/ha was highest in AC-542 followed by AC-517 and AC-465 which was 166.9, 150.3, and 144.7% higher over national check cultivar JCA-283, respectively.

Singh and Jain (2005) evaluated nine chilli cultivars out of that, BC-25, KCS-2013 and Co-4 produce maximum fruit yield under Uttaranchal condition and in the same year with the evaluation of 11 genotypes PC-6 followed by DLC-524 and DLC 352 gave maximum fruit yield, 144.0,138.0 and 133.0 q/ha of (red ripen) fruit yield, respectively.

Singh and Jain (2007) studied under AICVIP Trial which was conducted in pantnagar. Out of 6 entries PC-56 produced maximum fruit yield (135.0 q/ha) as compared to JCA-283 (108 q/ha) and Pant C-1 (112 q/ha).In the same year Singh and Jain (2007) evaluated 10 genotypes of chilli for growth and yield attributes, they found that PC-2067 followed by

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PC- 56 and PC-6 produced greater yield over check cultivars JCA-283 and LCA-206.

### **2.1.5 Disease infestation**

Sharma and Singh (1985) screened chilli genotypes for five years under the field conditions of natural infection of numerous genotypes of *Capsicum annuum* showed that Pant C – 1, S118-2, Lorai, Loungi and perennial type had resistances/ tolerance to cucumber mosaic virus and tobacco mosaic virus.

Singh and Kaur (1990) screened 24 chilli cultivars from indigenous as well as exotic material against fungal fruit rot and die back caused by (*Colletotricum capsici*), viral mosaic caused by TMC, CMC and tobacco leaf curl disease.

Kumar *et al.* (1999) reported that out of 37 chilli genotypes, three genotypes namely Pusa Jwala, Surya Mukhi, and Japanese lounge were rated resistance against leaf curl virus. Two lines were moderately resistant, 19 lines were susceptible and 13 were highly susceptible.

Kelaiya and Parakhia (2000) evaluated twenty chilli cultivars against fusarium wilt. None of the cultivars were immune; cultivar GC-1 and GC-2 were resistance, Jwala, HC-9, HC-1, PBC-86-1, and PBC-86-2 were moderately resistant, HC4, HC-10, HC-12, HC-5, HC-7, HC-13 were tolerant HC-15, HC-11, HC-2, HC-3 and HC-6 were susceptible. Reshampatto and Gholar were highly susceptible.

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Swaroop *et al.* (2001) evaluated twenty one lines of chilli from Taiwan for bacterial wilt and yield characters. They found lines PP9656-06, PP977127, PP9777195-1 and PP977635 exhibited the highest yield and bacterial wilt resistance.

Leaya and Khadar (2003) evaluated 37 genotypes of chilli against reaction to chilli leaf curl virus under natural field conditions. It was observed that the genotypes namely, Alampady local -1, Negyattinkara local, Kottiyam Kulam local were tolerant, 27 lines were susceptible and two lines were highly susceptible to this disease.

Singh and Sood (2004) screened 30 genotypes of sweet pepper comprising exotic and indigenous collection against bacterial wilt. Two genotypes, IHR-546 and PBC- 631, were found to be highly resistance to bacterial wilt. Five genotypes, Arka Gaurav, PBC-505 Cap B, Bertidon and Cap C were observed moderately resistant. The remaining 23 genotypes were moderately to highly susceptible.

Kaur *et al.* (2004) screened 150 chilli genotypes comprising hybrids, commercial cultivars and breeding lines against wilt disease. No cultivar/ hybrid was found to be immune or highly resistance under field conditions. Two cultivars namely, PBC-408 and PBC-199 were recorded as resistant but not of commercial use. Few cultivars such as Punjab Lal , Punjab Gucchedar and MF-41-1-1-1 possesses good degree of field resistance against wilt in addition to acceptable horticultural characters.

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Singh *et al.* (2004) evaluated 637 genotypes for qualitative and quantitative traits. They found that out of all genotypes, 74 chilli genotypes were found resistant to Fusarium wilt, Anthracnose, Bacterial wilt and phytophthora diseases.

Samnotra, *et al.* (2006) evaluated the twenty five genotypes of chilli from different parts of India for their stability for quality traits (Capsaicin content and coloring matter) at three locations in Punjab. In this they reported the highly significant mean squares for both quality traits indicated wide variability amongst the genotypes. The environment component was significant for colouring matter and non significant for capsaicin content. The highly significant effect of genotype X environment for both quality traits indicated differential response of genotypes to various environments. Genotype Punjab Lal had average stability for colouring matter and below average stability for capsaicin content. The genotypes Punjab Lal, HC-44, Phule Sai, G-4, CA-960 and Bireek-2 can be utilized in further quality breeding programmes.

Kameshwari and Prasad 2006 evaluated the yield performance of five varieties of chillies, namely LCA-235, CA-960, LCA-324 and LCA-325, along with local cultivar. They reported the results revealed that the variety LCA -324 recorded maximum green pod yield of 39.75q/ha followed by CA960 with 34.05 q/ha. The Local cultivar was found to be more

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susceptible to pod borer (with 11.39 %) infestation while the cultivar LCA-324 recorded only 3.22 % pod borer effect.

Prasath *et al.* (2007) evaluated the source of resistance to anthracnose or ripe fruit rot pathogen (*Colletotrichum capsici*) in 26 accessions and 30 hybrids of chilli (*Capsicum annuum* L.) and one accessions of cherry capsicum (*Capsicum frutescens* var *baccatum*). Cherry capsicum accession “PBC 81” was immune to anthracnose. Chilli accessions ‘Co-4’ and ‘S- 1’ were resistant. among the 30 F<sub>1</sub> hybrids, ‘Arka Lohit’ X ‘S-1’ , ‘MDUY’ X ‘S-1’ , ‘Arka Abir’ X ‘S-1’ and ‘Co 4’ X ‘S-1’ were resistant to anthracnose all of which has ‘S 1’ as a common resistant parent.

#### 2.1.6 Correlation:

Correlation coefficient analysis measures the mutual relationship between various plant characters and determines the component characters on which selection can be based for improvement in yield.

Chouvey *et al.* (1986) evaluated 30 genotypes of chilli for yield and seven related characters. They reported that fruit yield / plant was significantly correlated with, number of fruits /plant and 10 fruit weight. They also found that number of seeds per fruit, fruit circumference and peduncle length had direct positive effect on yield.

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Barai and Roy (1989) evaluated six chilli genotypes for various yield and agronomical traits. They found that fruit weight was positively correlated with days to maturity.

Dahiphale. *et al.* (1991) evaluated cultivar Pusa Jwala of chilli for seven yield components grown under three irrigation schedules and three different nitrogen levels. They found that green fruit yield was significantly correlated with fruit diameter, fruit length, plant height, no. of branches and dry matter and number of fruits / plant.

Singh *et al.* (1992) evaluated six cultivars for fourteen yield component including yield/ha, and they reported that high yielding genotypes significantly correlated with number of secondary branches, days to 50 % flowering, fruit length, fruit weight, number of fruits/plant and dry matter percentage.

Khurana *et al.* (1993) evaluated 10 genotypes of *Capsicum annuum* (L) and they observed that fruit yield was positively and significantly related to mean fruit weight, number of fruits, fruit length, leaf area, leaf weight, number of branches and stem weight. Mean fruit weight had the highest positive direct effect on yield.

Ali (1994) evaluated twelve (*Capsicum annuum*) genotypes and found that yield was significantly correlated with fruit number/plant, seed number/ fruit and number of seed /25 fruits. He also found that dry fruit

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weight was significantly correlated with fresh weight, maximum fruit width, 1000-seed weight and weight of the pedicel and pericarp.

Pawade *et al.* (1995) studied correlation in chilli cultivar. On eight yield components in 36 Local types grown in Nagpur district Maharashtra. They reported that number of fruits/ plant showed the strongest positive correlation with the yield, plant spread, no. of branches, plant height, fruit length and 100- seed weight also showed significant and positive association with yield. The effect was direct for number of fruits/plant and 100-seed weight and indirect for plant spread, plant height, number of branches, fruit length and maturity.

Rani (1996) observed positive correlation between seed weight per fruit and number of seeds fruit. Positive correlation was also observed for seed and seed weight per fruit, fruit diameter and fruit weight with yield.

Warade *et al.* (1996) reported that yield per plant was positively correlated with plant height, plant spread, fruit weight, seeds per fruit, days to 50% fruit set, fruit length and fruit girth and negatively correlated with days to 50% flowering and maturity.

Rani (1997) reported that positive and significant Correlation coefficient of fruit yield per plant was recorded with number of fruits /plant, plant height number of primary branches/plant, number of secondary branches /plant, number of fruits per plant with plant height, no. of primary and secondary branches, plant height with pedicel length

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and number of secondary branches /plant, fruit length with pedicel length. Fruit diameter were negatively correlated with fruit length number of primary branches/plant and pedicel length. 100 seed weight did not show any relation ship with any of the character.

Deka and Shedague (1997) analyse the character association in pepper seed accession the number of branches per plant had a strong positive correlation with yield.

Rani (1997) evaluated 73 diverse chilli genotypes for fruit weight and four other fruit traits at the Indian Institute of Horticultural Research, Bangalore, India. Fruit weight showed positive correlation with seed number, seed weight, 1000- seed weight and fruit pericarp weight. The “R” value (98.12%) was obtained due to the influence the fruit seed weight and fruit pericarp weight on fruit weight. Regression involving a combination of two variables was most efficient for selection.

Deshmukh *et al.* (1997) evaluated nine genotypes of chilli for eight yield characters at Akoka and they observed weight of 50 red ripe fruits had highest direct positive effect on yield, followed by plant diameter and weight of 50 dried fruits.

Das and Chaudhary (1999) investigated to assess the genetic advance in 25 genotypes of chilli at Bihar Agriculture College Sabour Bhagalpur. They studied the correlation and path coefficient of fruit yield and its component. They reported that fruit yield exhibited positive and

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significant correlation with weight of fruits per plant. While fruit diameter showed negative association with fruit length. It was concluded that no. of fruits and weight of fruits per plant and primary branches per plant should be selected when breeding is done for higher yield.

Kumar *et al.* (1999) studied the genotypic and phenotypic correlation and path coefficient to determine the true component of yield in chilli for 17 characters in 30 genotypes. They reported that fruit length, fruit diameter, fresh fruit weight. Fruit length and diameter, as well as harvest index, exhibited positive correlation with fruit yield. However, path analysis revealed highest direct contribution of fruits /plant towards total yield. It was concluded that no. of fruits/plant and fresh and dry weight/fruit were major yield contributing factor in chilli.

Munshi *et al.* (2000) evaluated 30 germplasm of chilli to study the association between yield and yield attributes. Yield per plant was significantly and positively correlated with number of fruits per plant and fruit weight. Significantly negative association of days to first flowering and yield per plant revealed selection aimed to improved yield and yield associated characters. Fruit weight showed significant negative correlation with number of fruits per plant and positive correlation with fruit length. Path analysis of yield and its component revealed that number of fruits/plant, fruit weight and fruit girth had direct positive effect on yield per plant.

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Rani and Singh (2000) collected the data for 20 different characters from 73 diverse genotypes of chilli. They reported that stem diameter exhibited maximum direct effect on dry fruit yield followed by root volume, root mass, fruit diameter via stem diameter confirm the importance of stem diameter in influencing the fruit yield.

Mishra *et al* (2001) evaluated nine genotypes of chilli for fruit characters. They found that red chilli yield was positively and highly correlated with fruits per plant but negatively correlated with seeds per fruits.

Rathod *et al.* (2002) evaluated thirteen chilli genotypes for yield and yield components and they found that genotypic correlation coefficient was higher than the phenotypic correlation coefficient for all the characters. The yield of chilli was positively and significantly associated with the number of fruits/plant, 100 seed weight, seed percentage and harvested index. 100 seed weight recorded the highest positive direct effects on the net red chilli yield/plant, followed by the seed percentage, days to 50% flowering and number of primary branches/plant.

Sujata *et al.* (2003) evaluated 20 genotypes of chilli for 18 characters. They reported that 11 characters showed positive and significant correlation with total fruit yield/plant and significant negative correlation with days to 50% red ripe fruit yield. The relation ship of total fruit yield/plant to fruit weight /plant (1<sup>st</sup> picking), fruit weight/plant (2<sup>nd</sup>

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picking), and total no of fruits and total yield/plant were among the all genotypes are highest. The character, no of fruits/plant (1<sup>st</sup> picking), no. of fruits/plant (2<sup>nd</sup> picking), early fruit length, fruit diameter and pedicel length has highest direct and indirect effect towards total fruit yield.

Gogoi and Gautam (2003) evaluated 52 chilli genotypes for 20 characters and they observed, fresh fruit yield/plant exhibited significant and positive correlation with dry fruit yield, no. of fruits/plant, no of flowers/plant, fresh fruit weight, leaves/plant, fruiting percentage, dry fruit weight, 1000 seed weight, plant height, plant spread, specific leaf weight, fruit length, no of seeds/fruits and no of primary branches. The association of yield with days to first flowering, fruit drop percentage, days to maturity and harvest duration was negative and non significant.

Ajjapplavara *et al.* (2005) Evaluated 36 genotypes of chilli for 18 different quantitative characters. the correlation study indicate that significant and desirable correlation between dry fruit yield/plant with all other characters except number of primary and secondary branches, fruit diameter, fruit volume, powdery mildew disease incidence and leaf curl incidence. Path analysis revealed that importance should be given to fruit weight and fruits / plant.

Harvinder *et al.* (2005) evaluated 25 genotypes of chilli (*Capsicum annum L.*) Which were subjected to correlation and path coefficient analysis. Strong correlation of yield with no. of fruits/plant showed positive

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and significant correlation with number of branches/plant. The path coefficient analysis indicated that number of fruits/plant and fruit width had highest direct effect on fruit yield.

Smitha and Basavaraja (2006) reported the correlation study in 40 chilli genotypes under rain fed conditions. Correlation study revealed that significant positive correlation of economic traits like fruits/plant, fruit length, fruit weight with yield was recorded and suggesting that selection for these characters would lead to crop improvement.

#### 2.1.7 Genetic variability, Heritability and Genet advance

Varalakshmi and Babu (1991) evaluated thirty two genotypes. They observed leaf area index, fruits/plant, fruit weight and total yield show greater variability and the recorded high heritability, coupled with high genetic advance for leaf area index, fruits/plant, fruit weight, seeds /fruits, plant height and fruit length.

Singh *et al.* (1994) studied variation for nine yield related traits in 20 genotypes of chilli at Birauli, Samastipur Bihar over two seasons. Summer and kharif 1989-90. With two dates of sowing in each season. He noted that variability was greatest for weight of fresh red ripe fruits/plant, high estimates was obtained for fruit length, weight of fresh ripen fruits, dry fruit weight, number of fruits /plant and fruit diameter.

Rani and Singh (1996) evaluated 79 genotypes of chilli for 19 agronomic traits and reported high genotypic and phenotypic coefficient of

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variation for fruit yield/plant, mean fruit weight, yield/plant, fruit length, weight of seeds/fruit, 100 seeds weight and dry matter production. High heritability estimates coupled with higher genetic advance as percentage of mean were observed for number and weight of fruits/plant, mean fruit weight and dry matter production.

Bhatt and Shah (1996) observed that high heritability coupled with high genetic advance for fruits/plant, average fruit weight and fruit diameter in 50 cultivar belonging to *Capsicum annuum* and *Capsicum frutescence*.

Ghaidhyal *et al.* (1996) evaluated 24 *Capsicum annuum* L. cultivars for 8 yield related traits or reported high heritability for number and weight of fruits/plant, fruit length and fruit circumference.

Warade *et al.* (1996) studied the information on genetic variability and heritability was derived from data on 13 yield related traits in 60 genetically diverse cultivars of chilli maintained at the Mahatma Phule Krishi Vidyapeeth, Rahuri and grown during the rainy season for 1989-90. They reported that heritability values were genetically high indicating good scope for improvement through selection.

Rani and Singh (1996) derived information's on genetic heritability variability and genetic advance from data on 21 characters in 73 chilli genotypes from the germplasm collection at the Indian Institute of Horticulture Research Bangalore. They observed significant differences for

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all the characters except for 'capsaicin' content. All characters showed moderate to high heritability, genetic advance range from 0.04 to 66.5 and was highest for ascorbic acid content followed by the number of fruits/plant, plant height, fruit weight and plant spread. Heritability and genetic advance were higher for fruit length.

Singh *et al.* (1998) studied the extent of variability heritability and genetic advance in 30 genotypes of chilli for seven polygenic traits. The result showed considerable genetic variability for pod yield and other traits. Heritability estimates were high for all the traits except days to 50 % flowering, high heritability linked with moderate genetic advance was observed for pods/plant, pod yield, fresh and dry weight of pods.

Rani and Singh (2000) conducted a field experiment at IIHR, Bangalore to evaluate 73 chilli varieties. They determined fruit length, surface area and stem diameter with their interactions. The results showed that fruit length ranges from 2.99 to 14.73 cm (Avg. 8.35 cm), fruit diameter 0.69 to 2.43 cm (Avg. 1.22 cm), all of these characters exhibited high variability.

Munshi *et al.* (2000) studied 30 germplasm lines of chillies. They observed considerable amount of genetic variability for all characters except fruit girth. The number of fruits/plant exhibited highest value of genotypic and phenotypic coefficient of variation. They also estimated high heritability in broad sense, genotypic coefficient of variation and genetic advance for fruit length, number of fruits/plant and yield/plant.

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Mishra *et al.* (2001) evaluated nine genotypes of chilli for fruit characters for 2 years. They found that phenotypic coefficient of variation (PCV) had slightly higher value as compared to the genotypic coefficient of variation (GCV) indicating the negligible effect of the environment on the fruit characters. They observed highest PCV and GCV for fruits/plant, followed by fruit length, dry weight of single fruit and red chilli yield/plant.

Mohammed *et al.* (2001) studied seventeen genotypes of chilli (*Capsicum annum*) and they observed that phenotypic and genotypic coefficient of variation were highest for fruit length (26.64cm and 26.21cm) followed by dry fruit yield (13.28 and 19.93), and number of branches/plant (19.46 and 15.10). They also observed that heritability was highest for plant height (98.12 %) followed by fruit length (96.74 %) and number of fruits/plant (96.18 %) where as number of branches/plant , followed by fruit width and dry fruit yield/plant showed higher genetic advance as percentage of mean.

Sree Latha Kumari and Rojmoni (2002) evaluated 70 diverse genotypes of chilli and they observed higher phenotypic and genotypic coefficient of variation for fruits/plant, fruit weight, fruit length, fruit girth, yield and leaf area in both shade and open areas. They also reported higher heritability and genetic advance for these characters

Gogoi and Gautam (2003) studied 52 genotypes of chilli (*Capsicum annum*) they observed higher phenotypic and genotypic coefficient of

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variation for fruit drop percentage, fresh fruit yield/plant and dry fruit yield/plant. They also estimated moderate to high heritability for all characters except the number of primary branches and they found highest genetic advance along with high heritability for fruit drop percentage followed by fresh fruit yield/plant, dry fruit yield/plant, number of fruits/plant, leaf area index and fruit length.

Rathod *et al.* (2002) evaluated thirteen chilli cultivars for eight yield components and they found high genotypic coefficient of variation for number of fruits/plant, fresh red chilli yield per plant and for plant height. They also recorded high heritability coupled with high expected

Gupta (2003) studied the performance of 30 genotypes, He reported that the extent of genotypic and phenotypic coefficient of variation, heritability, genetic advance and correlation coefficient. He found highest range of variability for fresh weight of shoot/plant and lowest variation for 100 seed weight and also found high heritability along with high genetic advances for weight of fruits/plant (red ripen) and fruit yield/ plant.

Verma *et al.* (2004) evaluated twelve chilli (*Capsicum annuum L.*) genotypes. They observed higher phenotypic coefficient of variation than genotypic coefficient of variation for all characters and high heritability for plant canopy, number of fruits/plant, days to 50 % fruiting, plant height, days to 50 % flowering and pod length. They estimated high genetic advance as percent of mean coupled with high heritability for the number

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of fruits/ plant, plant canopy, pod length and plant height suggesting additive genetic variance for these characters. High heritability along with moderate genetic advance as percent of mean was observed for number of branches/plant, leaf width and pod width indicating the performance of both additive and non additive gene action. High heritability associated with low genetic advance as percent of mean was observed for days to 50 % flowering and days to 50 % fruiting indicating a non additive gene action.

Wasule, *et al.* 2004 evaluated the variability studies in 17 genotypes of chilli (*Capsicum annum*). Observations were recorded for days to 50 % flowering, plant height, number of branches/plant, number of fruits/plant, fruit length, fruit girth, 1000- seed weight, seed percentage, incidences of dieback and fruit rot (*Colletotrichum capsici*), and yield of red chillies per plant. The presence of variability amongst the genotype for all the characters was observed. High values of genotypic coefficient of variation were noted for fruit rot incidence percentage, number of fruits/plant, wet red chilli yield, fruit girth and number of branches /plant, showing large variation for these traits. Heritability estimates ranged from 27.60 to 92.10 %. Nine characters showed high heritability (> 70 %). The expected genetic advance ranged from 3.73 to 74.90. High heritability (92.70%) was accompanied by high genetic advance (70%) in respect to number of fruits/plant, indicating prevalence of additive gene action which offers good scope for further improvement. Fruit rot percentage recorded high

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heritability with high genetic gain, while dieback recorded high heritability with moderate genetic gain.

Pramila (2005) evaluated forty genotypes for quantitative and qualitative traits. The genotypes EC 519637, Pant selection 20, EC 519640 and EC 519630 were found promising and produced 345.8, 343.0, 340.4 and 232.1 % higher yield over Pant C- 1, respectively. High phenotypic coefficient of variation and genotypic coefficient of variation recorded for 10 red ripe fruit weight, green fruit weight, number of fruits/plant, seed weight / 100 gm., weight of fruits/plant and fruit yield/ ha. Heritability were high for all the characters except plant height. High heritability along with high genetic advance were observed for 10 red and green fruit weight, number and weight of fruits/plant, fruit yield, seed weight and seed : husk ratio. Significant and positive correlation was recorded for weight of fruits/plant, pod length, pod periphery, fruit yield, 10 red and green fruit weight and plant height. EC 519645, EC 519629, EC 519632 and Pant Sel – 18 were less affected with anthracnose disease.

Raikar *et al.* (2005) evaluated the forty strains of chilli were grown in Pune, Maharashtra, India, during kharif season. Observation were recorded on days to flowering, maturity, number of primary and secondary branches/plant, plant height and spread, fruit length and girth, seeds/fruit, number of fruits/plant, fresh fruit weight/plant and dry fruit weight /plant. Correlations (genotypic and phenotypic) among these

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characters and path analysis (direct and indirect effects) revealed fresh fruit weight and number of fruits/plant as the most important and reliable yield indicators in chilli. The interrelationships also demonstrated that tall and spreading plants with higher number of secondary branches and early maturity would be high yielding types.

Verkey *et al.* (2005) evaluated the genetic variability and heritability for 12 characters of 45 genotypes of chilli (*Capsicum annuum*). They reported that the mean squares due to genotypes were significant for all the characters, except days to flower, indicating the existence of variability among the genotypes. High genotypic and phenotypic coefficients of variation were observed for number of fruits/plant and fresh fruit yield /plant. High heritability coupled with high genetic advance were recorded for number of fruits per plant, number of seeds /fruit and dry weight /plant. These traits can be exploited in breeding programmes to improve the yield in chilli.

Sandeep *et al.* (2005) studied the performance of chilli genotypes Punjab Guchedar, Ludhiana Long Selection, Punjab Lal, CH-1 and CH-3. CH-3 was superior for yield and yield contributing traits, which recorded maximum fruit length (7.25 cm), fruit weight (5.0 g) and total yield (211.40 q/ha) except plant height, number of fruits and capsaicin content. Maximum plant height (86.50 cm) was recorded in Ludhiana Long Selection whereas the maximum number of fruits (375.80) were recorded

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in Punjab Lal. The highest capsaicin content (0.87 g) was obtained in Punjab Lal.

Smitha and Basavaraja *et al.* (2006) evaluated the forty genotypes of chilli were evaluated to estimate variability, heritability, genetic advance and correlation coefficient. Higher genotypic and phenotypic coefficient of variation were observed for fruits/plant, fruit weight, fruit length, fruit girth and yield. Heritability and genetic advance were also higher for these characters indicating the possibility of selection to these characters.

Dutonde *et al.* (2006) studied the genetic variability and heritability for 17 characters in relation to heat tolerance was assessed in different chilli genotypes during summer in Maharashtra, India. In this analysis of variance showed highly significant differences among the genotypes for all the characters. Yield of green fruits/hectare showed the maximum variability, followed by capsaicin content, ascorbic acid content, green fruits/plant, marketable yield of green fruits/plant and yield of green fruits/plant. High values of heritability and genetic advance were recorded for yield of green fruits/plant, marketable yield of green fruits/plant and fruit length, indicating the possibility of larger response to selection and greater chance for improvement of chilli.

Pawandee *et al.* (2007) evaluated the 40 cultivars and local landraces of chilli (*Capsicum annum*). He reported that the phenotypic coefficient of variation (PCV) was higher than the genotypic coefficient of

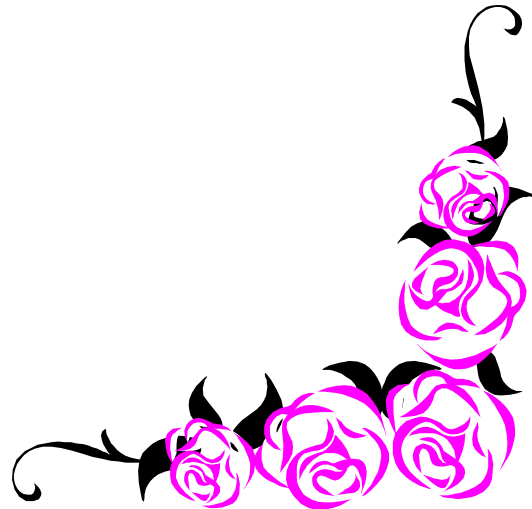
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variation (GCV) for most traits. high GCV accompanied by high heritability and genetic gain were recorded for coloring matter, ascorbic acid and dry matter, indicating that these traits could be improved by simple selection. Moderate to high heritability with low GCV and genetic gain were observed for capsaicin content, fruit weight, oleoresin content, fruit breath and number of fruits/plant. The genetic correlation was higher than the phenotypic correlation. Total yield showed the positive and significant phenotypic and genetic correlation with fruit length, fruit breadth, and fruits/plant. Path analysis showed that number of fruits/plant, fruit weight, capsaicin content, fruit breadth, fruit length, ascorbic acid content, and oleoresin content had high positive direct effects on yield.

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# *MATERIALS AND METHODS*



The present investigation was undertaken during spring summer season of 2007 at Vegetable Research Centre of the G. B. Pant University of Agriculture and Technology, Pantnagar, U.S. Nagar, Uttarakhand. The details of material used, experimental design layout and statistical techniques adopted during the course of investigation have been discussed as follows:

### 3.1 Experimental Site

Vegetable Research Centre, Pantnagar is located in the Tarai region of Uttarakhand adjoining the foothills of Shivalik range of the Himalayas. Geographically, it is situated at an altitude between 29<sup>o</sup> N latitude and 79.3<sup>o</sup> E longitudes having an altitude of 243.84 meters above the mean sea level.

### 3.2 Climate

The climate of Pantnagar is humid sub tropical with minimum and maximum temperature ranging between 4<sup>o</sup>C to 25.8<sup>o</sup>C and 17.7<sup>o</sup>C to 43<sup>o</sup>C, respectively. The summers are humid, dry and hot whereas winters are cool. Occasionally light rains occur during winter season also. Sometime frost may occurs occasionally.

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### 3.3 Soil

The soil of the experimental site was sandy loam in nature having pH 6.8 and has medium fertility. The details of weather parameter are given in Appendix – I.

### 3.4 Details of the Experiment

#### 3.4.1 Experimental materials

The experimental materials used for present investigation comprised of 93 genotypes of chilli. (*Capsicum annum var. accuminatum* (L.)). Some of which are obtained from AVRDC, Taiwan and some from reasonal Station NBPGR, Bhowali. The genotypes were diverse with respect to morphological and important economical traits. Among 93 genotypes, Pant C-1, JCA 283 and LCA-206 were undertaken as standard check. List of genotypes is given in Table 3.1.

Table 3.1: List of genotypes

S.No	Genotype	Symbol	Sourcc
1	Utkal yellow	(G <sub>1</sub> )	OUAT, Bhuvneshwer
2	PC- 56	(G <sub>2</sub> )	GBPUA&T, Pantnagar
3	Selection – 11	(G <sub>3</sub> )	P.A.U.Ludhiyana
4	HSHP -1111	(G <sub>4</sub> )	Shere-E-Kashmir Univ. of Ag. & Tech. Shalimar Srinagar
5	HSHP-154	(G <sub>5</sub> )	Shere-E-Kashmir Univ. of Ag. & Tech. Shalimar Srinagar
6	Pant Chilli-7	(G <sub>6</sub> )	GBPUA&T, Pantnagar
7	HDC-75	(G <sub>7</sub> )	Dharwad (Karnataka)
8	LCA - 353	(G <sub>8</sub> )	Lam, Research Station, Guntur, A.P.
9	DCL- 352	(G <sub>9</sub> )	IARI, Delhi

10	DCL- 524	(G <sub>10</sub> )	IARI, Delhi
11	DLC- 1	(G <sub>11</sub> )	Durga Seeds(Chandigarh)
12	DSC- 2	(G <sub>12</sub> )	Durga Seeds(Chandigarh)
13	Pant Chilli- 6	(G <sub>13</sub> )	GBPUA&T, Pantnagar
14	Indra Chilli	(G <sub>14</sub> )	IGKV, Raipur M.P.
15	Ajeet- 3	(G <sub>15</sub> )	Ajeet Seeds
16	BC- 25	(G <sub>16</sub> )	OUAT, Bhubaneswar
17	BC-40-2	(G <sub>17</sub> )	OUAT, Bhubaneswar
18	ACS – 2002 – 6	(G <sub>18</sub> )	G.A.U., Anand
19	F- 112 -5-83	(G <sub>19</sub> )	IIVR, Varanasi
20	SKAU-101	(G <sub>20</sub> )	Shere-E-Kashmir Univ. of Ag. & Tech. Shalimar Srinagar
21	KCS- 2013	(G <sub>21</sub> )	CSAUA&T, Kanpur
22	CO-4	(G <sub>22</sub> )	TNAU, Coimbatore
23	PC-2057	(G <sub>23</sub> )	AVRDC, Taiwan
24	PC-2062	(G <sub>24</sub> )	AVRDC Taiwan
25	PC-2064	(G <sub>25</sub> )	AVRDC Taiwan
26	Pant Chilli-4	(G <sub>26</sub> )	GBPUA&T, Pantnagar
27	Indo Sem Yeda	(G <sub>27</sub> )	Seed Company
28	Indo Sem Dona	(G <sub>28</sub> )	Seed Company
29	PC- 2005-6-P	(G <sub>29</sub> )	GBPUA&T, Pantnagar
30	PC-2006-B	(G <sub>30</sub> )	GBPUA&T, Pantnagar
31	Pant Chilli-10	(G <sub>31</sub> )	GBPUA&T, Pantnagar
32	P.J- Sel -1	(G <sub>32</sub> )	GBPUA&T, Pantnagar
33	PC-2006-50	(G <sub>33</sub> )	GBPUA&T, Pantnagar
34	PC-2006-2	(G <sub>34</sub> )	GBPUA&T, Pantnagar
35	Pc-7-1-2-1	(G <sub>35</sub> )	GBPUA&T, Pantnagar
36	SKJ-UP-2 -Sel	(G <sub>36</sub> )	GBPUA&T, Pantnagar
37	PC-2004-UP	(G <sub>37</sub> )	GBPUA&T, Pantnagar
38	EC-519621-UP	(G <sub>38</sub> )	AVRDC, Taiwan
39	EC-519636-D-UP	(G <sub>39</sub> )	AVRDC, Taiwan
40	EC-519636-UP	(G <sub>40</sub> )	AVRDC, Taiwan

41	EC-519640	(G <sub>41</sub> )	AVRDC, Taiwan
42	Pant Guchedar-P	(G <sub>42</sub> )	GBP UA&T, Pantnagar
43	PC-2004-UP-S.P.	(G <sub>43</sub> )	GBP UA&T, Pantnagar
44	PC-7-1	(G <sub>44</sub> )	GBP UA&T, Pantnagar
45	PC-2006-UP-5	(G <sub>45</sub> )	GBP UA&T, Pantnagar
46	PC-2004-UP-13-1	(G <sub>46</sub> )	GBP UA&T, Pantnagar
47	PC-2004-UP-13-2	(G <sub>47</sub> )	GBP UA&T, Pantnagar
48	Pant Guchadar-UP	(G <sub>48</sub> )	GBP UA&T, Pantnagar
49	Pant Sel-15-1-UP	(G <sub>49</sub> )	GBP UA&T, Pantnagar
50	PC-2006-UP-3	(G <sub>50</sub> )	GBP UA&T, Pantnagar
51	SKJ-UP-DF	(G <sub>51</sub> )	GBP UA&T, Pantnagar
52	PC-2006-UP-12	(G <sub>52</sub> )	GBP UA&T, Pantnagar
53	PC-1-20-UP	(G <sub>53</sub> )	GBP UA&T, Pantnagar
54	PC-2-UP	(G <sub>54</sub> )	GBP UA&T, Pantnagar
55	PC-2-1-UP-DF	(G <sub>55</sub> )	GBP UA&T, Pantnagar
56	PC-7-1-2-UP	(G <sub>56</sub> )	GBP UA&T, Pantnagar
57	Pant Sel-50-SP	(G <sub>57</sub> )	Moradabad ,UP
58	AC-510	(G <sub>58</sub> )	GBP UA&T, Pantnagar
59	Israil-2003	(G <sub>59</sub> )	Israil
60	PC-2057-B	(G <sub>60</sub> )	AVRDC, Taiwan
61	EC-519637	(G <sub>61</sub> )	AVRDC, Taiwan
62	Pant C-2 (P)	(G <sub>62</sub> )	GBP UA&T, Pantnagar
63	EC-519625-1	(G <sub>63</sub> )	AVRDC, Taiwan
64	Pant Chilli-12	(G <sub>64</sub> )	GBP UA&T, Pantnagar
65	EC-519636-1	(G <sub>65</sub> )	AVRDC, Taiwan
66	EC-519636-1-1	(G <sub>66</sub> )	AVRDC, Taiwan
67	Pant Chilli -25	(G <sub>67</sub> )	GBP UA&T, Pantnagar
68	EC-519636-2	(G <sub>68</sub> )	AVRDC, Taiwan
69	EC-519625	(G <sub>69</sub> )	AVRDC, Taiwan
70	Pant-Sel -7-1-2	(G <sub>70</sub> )	GBP UA&T, Pantnagar
71	Pant-Sel -13	(G <sub>71</sub> )	GBP UA&T, Pantnagar
72	Pant-Sel -13-2	(G <sub>72</sub> )	GBP UA&T, Pantnagar

73	Pant-Sel-15	(G <sub>73</sub> )	GBPUA&T, Pantnagar
74	Pant -Sel- 42	(G <sub>74</sub> )	GBPUA&T, Pantnagar
75	Pant Chilli- 3	(G <sub>75</sub> )	GBPUA&T, Pantnagar
76	Pant Sel -18	(G <sub>76</sub> )	GBPUA&T, Pantnagar
77	SKJ-2004-2	(G <sub>77</sub> )	GBPUA&T, Pantnagar
78	KA-2	(G <sub>78</sub> )	IIVR, Varanasi
79	Pant-Sel-31-1	(G <sub>79</sub> )	GBPUA&T, Pantnagar
80	IC-292480	(G <sub>80</sub> )	NBPGR, Research Station, Bhowali
81	IC-422010	(G <sub>81</sub> )	NBPGR, Research Station, Bhowali
82	IC-266832	(G <sub>82</sub> )	NBPGR, Research Station, Bhowali
83	IC-383136	(G <sub>83</sub> )	NBPGR, Research Station, Bhowali
84	IC-313389	(G <sub>84</sub> )	NBPGR, Research Station, Bhowali
85	IC-276575	(G <sub>85</sub> )	NBPGR, Research Station, Bhowali
86	IC-398082	(G <sub>86</sub> )	NBPGR, Research Station, Bhowali
87	IC-368781	(G <sub>87</sub> )	NBPGR, Research Station, Bhowali
88	AC-800-2	(G <sub>88</sub> )	GBPUA&T, Pantnagar
89	AC-800-3	(G <sub>89</sub> )	GBPUA&T, Pantnagar
90	AC-800-4	(G <sub>90</sub> )	GBPUA&T, Pantnagar
91	Pant C-1 (check)	(G <sub>91</sub> )	GBPUA&T, Pantnagar
92	JCA-283 (check)	(G <sub>92</sub> )	JNKV, Jabalpur
93	LCA 206 (check)	(G <sub>93</sub> )	Lam, Research Station, Guntur, A.P.

### 3.4.2 Lay out and design of the experiment

Ninety three genotypes were transplanted in an augmented block design in March 2007 along with the three check varieties namely, Pant C-1, JCA-283 and LCA-206. Experimental materials were allocated in six blocks in augmented block design with three checks distributed randomly in each block.

(a) Lay out of the experiment is given in fig-3.2

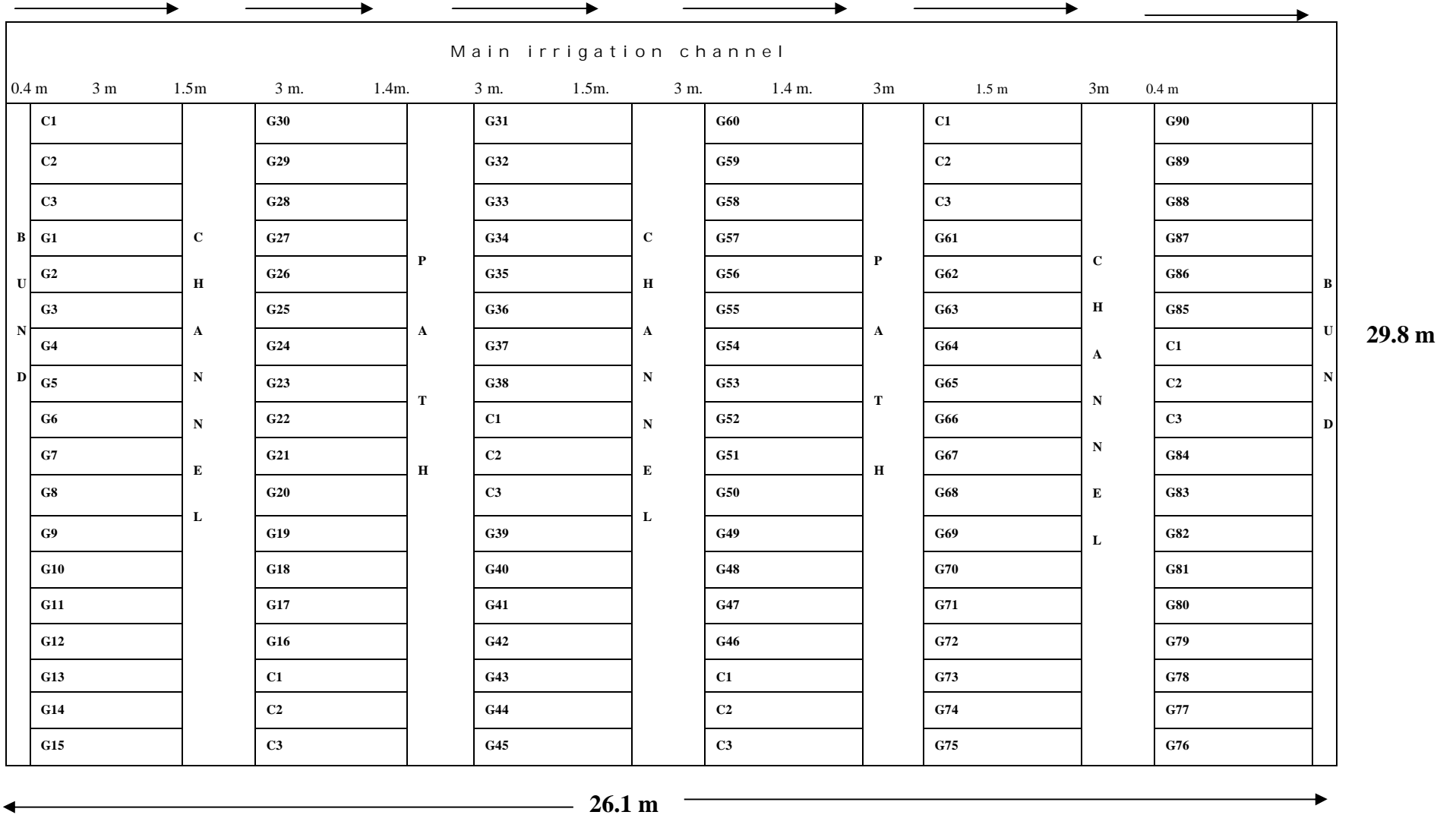


Fig. 3.2: Layout plan of the experiment

### 3.3: Details of technical programme

1.	Site of experiment	Vegetable Research Centre G.B.P.U.A&T., Pantnagar, U.S. Nagar, Uttarakhand
2.	Period of experiment	Spring Summer Season, 2007
3.	Number of genotypes	(90+3 Checks)=93
4.	Experimental design	Augmented Design
5.	Planting distance	50 x 50 cm.
6.	Fertilizer doses	120:60:60: Kg/ha N:P:K
7.	Fertilizer application	
	1.Nitrogen@120 Kg/ha given in 3 split doses	½ as basal ¼ as 30 days after transplanting of the seedlings. ¼ as 60 days after transplanting of the seedlings.
	2.Phosphorus @ 60 kg/ha	Full dose as basal
	3.Potassium@60 kg/ha	Full dose as basal
8.	No.of plants per genotypes	18
9.	No. of blocks	6
10.	Total no. of plots	108
11.	Plot size	3.0 x 1.5= 4.5m <sup>2</sup>
12.	Net experimental area	108 x 4.5 = 486 m <sup>2</sup>
13.	Standard checks (three)	Pant C-1, JCA-283 and LCA- 206
14.	Date of seed sowing	20 <sup>th</sup> December 2006

15	Gross experimental area	$29.8 \times 26.1 = 777.78 \text{ m}^2$
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### 3.4.3 Nursery preparation and seed sowing

Raised bed was prepared for growing nursery to prepare the seedlings of all the 93 genotypes. Bed was raised 15cm above the ground level and channel 25-30 cm thus formed around, was used for irrigation and drainage. The size of bed was 1.0 m width and length was 20.0 m for sowing of seeds. The bed was prepared on 19<sup>th</sup> December, 2006. The seeds were sown after proper treatment with fungicide viz. Thiram @ 2.5g/kg of seed. All preparations were taken regarding cultural management practices till the seedlings were ready for transplanting.

### 3.3.4 Field preparation

The experimental field was prepared by tillage operation, one deep ploughing followed by three harrowing and clod breaking, hoeing and levelling. After that field was levelled and divided into plots. The bunds and channels were prepared as per the layout. A basal dose of 60 kg N:60 kg P<sub>2</sub>O<sub>5</sub> and 60 kg K<sub>2</sub>O per ha was applied before transplanting of seedlings. In addition to basal dose, 60 kg N was applied in two equal split doses i.e. at 30 days and 60 days after transplanting.

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### 3.3.5 Transplanting and gap filling

The seedlings were transplanted was done on 23<sup>th</sup> March 2007. Transplanting of seedling was done in the evening hours and just after transplanting a light irrigation was given. The gap-filling operation was done after 5 days of transplanting and light irrigation was given to the crop.

### 3.3.6 Cultural operations after planting

The intercultural operations and plant protection measures recommended for the crop were followed and weekly irrigation was given to maintain the proper moisture in the field for better growth and development of the plants.

Observations were recorded

#### A. Qualitative characters

- 1) Plant growth habit (Dwarf/Medium/Tall)
  - 2) Stem colour (Green/light green/purple green/dark green)
  - 3) Stem surface (Round/angular)
  - 4) Stem type (Round/Angular)
  - 5) Leaf colour (Light green/green/dark green/purple)
  - 6) Leaf size (Small/medium/large)
  - 7) Lamina Margin (Wavy/Entire)
  - 8) Inflorescence (Solitary/cluster)
  - 9) Calyx (Loose/Crowded)
  - 10) Corrola Colour (White/Purple/White with green tinge/others)
-

- 11) Pedicel size (Short/Medium/Long)
- 12) Fruit Position (Erect/Semi erect/Pendulous)
- 13) Fruit size (Small/medium/large)
- 14) Fruit Shape (Linear/Cylindrical/Oval/Obovate/Oblong/pear Shaped)
- 15) Fruit surface (Smooth/wrinkled)
- 16) Fruit tip (Pointed/blunt)
- 17) Fruit base (Bulging/Non-bulging)
- 18) Fruit colour (Red/orange/scarlet/yellow/purple)
- 19) Fleshiness of pericarp (Fleshy/Non Fleshy)
- 20) Thickness of pericarp (Thick/medium/thin)
- 21) Seediness (Low/Moderate/High)
- 22) Pungency of Fruit (Nil/Mild/Moderate/High)
- 23) Seed size (Small/Medium/Large)

#### B. Quantitative characters

- 1) Plant height (cm.) at final picking
  - 2) No. of branches/plant at final picking
  - 3) Stem diameter (At final picking)
  - 4) Fresh weight of shoots per plant
  - 5) Fresh weight of roots per plant
  - 6) Days to 50% flowering
  - 7) Days to 1<sup>st</sup> fruit ripening
  - 8) Days to final picking
-

- 9) Number of fruits/plant
- 10) Weight of fruits/plant
- 11) Fruit length
  - (a) Stalk Length (cm)
  - (b) Fruit body Length (cm)
- 12) Fruit periphery (cm)
- 13) No. of seeds/fruit
- 14) Weight of seeds/fruit
- 15) Seed yield/plant (g)
- 16) 100-seed weight (mg)
- 17) Seed: husk ratio
- 18) Dry fruit weight (%)
- 19) Total yield q/ha
- 20) Vitamin C content (mg/100g. of fruits)
- 21) Disease incidence (%)
  - (a) Anthracnose
  - (b) Leaf curl virus
  - (c) Nematodes

### 3.4 Details of Observation

The observations on various morphological and quantitative characters constituting plant growth, flowering, fruiting and yield were recorded. There are 23 qualitative and 21 quantitative

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characters. Five random sample plants were tagged in each plot and were used for recording the observations.

### 3.4.1 Quantitative characters

#### Plant height (cm)

The height of five plants was recorded from ground level to the tip of last leaf at final picking and the average of plant height was calculated.

#### Number of primary branches/plant

The primary branches arising from the main stem were counted at the final harvest on tagged plants in each genotype and in each blocks and mean data were calculated.

#### Stem Diameter (cm)

The thickness of stem was measured from the collar portion at the time of final harvest in all the five tagged plants in each genotype and mean data were calculated.

#### Fresh weight of shoots per plant

After final picking of fruits, five tagged plants were uprooted. These were weighed and average fresh weight per plant was calculated.

#### Fresh weight of roots per plant

The roots of five tagged plants were washed with tap water and

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their weight was recorded and the average fresh root weight per plant was calculated.

#### Days to 50 % flowering

Days to 50 % flowering was recorded as the number of days from the date of transplanting till the date on which 50 % of the plants in a plot showed appearance of open flower.

#### Days to 50 % fruit ripening

Days to 50 % fruit ripening was recorded as the number of days from the date of transplanting to the date when 50% of the plants in each treatment in each block showed at least one harvestable fruit.

#### Number of fruits/plant

The fruits of all plant were picked in each picking and counted, summed up and by dividing the total value from the number of plants per entry to get the fruits /plant and their mean was calculated.

#### Weight of fruits/plant (g)

The fruits of all pickings of all the plant were picked and weighed. Then the total value was divided by number of plants per entry to calculate the average weight of fruits/plant.

#### Fruit length (cm)

The five fruits per genotype were randomly taken and a length of fruits from the base of the peduncle to the tip of the fruit was measured and means fruit length was calculated.

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#### Fruit stalk length (cm)

The above five fruits were also used to record the stalk length from stem end to the base of fruit and mean fruit stalk length was calculated.

#### Fruit Periphery (cm)

The above five fruits were also used to record the periphery of each fruit was measured with the help of thread at fruit base and mean was calculated.

#### Per cent dry weight of fruit

Hundred gram fruits were taken randomly in each genotype in 2<sup>nd</sup> picking and dried in drier up to a constant weight and final weight was recorded to get the percent dry weight of pods in each genotype in each blocks.

#### Seed: husk ratio

From above dry fruits seeds were extracted and then seed and husk were weighed separately. To calculate seed: husk ratio the weight of total husk is divided by weight of seed.

#### Number and weight of seeds/fruit

Five dried fruits were randomly taken from dry sample from each genotype of each block and their seeds were extracted separately. The number of seeds of five fruits were counted and weighted and divided by five to get average seed number per fruit.

#### Hundred Seed weight (mg)

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One hundred dried seeds from the seed bulk of each genotype in each block were counted and weighed and multiplied by 10 to get the thousand seed weight.

Seed Yield per plant

We take 100 gram of fruit and dry the fruit completely. Then separate the seed from the fruit and take the weight of seeds and calculate the seed yield of the fruit.

Total yield (q/ha):

The weight of fruits/plant was recorded per plot and multiplied by the area of genotypes covered in the field. After yield per plot was converted into that q/ha.

Vitamin ‘C’ Content (mg/100 g of fresh fruit)

The estimation of vitamin C content in red fruits was done as followed by Rangana (1986) and as described below:

a. preparation of solutions

i) Three per cent Metaphosphoric acid solution

It was prepared by dissolving the 30 g of  $\text{H}_3\text{PO}_3$  in some distilled water and the volume of solution was then made up to 1000 ml.

ii) Standard ascorbic acid solution

100 mg of ascorbic acid was dissolved in 3% metaphosphoric acid solution and the volume was made up to 100 ml by adding 3%  $\text{H}_3\text{PO}_3$  solution. The 10 ml of this solution was further diluted to 100 ml with 3%  $\text{H}_3\text{PO}_3$  solution. It means 1 ml of the final solution contain 0.1 mg of ascorbic acid.

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iii) Dye solution

50mg of 2, 6-Dichlorophenol-Indophenol dye and 42 mg Sodium Bicarbonate were dissolved in hot distilled water and the volume was made up to 200 ml. it was stored in refrigerated conditions for further use.

b. Procedure of estimation of vitamin 'c' content

i) standardization of the dye solution

Five ml of standard ascorbic acid solution was taken in a beaker and 5 ml of 3 % HPO<sub>3</sub> was added to it. The dye solution was taken in a burette and titrated against standard ascorbic acid solution to a pink end point. The dye factor was then determined by using the following formulae:

$$\text{Dye factor} = \frac{0.5}{\text{Titer value}}$$

ii) Preparation of sample

Five gram of fresh chilli fruits (with out peduncle) was taken and crushed in grinder mixer using 3% HPO<sub>3</sub> solution. After filtration the final volume was made up to 100 ml with 3 % HPO<sub>3</sub> solution.

iii) Assay of extract

Ten ml of aliquot was taken in 100 ml conical flask and titrated against standard dye solution to a pink end point which persisted for at least fifteen seconds.

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c. Calculation

Calculation of ascorbic acid content of the sample was done with the help of the following formulae:

Following formula:

$$\text{Ascorbic acid (Mg/100 g fresh fruit)} = \frac{\text{Titer value} \times \text{dye factor} \times \text{volume made up}}{\text{Aliquot volumes taken For estimation} \times \text{weight of sample taken for estimation}} \times 100$$

### 3.4.2 Disease infestation

Anthracnose:

Anthracnose disease caused by *Colletotricum capsici* also called fruit rot and die back. It is seed borne disease. Symptoms first appear as small water soaked spots on leaves or stem, which when fully developed are dark sunken with acervulli bearing spore masses arranged in concentric rings. In die back symptoms, the tender branches from the top show necrosis to downwards. This disease spread under high humidity. In fruit rot, the symptoms appear on the surface of fruit body as large burning spot and due to high moisture the fruits are rotted on the basis of the above symptoms the affected plants were counted and there percentage was calculated.

Leaf curl virus:

It is very serious viral disease of chilli. Symptoms are curling of leaves accompanied by puckering and blistering of interveinal areas

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and thickening of the veins. It is transmitted by white fly, aphids and mites. In advance stages axillary buds are stimulated to produce cluster of leaves which are reduced in size. On the basis of curling symptoms, the affected plants in each block, in each genotype were counted and their percentage was calculated.

Nematode:

Nematode is a serious problem in several vegetable. It is caused by *Malloidogy incognita* and *M. japonica*. The problem arises in the humid subtropical region. The affected plants form a irregular shape of knots in the roots and reduces the uptake of the nutrients and thus, there is no fruiting and flowering takes place. In the present study the data was collected in all the genotypes and their percentage was calculated.

### 3.5 Statistical Analysis

#### **Analysis of variance**

The analysis of variance for augmented design was done by using the method given by Federer (1956, 1975). For this purpose two-way table of checks was prepared.

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Checks	Blocks 1 ,2 3 j			Total	Mean
	1	2	3.....j		
<b>Pant C-1</b>	$X_{1,1}$	$X_{1,2}$	$X_{1,3} \dots X_{1,j}$	$C_1$	$X_1$
<b>JCA-283</b>	$X_{2,1}$	$X_{2,2}$	$X_{2,3} \dots X_{2,j}$	$C_2$	$X_2$
<b>LCA-206</b>	$X_{3,1}$	$X_{3,2}$	$X_{3,3} \dots X_{3,j}$	$C_3$	$X_3$
<b>Total</b>	$B_1$	$B_2$	$B_3 \dots B_j$	$G$	$M$

Where,

$X_{ij}$  = Yield of the  $i^{\text{th}}$  check in the  $j^{\text{th}}$  block

$B_j = \sum X_{ij}$  Sum of all checks in the  $j^{\text{th}}$

$C_j = \sum X_{ij} =$  Sum of all yields of the  $i^{\text{th}}$  check

$G = \sum B_j = \sum C_i$  grand total of all check yields

$X_i = C_i / b =$  Mean yield of the  $i^{\text{th}}$  check

$M = \sum X_i = G/b =$  sum of the check means

$b =$  number of blocks

$c =$  number of checks

The next step is to compute on adjustment factor  $r_j$ , for each block. It is computed as:

$$R_j = (1/c) (B_j - M)$$

Note: as a check on the computation,  $\sum r_j = 0$

A table of actual yields of the genotypes, and the yields adjusted for the effect of the block in which the genotypes was grown can now be constructed.

Selection Block	Yield	
	Observed value	Adjusted value
1	$Y_{1j}$	$Y_1$
2	$Y_{2j}$	$Y_2$
-	-	-
-	-	-
-	-	-
-	-	-
V	$Y_{vj}$	$Y_v$

Where,

$Y_{ij}$  = Yield of the  $i^{\text{th}}$  genotype (in the  $j^{\text{th}}$  block)

$Y_v = Y_{ij} - r_j$  = adjusted yield of the  $I^{\text{th}}$  genotype (adjusted for block effect)

To obtain estimate of experimental error for computing least significant difference (LSD's) and comparing means, the analysis of variance table of check cultivars was prepared as follows:

Source of Variation	Degree of freedom	Sum of Squares	Mean sum of squares I	F-Cal.
Block	b-1	SSB	$SSB / b-1 = MSB$	MSB / MSE
Checks	c-1	SSC	$SSC / c-1 = MSC$	MSC/ MSE
Error	(b-1) (c-1)	SSE	$SSE / (b-1) (c-1) = MSE$	
Total	bc-1	SST		

Where,

$$SSB = (1/c) \sum_j B_j^2 - G^2/bc$$

$$SSC = (1/b) \sum_j C_i^2 - G^2/bc$$

$$SST = \sum_i \sum_j X_{ij}^2 - G^2/bc$$

$$SSE = SST - SSB - SSC$$

$$MSB = SSB / (b-1)$$

$$MSC = SSC / (c-1)$$

$$MSE = SSE / (b-1)(c-1)$$

### Variance for different pair wise comparison

1. Difference between two check means =  $2 \text{ MSE}/b$
2. Adjusted yield differences in two genotypes of same block =  $2\text{MSE}$
3. Difference between adjusted yields of two genotypes in difference blocks  
=  $2\text{MSE}(c+1)/c$
4. Difference between the adjusted yield of  $\sim$  genotypes and a check mean =  
 $\text{MSE} (b+1) (c+1)/bc$

### Least significant difference value

LSD's was computed using the variance, given above, in the following way:

1. For the check means =  $t \cdot \sqrt{2\text{MSE}/b}$
  2. For the two adjusted genotypes in the same block =  $t \sqrt{2\text{MSE}}$
  3. For two adjusted genotypes in different blocks  
=  $t \sqrt{2\text{MSE} (C + 1) / C}$
  4. For an adjusted genotype against check mean
-

$$= t\sqrt{MSE (b + 1) (c + 1)/bc}$$

For all LSD's the 't' value at (P=0.05) error degree of freedom is used.

The analysis gave adjusted values for all characters in each genotype.

Further, classificatory analysis was done on these adjusted values of variables.

### **Estimation of variability:**

Mean, range, per cent range of variation and phenotypic coefficient of variation (P.C.V.) for different characters were worked out for all genotypes.

### **Mean**

Mean of the individual genotype was calculated as arithmetic average of the values of each character:

$$\bar{X} = \sum_i^n \frac{X_i}{n}$$

Where,

$\bar{X}$  = mean

$X_i$  = value of the character of  $i^{\text{th}}$  plant

n = number of plants

### **Range**

This denotes the largest and the smallest value of the character in the material.

### **Phenotypic coefficient of variation (PCV)**

The PCV is computed by the given formulae:

$$\text{PCV (per cent)} = \frac{\text{Phenotypic standard deviation}}{\text{General mean of the character}} \times 100$$

### Correlation coefficient (r)

The estimation of correlation coefficients is based on the variance and covariance of x and y variables. Correlation is ranged between +1 to -1. The intensity of relationship is measured by correlation coefficients (r). The formula for estimation of correlation coefficients given by Searle (1961):

$$r_{xy} = \frac{\text{Cov. (xy)}}{\sqrt{\text{Var } x \cdot \text{Var } y}}$$

Where,

$r_{xy}$  = Correlation coefficient between x and y

Cov. (xy) = Covariance between x and y

Var. (x) = Variance of x

Var. (y) = Variance of y

n = number of observations

Variance and covariance were calculated by following formula:

$$\text{Var. (x)} = \frac{1}{n} \left[ \sum x^2 - \frac{(\sum x)^2}{n} \right]$$


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$$\text{Var. (y)} = \frac{1}{n} \left[ \sum y^2 - \frac{(\sum y)^2}{n} \right]$$

$$\text{Cov. (xy)} = \frac{1}{n} \left[ \sum xy - \frac{(\sum x)(\sum y)}{n} \right]$$

To test the significance of correlation coefficient the calculated t-value is compared with tabulated t-value on n-2 degree of freedom (Snedecor and Cochran, 1967):

$$t = \frac{r}{\sqrt{1 - r^2}} \times \sqrt{n - 2}$$

Where,

r = Correlation coefficient and

n = number of observations

### **Heritability:**

Heritability in broad sense ( $H_b$ ) was estimated as the ratio of genotypic variance to the phenotypic variance (Allard, 1960). Here heritability estimates were calculated as follows:

$$h^2 = \frac{\sigma^2 g}{\sigma^2 p} \times 100$$

Where,

$h^2$  = heritability of character in broad sense

$\sigma^2 g$  = genotypic variance of the character

$\sigma^2 p$  = phenotypic variance of the character

### Genetic advance:

Expected genetic advance was calculated by the formula given by Johnson *et al.* (1955).

$$GA = \frac{\sigma^2 g \times k \times p}{\sigma^2 p} \times 100$$

Where,

$h$  = heritability estimate

$\sigma^2 g$  = genotypic variance of the character

$\sigma^2 p$  = phenotypic variance of the character

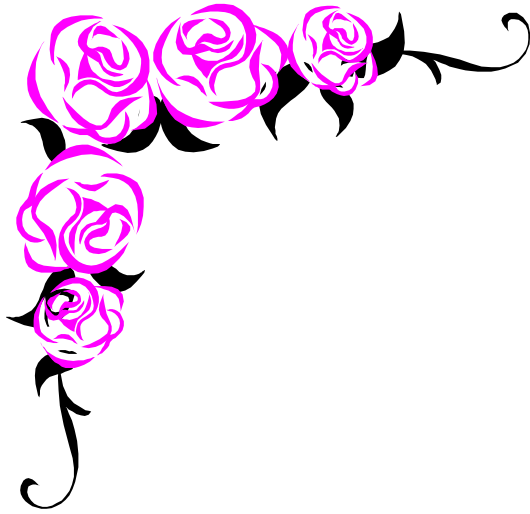
$p$  = phenotypic standard deviation

$k$  = selection differential at five percent selection intensity

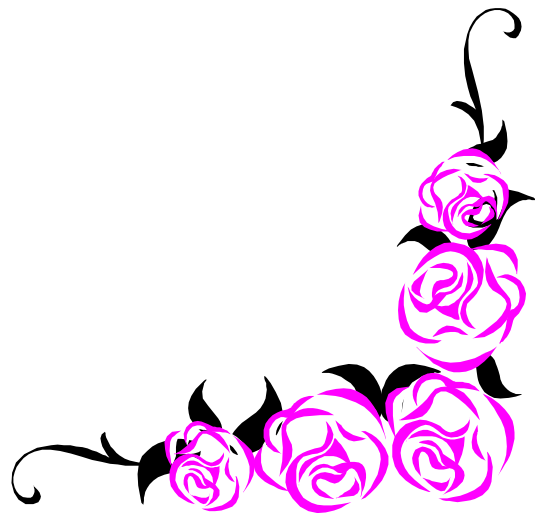
( $k = 2.06$ )

$G$  = Genetic advance

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# *EXPERIMENTAL RESULTS*



## Chapter 4

## *EXPERIMENTAL RESULTS*

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Experimental result obtained for various characters during the course of this investigation have been presented in this chapter under the following heads:

1. Qualitative characters / phenotypic characters
2. Analysis of variance
3. Estimation of variability
4. Estimation of heritability and genetic advance
5. Correlation coefficient

### 4.1 Qualitative characters

The various qualitative characters of ninety three genotypes of chilli observed during the course of investigation are presented in table 4.1:

#### 4.1.1 Plant height

Chilli genotypes namely, HSHP-154, HDC-75 , Pant Chilli – 6, BC-40-2 ,CO-4, Pant Chilli-4, Indo Sem Dona , Pant Chilli-10, PC-7-1-2-1 , EC-519636-UP, PC-2004-UP-SP, Pant Chilli-7-1, PC-1-20-UP, PC-2-UP, PC-2-1-UP-DF, PC-7-1-2-UP,EC-919637, Pant C -2 (P), Pant Chilli-25, Pant Sel-13-2, Pant Sel -15, SKJ-2004-2, IC-292480,IC-422010, IC-266432, IC-383136, IC-313389, IC-276575, IC-398082 and LCA-206 were of tall habit and DSC-2, ACS-2002-6 ,PC-2005-6-P, EC-519636-D- -UP, PC-2057-b, EC-519636-1, Pant Sel -7-1-2 and

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KA-2 were of dwarf habit and rest of the genotypes were of medium habit.

#### 4.1.2. Stem colour

Among all the genotypes seven genotypes, namely, DCL-524, PC-2006-2, PC-7-1-2-1, Pant Chilli -12, EC-519636-2, EC-519625 and AC-800-4 had dark green stem colour. On other hand, three genotypes IC-383136, IC-276575, and AC-800-3 had purple green colour of stem. where as HSHP-1111, DCL-352, Pant Chilli-6, Indra Chilli, BC-40-2, ACS-2002-6, F-112-5-83, SKAU-101, PC-2057, PC-2062, Pant Chilli-4, PC-2005-6-P, PC-2006-B, Pant Chilli-10, EC-519621-UP, EC-519636-D-UP, EC-919640, Pant Guchhedar-P , PC-2006-UP-5, Pant Sel-15-1-UP, SKJ-UP-DF, PC-2006-UP-12, PC-1-20-UP, PC-2-UP, Pant Sel -50-SP, AC-510, EC-519637, EC-519636-1-1, Pant Sel-15, IC-292480, IC-422010, IC-313389 and IC-398082 had green colour stem and remaining genotypes of chilli had light green stem colour

#### 4.1.3 Stem surface

Among all the chilli genotypes, Selection -11, HDC-75, BC-25, BC-40-2, SKAU-101, KCS-2013, PC-2062, Indo Sem Yeda, PJ –Sel-1, EC-519621-UP, EC-919640, Pant Guchhedar-P , PC-2006-UP-5, SKJ-UP-DF, PC-2-UP, Pant Chilli-25, Pant Sel-13, Pant Sel-15, IC266832, IC-383136, Pant C-1 and JCA-283 had pubescent stem surface and remaining genotypes of chilli had smooth stem surface.

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Table 4.1: Qualitative characters of chilli **genotypes**

S. No.	Genotype	Growth habit	Stem colour	Stem surface	Stem type	Leaf colour	Leaf size	Lamina margin	Inflorescence	calyx	Corolla colour	Pedicel size	Fruit position	Fruit size
1	Utkal yellow	Medium	Light green	Smooth	Angular	Light Green	medium	Wavy	Solitary	Crowed	White	Long	Semi erect	Small
2	PC- 56	Medium	Light green	Smooth	Angular	Dark Green	medium	Wavy	Solitary	Crowed	White	Medium	Pendulous	Medium
3	Selection - 11	Medium	Light green	Pubescent	Angular	Green	Small	Entire	Solitary	Crowed	White	Medium	Pendulous	Large
4	HSHP -1111	Medium	Green	Smooth	Angular	Green	Medium	Wavy	Solitary	Crowed	White	Medium	Pendulous	Medium
5	HSHP-154	Tall	Light green	Smooth	Angular	Green	Small	Entire	Solitary	Crowed	White	Medium	Pendulous	Medium
6	Pant Chilli-7	Medium	Light green	Smooth	Angular	Green	Medium	Entire	Solitary	Crowed	White	Short	Pendulous	Large
7	HDC-75	Tall	Light green	Pubescent	Angular	Light Green	Medium	Entire	Solitary	Crowed	White	Medium	Pendulous	Medium
8	LCA - 353	Dwarf	Light green	Smooth	Angular	Light Green	Small	Entire	Solitary	Crowed	White	Medium	Pendulous	Medium
9	DCL- 352	Dwarf	Green	Smooth	Angular	Dark Green	Large	Entire	Solitary	Crowed	White	Short	Erect	Small
10	DCL- 524	Medium	Dark green	Smooth	Angular	Dark Green	Small	Wavy	Solitary	Crowed	White	Medium	Pendulous	Large
11	DLC- 1	Medium	Light green	Smooth	Angular	Green	Large	Entire	clusters	Crowed	White	Short	Erect	Small
12	DSC- 2	Dwarf	Light green	Smooth	Angular	Green	medium	Entire	clusters	Loose	White	Medium	Erect	Small
13	Pant Chilli- 6	Tall	Green	Smooth	Angular	Dark Green	Medium	Entire	Solitary	Crowed	White	Short	Pendulous	Large
14	Indra Chilli	Medium	Green	Smooth	Angular	Green	Large	Entire	clusters	Loose	White	Medium	Erect	Small
15	Ajeet- 3	Medium	Light green	Smooth	Angular	Green	Small	Entire	Solitary	Loose	White	Medium	Pendulous	Medium
16	BC- 25	Medium	Light green	pubescent	Angular	Green	Small	Entire	Solitary	Crowed	White	Medium	Pendulous	Large
17	BC-40-2	Tall	Green	pubescent	Angular	Green	Medium	Entire	Solitary	Crowed	White	Medium	Pendulous	Medium
18	ACS - 2002 - 6	Dwarf	Green	Smooth	Angular	Light Green	Small	Entire	Solitary	Crowed	White	Medium	Pendulous	Medium
19	F- 112 -5-83	Medium	Green	Smooth	Angular	Green	medium	Wavy	Solitary	Crowed	White	Medium	Pendulous	Large
20	SKAU-101	Medium	Green	pubescent	Angular	Green	medium	Entire	Solitary	Crowed	White	Short	Pendulous	Large
21	KCS- 2013	Medium	Light green	pubescent	Angular	dark Green	Medium	Entire	Solitary	Crowed	White	Medium	Pendulous	Medium

22	CO-4	Tall	Light green	Smooth	Angular	Green	medium	Entire	Solitary	Crowed	White	Medium	Pendulous	Small
23	PC-2057	Medium	Green	Smooth	Angular	Dark Green	medium	Wavy	Solitary	Crowed	White	Medium	Pendulous	Medium
24	PC-2062	Medium	Green	Pubescent	Angular	Green	Small	Wavy	Solitary	Crowed	White	Short	Pendulous	Medium
25	PC-2064	Medium	Light green	Smooth	Angular	Dark Green	Small	Entire	Solitary	Crowed	White	Medium	Pendulous	Small
26	Pant Chilli-4	Tall	Green	Smooth	Angular	Green	medium	Entire	Solitary	Crowed	White	Medium	Semi erect	Small
27	Indo Sem Yeda	Medium	Light green	pubescent	Angular	Light Green	Medium	Entire	Solitary	Crowed	White	Long	Pendulous	Large
28	Indo Sem Dona	Tall	Light green	Smooth	Angular	Green	Small	Entire	Solitary	Crowed	White	Medium	Pendulous	Medium
29	PC- 2005-6-P	Dwarf	Green	Smooth	Angular	Green	Small	Entire	Solitary	Crowed	White	Medium	Pendulous	Small
30	PC-2006-B	Medium	Green	Smooth	Angular	Green	Small	Entire	Solitary	Crowed	White	Medium	Pendulous	Medium
31	Pant Chilli-10	Tall	Green	Smooth	Angular	Dark Green	Large	Entire	Solitary	Crowed	White	Medium	Pendulous	Small
32	P.J- Sel -1	Medium	Light green	pubesent	Angular	Green	medium	Entire	clusters	Crowed	White	Short	Pendulous	Medium
33	PC-2006-50	Medium	Light green	Smooth	Angular	Dark Green	medium	Entire	Solitary	Crowed	White	Medium	Pendulous	Medium
34	PC-2006-2	Medium	Dark green	Smooth	Angular	Dark Green	Medium	Entire	Solitary	Crowed	White	Medium	Pendulous	Medium
35	Pc-7-1-2-1	Tall	dark green	Smooth	Angular	Dark Green	Medium	Entire	Solitary	Crowed	White	Medium	Erect	Small
36	SKJ-UP-2 -Sel	Medium	Light green	Smooth	Angular	Light Green	Small	Entire	Solitary	Crowed	White	Short	Pendulous	Large
37	PC-2004-UP	Medium	Light green	Smooth	Angular	Dark Green	Medium	Entire	Solitary	Crowed	White	Long	Erect	Small
38	EC-519621-UP	Medium	Green	pubescent	Angular	Green	Small	Entire	Solitary	Crowed	White	Medium	Erect	Medium
39	EC-519636-D-UP	Dwarf	Green	Smooth	Angular	Green	medium	Entire	Solitary	Crowed	White	Medium	Semi erect	Medium
40	EC-519636-UP	Tall	Light green	Smooth	Angular	Dark Green	Medium	Entire	Solitary	Crowed	White	Short	Semi erect	Small
41	EC-519640	Medium	Green	Pubescent	Angular	Dark Green	Small	Entire	Solitary	Crowed	White	Short	Pendulous	Medium
42	Pant Guchadar-P	Medium	Green	Pubescent	Angular	Dark Green	Large	Entire	clusters	Crowed	White	Medium	Erect	Small
43	PC-2004-UP-S.P.	Tall	Light green	Smooth	Angular	Dark Green	Small	Entire	Solitary	Crowed	White	Medium	Pendulous	Medium
44	PC-7-1	Tall	Light green	Smooth	Angular	Green	Large	Entire	Solitary	Crowed	White	Short	Pendulous	Medium
45	PC-2006-UP-5	Medium	Green	Pubscnt	Angular	Dark Green	Medium	Entire	Solitary	Crowed	White	Medium	Semi erect	Medium
46	PC-2004-UP-13-1	Medium	Light green	Smooth	Angular	Dark Green	Small	Entire	Solitary	Crowed	White	Medium	Pendulous	Medium

47	PC-2004-UP-13-2	Medium	Light green	Smooth	Angular	Dark Green	Large	Entire	Solitary	Crowed	White	Medium	Pendulous	Small
48	Pant Guchadar-UP	Medium	Light green	Smooth	Angular	Green	Medium	Entire	clusters	Crowed	White	Medium	Erect	Small
49	Pant Sel-15-1-up	Medium	green	Smooth	Angular	Green	Medium	Entire	Solitary	Crowed	White	Medium	Semi erect	Small
50	PC-2006-UP-3	Medium	Light green	Smooth	Angular	Green	Small	Entire	Solitary	Crowed	White	Long	Semi erect	Medium
51	SKJ-UP-D.f.	Medium	Green	Pubescent	Angular	Green	Small	Entire	Solitary	Crowed	White	Medium	Erect	Medium
52	PC-2006-UP-12	Medium	Green	Smooth	Angular	Green	Medium	Wavy	Solitary	Crowed	White	Medium	Pendulous	Medium
53	PC-1-20-UP	Tall	Green	Smooth	Round	Green	Medium	Entire	Solitary	Crowed	White	Short	Erect	Medium
54	PC-2-UP	Tall	Green	Pubescent	Angular	Dark Green	Small	Entire	Solitary	Crowed	White	Medium	Erect	Small
55	PC-2-1-UP-D-f	Tall	Light green	Smooth	Angular	Light Green	Large	Entire	Solitary	Crowed	White	Medium	Pendulous	Medium
56	PC-7-1-2-UP	Tall	Light green	Smooth	Angular	Dark Green	Medium	Entire	Solitary	Crowed	White	Medium	Pendulous	Medium
57	Pant Sel-50-SP	Medium	Green	Smooth	Angular	Dark Green	Small	Entire	Solitary	Crowed	White	Short	Erect	Small
58	AC-510	Medium	Green	Smooth	Round	Dark Green	Medium	Entire	Solitary	Crowed	White	Medium	Pendulous	Medium
59	Israil-2003	Medium	Light green	Smooth	Angular	Dark Green	Medium	Entire	Solitary	Crowed	White	Short	Pendulous	Medium
60	PC-2057-b	Dwarf	Light green	Smooth	Angular	Dark Green	medium	Entire	Solitary	Crowed	White	Medium	Pendulous	Small
61	Ec-519637	Tall	Green	Smooth	Round	Dark Green	Medium	Entire	Solitary	Crowed	White	Medium	Pendulous	Medium
62	Pant C-2 (p)	Tall	Light green	Smooth	Angular	Dark Green	Small	Entire	Solitary	Crowed	White	Short	Pendulous	Small
63	EC-519625-1	Medium	Light green	Smooth	Angular	Dark Green	Small	Entire	Solitary	Crowed	White	Medium	Pendulous	Medium
64	Pant Chilli-12	Medium	dark green	Smooth	Angular	Dark Green	Medium	Entire	Solitary	Crowed	White	Long	Pendulous	Medium
65	EC-519636-1	Dwarf	Light green	Smooth	Angular	Green	Medium	Wavy	Solitary	Crowed	White	Short	Pendulous	Large
66	EC-519636-1-1	Medium	green	Smooth	Angular	Light Green	Small	Entire	Solitary	Crowed	White	Medium	Pendulous	Medium
67	Pant Chilli -25	Tall	Light green	Pubescent	Angular	Dark Green	Medium	Entire	Solitary	Crowed	White	Long	Pendulous	Large
68	EC-519636-2	Medium	dark green	Smooth	Angular	Green	Small	Entire	Solitary	Crowed	White	Medium	Pendulous	Medium
69	EC-519625	Medium	Dark green	Smooth	Angular	Dark Green	Medium	Entire	Solitary	Crowed	White	Short	Pendulous	Medium
70	Pant-Sel -7-1-2	Dwarf	Light green	Smooth	Angular	Dark Green	Medium	Entire	Solitary	Crowed	White	Medium	Pendulous	Medium
71	Pant-Sel -13	Medium	Light green	Pubescent	Angular	Green	Medium	Entire	Solitary	Crowed	White	Short	Pendulous	Small

72	Pant-Sel -13-2	Tall	Light green	Smooth	Round	Green	Medium	Entire	Solitary	Crowed	White	Medium	Pendulous	Small
73	Pant-Sel-15	Tall	Green	Pubescen	Angular	Green	Medium	Entire	Solitary	Crowed	White	Medium	Pendulous	Medium
74	Pant -Sel- 42	Medium	Light green	Smooth	Round	Green	Small	Entire	Solitary	Crowed	White	Medium	Semi erect	Medium
75	Pant Chillli- 3	Medium	Light green	Smooth	Round	Dark Green	Medium	Entire	Solitary	Crowed	White	Medium	Pendulous	Medium
76	Pant Sel -18	Medium	Light green	Smooth	Angular	Green	Large	Entire	Solitary	Crowed	White	Short	Pendulous	Medium
77	SKJ-2004-2	Tall	Light green	Round	Angular	Purple dark Green	medium	Entire	Solitary	Crowed	White	Medium	Pendulous	Small
78	KA-2	Dwarf	Light green	Smooth	Angular	Dark Green	Small	Entire	Solitary	Crowed	White	Short	Pendulous	Medium
79	Pant-Sel-31-1	Medium	Light green	Smooth	Angular	Green	Small	Entire	Solitary	Crowed	White	Short	Pendulous	Medium
80	IC-292480	Tall	Green	Smooth	Angular	Light Green	medium	Wavy	Solitary	Crowed	White	Short	Pendulous	Large
81	IC-422010	Tall	Green	Smooth	Angular	Green	medium	Entire	Solitary	Crowed	White	Long	Erect	Medium
82	IC-266832	Tall	Light green	Pubescent	Angular	Green	Medium	Entire	Solitary	Crowed	White	Short	Semi erect	Medium
83	IC-383136	Tall	Purple	Pubescent	Angular	Dark Green	Medium	Entire	Solitary	Crowed	White	Medium	Pendulous	Small
84	IC-313389	Tall	Green	Smooth	Angular	Dark Green	Medium	Entire	Solitary	Crowed	White	Medium	Pendulous	Small
85	IC-276575	Tall	Purple	Smooth	Angular	Green	Small	Entire	Solitary	Crowed	Purple	Medium	Semi erect	Small
86	IC-398082	Tall	Green	Smooth	Angular	Green	medium	Entire	solitary	Crowed	White	Medium	Pendulous	Small
87	IC-368781	Medium	Light green	Smooth	Angular	Dark Green	medium	Entire	Solitary	Crowed	White	Long	Erect	Medium
88	AC-800-2	Medium	Light green	Smooth	Round	Dark Green	Medium	Entire	Solitary	Crowed	Purple	Long	Erect	Medium
89	AC-800-3	Medium	Purple	Smooth	Angular	Dark Green	Medium	Entire	Solitary	Crowed	Purple	Medium	Erect	Small
90	AC-800-4	Dwarf	Dark green	Smooth	Angular	Dark Green	medium	Entire	Solitary	Crowed	Purple	Medium	Erect	Small
91	Pant C-1(check)	Medium	Light green	Pubescent	Angular	Dark Green	Small	Entire	Clusters	Crowed	White	Short	Erect	Small
92	JCA-283(check)	Medium	Light green	Pubescent	Angular	Dark Green	Medium	Wavy	Solitary	Crowed	White	Medium	Pendulous	Medium
93	LCA 206(check)	Tall	Light green	Smooth	Angular	Light Green	Small	Wavy	Solitary	Crowed	White	Medium	Pendulous	Medium

Table 4.1: Contd...

		Fruit	Fruit	Fruit base	Fruit colour	Fruit	Flesiness of	Pericarp	Seediness	Pungency	Fruit shape	Seed size
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S. No.	Genotype	surface	tip		(Immature)	colour (Mature)	pericarp	Thicknes s				
1	Utkal yellow	Smooth	Pointed	Bulging	Yellow	Red	Non fleshy	Thin	Moderate	Moderate	Cylindrical	Medium
2	PC- 56	Smooth	Pointed	Non-bulging	Green	Red	Non fleshy	Medium	Moderate	High	Cylindrical	Large
3	Selection - 11	Smooth	Blunt	Non-bulging	Light green	Red	Non fleshy	Medium	Moderate	Moderate	Cylindrical	Medium
4	HSHP -1111	Wrinkled	Pointed	Bulging	Light green	Red	Non fleshy	Medium	Moderate	Mild	Cylindrical	Medium
5	HSHP-154	Wrinkled	Pointed	Bulging	Light green	Red	Non fleshy	Medium	High	Moderate	Cylindrical	Large
6	Pant Chilli-7	Wrinkled	Pointed	Bulging	dark green	Red	Non fleshy	Medium	Low	Moderate	Cylindrical	Large
7	HDC-75	Wrinkled	Blunt	Bulging	Dark green	Red	Non fleshy	Medium	Moderate	Moderate	Cylindrical	Medium
8	LCA - 353	Smooth	Blunt	Bulging	Light green	Red	Non fleshy	Medium	Moderate	Mild	Cylindrical	Medium
9	DCL- 352	Wrinkled	Pointed	Non-bulging	Light green	Red	Non fleshy	Medium	Moderate	Moderate	Cylindrical	Large
10	DCL- 524	Smooth	Blunted	Bulging	Light green	Red	Non fleshy	Medium	High	Moderate	Cylindrical	Medium
11	DLC- 1	Wrinkled	Pointed	Non-bulging	Light green	Red	Non fleshy	Medium	Moderate	Moderate	Cylindrical	Medium
12	DSC- 2	Wrinkled	Pointed	Non-bulging	Light green	Red	Non fleshy	Medium	Moderate	Moderate	Cylindrical	Medium
13	Pant Chilli- 6	Wrinkled	Pointed	Bulging	Light green	Red	Non fleshy	Medium	Moderate	Moderate	Cylindrical	Medium
14	Indra Chilli	Wrinkled	Pointed	Bulging	Light green	Red	Non fleshy	Medium	Moderate	Moderate	Cylindrical	Medium
15	Ajeet- 3	Wrinkled	Pointed	Non bulging	Light green	Red	Non fleshy	medium	Moderate	Moderate	Cylindrical	Medium
16	BC- 25	Smooth	Pointed	Bulging	Light green	Red	Non fleshy	Medium	Moderate	High	Cylindrical	Medium
17	BC-40-2	Wrinkled	Pointed	Bulging	Light green	Red	Non fleshy	Medium	Moderate	Moderate	Cylindrical	Medium
18	ACS - 2002 - 6	Wrinkled	Blunt	Bulging	Light green	Red	Non fleshy	Medium	Moderate	Moderate	Cylindrical	Medium
19	F- 112 -5-83	Wrinkled	Pointed	Bulging	Light green	Red	Non fleshy	Medium	Moderate	Moderate	Cylindrical	Medium
20	SKAU-101	Wrinkled	Pointed	Bulging	Light green	Red	Non fleshy	medium	Moderate	Moderate	Cylindrical	Medium
21	KCS- 2013	Wrinkled	Pointed	Bulging	Light green	Red	Non fleshy	Medium	Moderate	Moderate	Cylindrical	Medium
22	CO-4	Wrinkled	Blunt	Non-bulging	Light green	Red	Non fleshy	Medium	Moderate	High	Cylindrical	Medium

23	PC-2057	Wrinkled	Pointed	Bulging	Light green	Red	Non fleshy	Medium	Moderate	Moderate	Cylindrical	Medium
24	PC-2062	Wrinkled	Pointed	Non-bulging	Light green	Red	Non fleshy	Medium	Low	Moderate	Cylindrical	Medium
25	PC-2064	Smooth	Pointed	Bulging	Dark green	Red	Non fleshy	Medium	High	Moderate	Cylindrical	Medium
26	Pant Chilli-4	Wrinkled	Pointed	Non-bulging	Light green	Red	Non fleshy	Thin	Moderate	Moderate	Cylindrical	Medium
27	Indo Sem Yeda	Wrinkled	Pointed	Bulging	Light green	Red	Non fleshy	Thick	Low	Moderate	Cylindrical	Medium
28	Indo Sem Dona	Wrinkled	Pointed	Bulging	Light green	Red	Non fleshy	Thin	Moderate	Moderate	Cylindrical	Medium
29	PC- 2005-6-P	Wrinkled	Pointed	Bulging	Light green	Red	Non fleshy	Thin	Moderate	Moderate	Cylindrical	Medium
30	PC-2006-B	Wrinkled	Pointed	Bulging	Light green	Red	Non fleshy	Thin	High	High	Cylindrical	large
31	Pant Chilli-10	Wrinkled	Pointed	Non-bulging	Light green	Red	Non fleshy	Medium	Moderate	Moderate	Cylindrical	Medium
32	P.J- Sel -1	Wrinkled	Pointed	Bulging	Dark green	Red	Non fleshy	Medium	Moderate	Mild	Cylindrical	Medium
33	PC-2006-50	Wrinkled	Pointed	Non-bulging	Light green	Red	Non fleshy	Medium	Moderate	Moderate	Cylindrical	Medium
34	PC-2006-2	Wrinkled	Pointed	Bulging	Light green	Red	Non fleshy	Medium	Low	High	Cylindrical	Medium
35	Pc-7-1-2-1	Wrinkled	Blunt	Bulging	Light green	Red	Non fleshy	Thin	Moderate	High	Cylindrical	Large
36	SKJ-UP-2 -Sel	Wrinkled	Pointed	Non-bulging	Light green	Red	Non fleshy	Medium	Moderate	Moderate	Cylindrical	Medium
37	PC-2004-UP	Wrinkled	Pointed	Non-bulging	Light green	Red	Non fleshy	Thin	Low	High	Cylindrical	Medium
38	EC-519621-UP	Smooth	Pointed	Non-bulging	Dark green	Red	Non fleshy	Medium	High	High	Cylindrical	Medium
39	EC-519636-D-UP	Wrinkled	Pointed	Non-bulging	Light green	Red	Non fleshy	Thin	Low	Mild	Cylindrical	Medium
40	EC-519636-UP	Wrinkled	Blunt	Non-bulging	Light green	Red	Non fleshy	Medium	Moderate	Moderate	Cylindrical	Medium
41	EC-519640	Smooth	Blunt	Non-bulging	Light green	Red	Fleshy	Medium	Low	Mild	Cylindrical	Medium
42	Pant Guchadar-P	Wrinkled	Pointed	Bulging	Light green	Red	Non fleshy	Medium	Low	Moderate	Cylindrical	Medium
43	PC-2004-UP-S.P.	Smooth	Pointed	Bulging	Light green	Red	Non fleshy	Thin	High	Moderate	Cylindrical	Medium
44	PC-7-1	Smooth	Pointed	Non-bulging	Light green	Red	Non fleshy	Thin	Low	Moderate	Cylindrical	Medium
45	PC-2006-UP-5	Smooth	Blunt	Non-bulging	Light green	Red	Non fleshy	Medium	Moderate	High	Cylindrical	Medium
46	PC-2004-UP-13-1	Wrinkled	pointed	Bulging	Light green	Red	Non fleshy	Thin	Low	Mild	Cylindrical	Medium
47	PC-2004-UP-13-2	Wrinkled	Pointed	Non-bulging	Light green	Red	Non fleshy	Thin	Low	Moderate	Cylindrical	Medium

48	Pant Guchadar-UP	Wrinkled	Pointed	Bulging	Light green	Red	Non fleshy	Medium	Low	Moderate	Cylindrical	Medium
49	Pant Sel-15-1-up	Wrinkled	Pointed	Non-Bulging	Light green	Red	Non fleshy	Thin	High	Moderate	Cylindrical	Medium
50	PC-2006-UP-3	Smooth	Pointed	Bulging	Light green	Red	Non fleshy	Medium	High	High	Cylindrical	Medium
51	SKJ-UP-D.f.	Wrinkled	Blunt	Bulging	Light green	Red	Non fleshy	Thin	High	Moderate	Cylindrical	Medium
52	PC-2006-UP-12	Smooth	Pointed	Non-bulging	Light green	Red	Non fleshy	Medium	Low	High	Cylindrical	Medium
53	PC-1-20-UP	Smooth	Pointed	Non-bulging	Light green	Red	Non fleshy	Medium	Moderate	Moderate	Cylindrical	Medium
54	PC-2-UP	Wrinkled	Pointed	Non-bulging	Light green	Red	Non fleshy	Thin	Low	Moderate	Cylindrical	Medium
55	PC-2-1-UP-D-f	Wrinkled	Pointed	Non-bulging	Light green	Red	Non fleshy	Medium	Low	Moderate	Cylindrical	Medium
56	PC-7-1-2-UP	Smooth	Blunt	Bulging	Light green	Red	Non fleshy	Medium	Low	Moderate	Cylindrical	Medium
57	Pant Sel-50-SP	Wrinkled	Pointed	Non-bulging	Light green	Red	Non fleshy	Medium	High	High	Cylindrical	Medium
58	AC-510	Smooth	Pointed	Bulging	Light green	Red	Non fleshy	Medium	Moderate	Moderate	Cylindrical	Medium
59	Israil-2003	Wrinkled	Pointed	Bulging	Dark green	Red	Non fleshy	Medium	Moderate	Mild	Cylindrical	Medium
60	PC-2057-b	Wrinkled	Blunt	Bulging	Light green	Red	Non fleshy	Medium	Moderate	Moderate	Cylindrical	Medium
61	Ec-519637	Wrinkled	Pointed	Bulging	Light green	Red	Fleshy	Thin	Low	High	Cylindrical	Medium
62	Pant C-2 (p)	Wrinkled	Pointed	Bulging	Light green	Red	Non fleshy	Thin	Low	High	Cylindrical	Medium
63	EC-519625-1	Wrinkled	Blunt	Bulging	Light green	Red	Non fleshy	Medium	Moderate	High	Cylindrical	Medium
64	Pant Chilli-12	Wrinkled	Pointed	Bulging	dark green	Red	Non fleshy	Medium	Moderate	Moderate	Cylindrical	Medium
65	EC-519636-1	Smooth	Blunt	Bulging	Yellow	red	Non fleshy	Thick	Low	Mild	Cylindrical	Medium
66	EC-519636-1-1	Smooth	Pointed	Non-bulging	Light green	Red	Non fleshy	Medium	Moderate	Moderate	Cylindrical	Medium
67	Pant Chilli -25	Wrinkled	Pointed	Bulging	Dark green	Red	Non fleshy	Medium	Low	Moderate	Cylindrical	Medium
68	EC-519636-2	Wrinkled	Pointed	Non-bulging	Light green	Red	Non fleshy	Medium	Low	High	Cylindrical	Medium
69	EC-519625	Smooth	Pointed	Bulging	Light green	Red	Fleshy	Thin	Moderate	Mild	Cylindrical	Medium
70	Pant-Sel -7-1-2	Smooth	Blunt	Bulging	Light green	Red	Non fleshy	Thin	High	High	Cylindrical	Large
71	Pant-Sel -13	Wrinkled	Blunt	Non-bulging	Light green	Red	Non fleshy	Thin	High	Moderate	Cylindrical	Medium
72	Pant-Sel -13-2	Wrinkled	Pointed	Non-bulging	Light green	Red	Non fleshy	Thin	Moderate	High	Cylindrical	Medium

73	Pant-Sel-15	Wrinkled	Pointed	Bulging	Light green	Red	Non fleshy	Thin	Moderate	Mild	Cylindrical	Medium
74	Pant -Sel-42	Smooth	Pointed	Bulging	Light green	Red	Non fleshy	Thin	Moderate	Moderate	Cylindrical	Medium
75	Pant Chilli- 3	Wrinkled	Pointed	Bulging	Dark green	Red	Non fleshy	Thin	High	Moderate	Cylindrical	Medium
76	Pant Sel -18	Wrinkled	Pointed	Bulging	green	Red	Non fleshy	Medium	Moderate	High	Cylindrical	Medium
77	SKJ-2004-2	Wrinkled	Blunt	Bulging	Light green	Red	Non fleshy	Medium	Moderate	High	Cylindrical	Medium
78	KA-2	Smooth	Pointed	Bulging	Dark green	Red	Non fleshy	Medium	Low	High	Cylindrical	Medium
79	Pant-Sel-31-1	Wrinkled	Blunt	Bulging	Light green	Red	Non fleshy	Medium	Moderate	Moderate	Cylindrical	large
80	IC-292480	Wrinkled	Pointed	Non-bulging	Light green	Red	Non fleshy	Thin	High	Moderate	Cylindrical	Medium
81	IC-422010	Wrinkled	Pointed	Bulging	Light green	Red	Non fleshy	Thin	High	Moderate	Cylindrical	Medium
82	IC-266832	Wrinkled	Pointed	Bulging	Light green	Red	Non fleshy	Thin	Moderate	Moderate	Cylindrical	Medium
83	IC-383136	Wrinkled	Pointed	Non-bulging	Light green	Red	Non fleshy	Thin	Moderate	Moderate	Cylindrical	Medium
84	IC-313389	Wrinkled	Blunt	Non-Bulging	Light green	Red	Non fleshy	Thin	Low	Moderate	Cylindrical	Medium
85	IC-276575	Wrinkled	Pointed	Bulging	Deep purple	Red	Non fleshy	Thin	Moderate	High	Cylindrical	Medium
86	IC-398082	Wrinkled	Blunt	Non-Bulging	Light green	Red	Non fleshy	Medium	Low	Mild	Cylindrical	Medium
87	IC-368781	Wrinkled	Pointed	Non-bulging	Light green	Red	Non fleshy	Thin	High	Moderate	Cylindrical	large
88	AC-800-2	Smooth	Pointed	Bulging	Purple	Red	Non fleshy	Medium	Low	Moderate	Cylindrical	Medium
89	AC-800-3	Wrinkled	Blunt	Non-Bulging	Purple	Red	Fleshy	Medium	Moderate	Moderate	Oval	Medium
90	AC-800-4	Smooth	Pointed	Non-Bulging	Deep Purple	Red	Non fleshy	Thin	Low	Moderate	Cylindrical	Medium
91	Pant C-1(check)	Wrinkled	Pointed	Non-bulging	Light green	Red	Non fleshy	Thin	High	Moderate	Cylindrical	Medium
92	JCA-283(check)	Wrinkled	Pointed	Non-bulging	Light green	Red	Non fleshy	Medium	Moderate	Moderate	Cylindrical	Large
93	LCA 206(check)	Wrinkled	Pointed	Non-bulging	Light green	Red	Non fleshy	Medium	Moderate	Moderate	Cylindrical	Medium

#### 4.1.4 Stem type

Out of ninety three genotypes of chilli, seven genotypes namely, PC-1-20-UP, AC-510, EC-519637, Pant Sel-13-2, Pant Sel-42, Pant Chilli-3 and AC-800-2 had round stem where as rest of the chilli genotypes had angular stem.

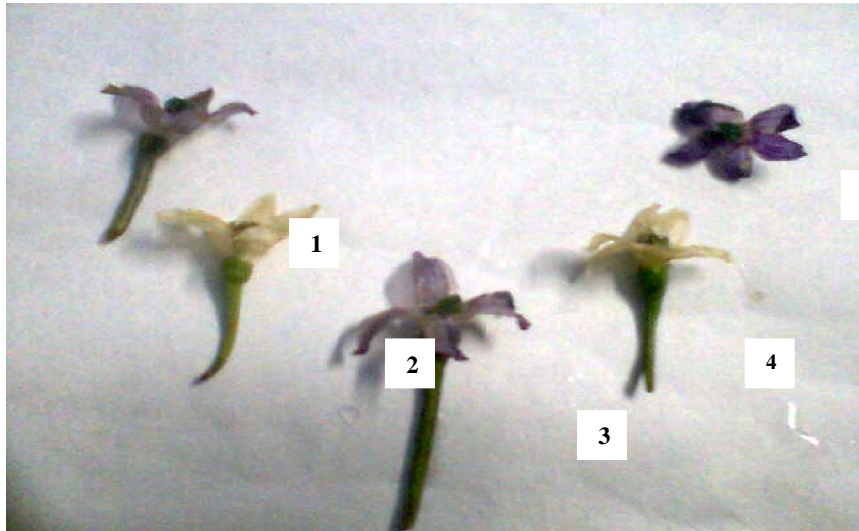
#### 4.1.5 Leaf colour

Among all the chilli genotypes, Utkal Yellow , HDC-75, LCA-353, ACS-2002-6, Indo Sem Yeda, SKJ-UP-2-Sel, PC-2-1-UP-DF, EC-519636-1-1, IC-292480 and LCA -206 had light green colour and PC-56, DCL-352, DCL-524, Pant Chilli-6, KCS-2013, PC-2057, PC-2064, Pant Chilli-10, PC-2006-50, PC-2006-2, PC-7-1-2-1, PC-2004-UP, EC-519636-UP, EC-519640, Pant Guchhedar-P , PC-2004-UP-SP, PC-2006-UP-5, PC-2004-UP-13-1, PC-2004-UP-13-2, PC-2-UP, PC-7-1-2-UP, Pant Sel-50-SP, AC-510, Israil-2003, PC-2057-b, EC-519637, Pant C-2(P), EC-519625-1, Pant Chilli-12, Pant Chilli-25, EC-519625, Pant Sel-7-1-2, Pant Chilli-3,KA-2, IC-383136, IC-313389,IC-368781, AC-800-2,AC-800-3, AC-800-4Pant C-1 and JCA-283 had dark green leaf colour and SKJ-2004-2 had dark purple green leaf colour and remaining chilli genotypes had green colour leaf.

#### 4.1.6 Leaf size

Out of ninety three chilli genotypes, Selection -11, HSHP-154, LCA -353, DCL-524,Ajeet -3, BC-25, ACS-2002-6,PC-2062, PC-2064, Indo Sem Dona, PC-2005-6-P, PC-2006B, SKJ-UP-2-Sel, EC-919621-

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1. Light purple colour in AC-800-2
2. White colour in Pant C-1
3. Light purple colour in AC-800-3
4. Light yellow colour in Utkal Yellow
5. Dark purple colour in AC-800-4



6. White colour flower in JCA-283
7. Light purple colour flower in IC-276575

**Fig. 4.2- Variation in flower colour**

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**DCL-1**  
(*Capcicum frutescence*)



**Pant Chilli -10**



**Pant C-1**



**SKJ-UP-DF**



**AC-800-2**

**Fig no.4.3- Fruit orientation in different genotypes (Erect)**

UP, EC-919640, PC-2004-UP-SP, PC-2004-UP-13-1, PC-2006-UP-3, SKJ-UP-DF, PC-2-UP, Pant Sel- 50- SP, Pant C -2 (P), EC-519625-1 , EC-519636-1-1, EC-519636-2, Pant Sel-42,KA-2, Pant Sel-31-1 , IC-276575, Pant C-1 and LCA-206 had small size of leaf where as DCL-352,DLC-1, Indra Chilli, Pant Chilli-10, Pant Guchhedar-P, Pant C -1 , PC-2004-UP-13-2,PC-2-1-UP-DF and Pant Sel- 18 had large leaf size. Except above mention chilli genotypes rest of the genotypes had medium size of leaf.

#### 4.1.7 Leaf margin

Among all the chilli genotypes, Utkal Yellow, PC-56, HSHP-1111, DCL-524, F-112-5-83, PC-2057, PC-2062, PC-2006-UP-12, EC-519636-1, IC-292480, JCA-283 and LCA-206 had wavy leaf margin where as rest of the chilli genotypes had entire leaf margin.

#### 4.1.8 Reproductive characters

##### Flower characters

Cluster type inflorescence was observed in Indra Chilli, PJ-Sel-1, Pant Guchhedar-P, Pant Guchhedar-UP and Pant C -1 where as all the other genotypes possessed solitary inflorescence. All the genotypes had white corolla colour except IC 276575, AC-800-2, AC-800-3 and AC-800-4 because IC 276575, AC-800-2, AC-800-3, and AC-800-4 genotypes had purple corolla colour (Flg 4.2). Calyx was found loose in DSC-2, Indra Chilli and Ajeet-3 where as rest of the other genotypes had crowded type calyx.

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**Pant Chilli-7**



**Pant Chilli-6**



**Selaction-11**



**PC -56**

**Fig no.4.4- Variation in fruit orientation (pendulous)**

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**PC-2057**



**Pant - C-1**



**Pant Chilli-7**



**Pant Chilli-5**



**Pant Chilli-3**



**PC -56**

**Fig – 4.8– Variation in number of fruits**

#### 4.1.9 Fruit characters

##### Fruit position, shape, size and pedicel size

Erect fruit orientation was found in DCL-352, DLC-1, DSC-2, Indra Chilli , PC-7-1-2-1 ,PC-2004-UP, EC-519621-UP,Pant Guchhedar-P, Pant Guchhedar-UP,SKJ-UP-DF, PC-1-20-UP, PC-2-UP, Pant Sel -50-SP, IC -422010, IC-368781, AC-800-2, AC-800-3, AC-800-4 and Pant C -1 (Fig-4.3), where as semi erect fruit orientation was found in Utkal Yellow , Pant Chilli -4, EC-519636-D-UP, EC-519636- UP, PC-2006-UP-5, Pant Sel -15-1-UP, PC-2006-UP-3 , Pant Sel -42,IC-276575, and rest of the genotypes showed pendulous fruiting habit (Fig -4.4).

Fruit shape was found oval in AC-800-3 and obovate fruit shape found only in EC-519625 Where as oblong fruit shape was found only in EC-519640 and rest of the genotypes had cylindrical fruit shape.

Large fruit size was found in Selection-11, Pant Chilli-7, DCL-524, Pant Chilli-6, BC-25, F-112-5-83 , SKAU-101, Indo Sem Yeda, SKJ-UP-2-Sel, EC-519636-1, Pant Chilli-25 and IC-292480( Fig- 4.5), where as small fruit size was found in Utkal Yellow, DCL-352, DLC-1, DSC-2, Indra Chilli , CO-4,PC-2064, Pant Chilli-4, PC-2005-6-P, Pant Chilli-10, PC-7-1-2-1, PC-2004-UP, EC-519636-UP, Pant Guchhedar-P, Pant Chilli -7-1, PC-2004-UP-13-2 , Pant Guchhedar-UP , Pant Sel-

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15-1-UP, PC-2-UP, Pant Sel-50-SP, PC-2057-B, Pant -C-2(P), Pant Sel-13, Pant Sel-13-2, SKJ-2004-2, IC-383136, IC-313389, IC-276575,



**Cluster types fruiting with purple colour**



**Cluster types fruiting with purple and orange colour**



**Pendent fruiting with solitary**



**Erect fruiting with solitary**

**Fig -4.6- Variation in plants (foliage colour, fruit colour, orientation, fruit stalk length)**

IC-398082, AC-800-3, AC-800-4, Pant C -1 and rest of the chilli genotypes had medium fruit size.

Among all the chilli genotypes , Utkal Yellow, Indo Sem Yeda, PC-2004-UP, PC-2006-UP-3, Pant Chilli-12, Pant Chilli-25, IC-422010, IC-368781, AC-800-2 had large pedicel size where as Pant Chilli-7, DCL-352, DLC-1, Pant Chilli-6, SKAU-101, PC-2062, PJ-Sel-1, SKJ -UP-2- Sel, EC-519636-UP, EC-519640, Pant Chilli-7-1, PC-1-20-UP, Pant Sel-50-SP, Israil -2003, Pant -C-2 (P), EC-519636-1, EC-519625, Pant Sel-18, KA-2, Pant Sel-31-1, IC-292480, IC-266832 and Pant C -1 had short pedicel size and rest of the chilli genotypes had medium fruit size.

#### 4.1.10 Fruit surface, tip and fruit base

The fruit surface were found smooth in Utkal Yellow, PC-56, Selection-11, LCA-353, DCL-524, BC-25, PC-2064, EC-519621-UP, EC-519640, PC-2004-UP-SP, PC-7-1, PC-2006-UP-5, PC-2006-UP-3, PC-2006-UP-12, PC-1-20-UP, PC-7-1-2-UP, AC-510, EC-519636-1, EC-519636-1-1, EC-519625, Pant Sel-7-1-2, Pant Sel-42, KA-2, AC-800-2 and AC-800-4 and rest of the other chilli genotypes had wrinkled fruit surface( Fig – 4.6).

Blunt fruit tip was observed in the Selection-11, HDC-75, LCA-206, DCL-524, ACS-2002-6, CO-4, PC-7-1-2-1, EC-519636-UP, EC-

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519640, PC-2006-UP-5, SKJ –UP-DF, PC-7-1-2-UP, PC-2057-B, EC-519625-1, EC-519636-1, Pant Sel-7-1-2, Pant Sel-13, SKJ –2004-2,



**Fig – 4.6- Variation in fruit colour**



**Fig- 4.4- Variation in size of fruits**

Pant Sel-31-1, IC-313389, IC-398082, AC-800-3, and rest of the other chilli genotypes had pointed fruit tip.

Bulging type fruit base was found in Utkal Yellow, HSHP-1111, HSHP-154, Pant Chilli-7, HDC-75, LCA-353, DCL-524, Pant Chilli-6, Indra Chilli ,BC-25, BC-40-2 , ACS-2002-6, F-112-5-83, SKAU-101, KCS-2013,PC-2057,PC-2064, Indo Sem Yeda, Indo Sem Dona, PC-2005-6-P,PC-2006-B, PJ-Sel-1, PC-2006-2, PC-7-1-2-1, Pant Guchhedar-P, PC-2004-UP-SP, PC-2004-UP-13-1, Pant Guchhedar-UP, PC-2006-UP-3, SKJ-UP-DF, PC-7-1-2-UP, AC-510, Israil-2003, PC-2057-B, EC-919637, Pant C -2 (P), EC-519625-1, Pant Chilli-12, EC-519636-1, Pant Chilli-25,EC-519625, Pant Sel-7-1-2, Pant Sel -15, Pant Sel -42, Pant Chilli-3, , Pant Sel -18, SKJ-2004-2, KA-2, Pant Sel -31-1,IC-422010, IC-266832, IC-276575 and AC-800-2, While remaining genotypes possessed non bulging type fruit base.

#### 4.1.11 Fruit colour, fleshiness and thickness of pericarp

Majority of genotypes had light green to dark green colour of immature fruits except IC-276575, AC-800-2, AC-800-3, AC-800-4 had deep purple colour and Utkal Yellow and EC-519636-1 had yellow colour in immature stage of fruit. The colour of fruits was found red in majority of the genotypes ( Fig – 4.7).

The genotypes were classified with fleshy and non fleshy pericarp. The genotypes, namely EC-519625, EC-519637, EC-519640 and AC-800-

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3 had fleshy pericarp where as other genotypes had non fleshy pericarp.

Thick fruit pericarp was found in Indo Sem Yeda, EC519636-1 and rest of the chilli genotypes had either medium and thin pericarp.

#### 4.1.12 Seed character and Pungency

Out of ninety three chilli genotypes, HSHP-154, DCL-524, PC-2064, PC-2006-B, EC-519621-UP, PC-2004-UP-SP, Pant Sel -15-1-UP, PC-2006-UP-3, SKJ-UP-DF, Pant Sel -50-SP, Pant Sel -7-1-2, Pant Sel -13, Pant Chilli-3, IC-292480, IC-422010, IC-367881, Pant C-1 had high seediness, where as Pant Chilli-7, PC-2062, Indo Sem Yeda, PC-2006-2, PC-2004-UP, EC-519636-D-UP, EC-519640, Pant Guchhedar-P, Pant Chilli-7-1, PC-2004-UP-13-1, PC-2004-UP-13-2, Pant Guchhedar-UP, PC-2006-UP-12, PC-2-UP, PC-2-1-UP-DF, PC-7-1-2-UP, EC-519637, Pant C -2 (P), EC-519636-1, Pant Chilli-25, EC-519636-2, KA-2, IC-313389, IC-398082, AC-800-2, AC-800-4 had low seediness and rest of the genotypes had moderate seediness. While large seed size were found in genotypes PC-56, HSHP-154, Pant Chilli-7, DCL-352, PC-2006-B, PC-7-1-2-1, Pant Sel -7-1-2, Pant Sel -31-1, IC-368781, JCA-283 while other genotypes had medium seed size.

Pungency of fruits were found high in PC-56, BC-25, CO-4, PC-2006-B, PC-2006-2, PC-7-1-2-1, PC-2004-UP, EC-519621-UP, PC-2006-UP-5, PC-2006-UP-3, PC-2006-UP-12, Pant Sel -50-SP, EC-

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919637, Pant C -2 (P), EC-519625-1, Pant Sel-7-1-2, Pant Sel -13-2, Pant Sel -18, SKJ-2004-2, KA-2, IC-276575 where as mild pungency was found in HSHP-1111, LCA-353, PJ-Sel-1, EC-519636-D-UP, EC-519640, PC-2004-UP-13-1, Israil-2003, EC-519636-1, EC-519625, Pant Sel -15, IC-398082, and remaining genotypes had moderate pungency in their fruits.

#### 4.2 Analysis of variance

The analysis of variance was carried out for all the characters in augmented block design and results are presented in table 4.8. The differences among the checks were highly significant for number of fruits/plant, weight of fruits/plant, fruit body length, days to 50 % flowering, root weight, seed weight of 100 g fruit, seed weight /fruit, number of seeds/fruit, seed yield/plant, ascorbic acid content, and total fruit yield, where as significant differences were observed for stem diameter, shoot weight/plant, and seed: husk ratio.

Block effects were highly significant for various characters such as number of fruits/plant, weight of fruits/plant, total fruit yield. On the other hand, significant differences were observed for anthracnose and rest of the other characters namely plant height, stem diameter, number of branches/plant, fruit body length, stalk length, fruit periphery, days to 50 % flowering, days to 50 % ripening, root weight/plant, shoot weight / plant, percent fruit dry weight, seed weight in 100 g of fruits, husk weight in 100 g of fruits, 100 seed

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Table 4.8: Analysis of variance for different characters

Characters	Mean Square		
	Block (5)	Check (2)	Error (10)
Plant height (cm)	107.10	263.09	77.55
Stem diameter (cm)	0.13	0.26*	0.05
No. of Branches Per plant	6.87	9.22	3.73
No of fruits per plant	1023.02**	7880.20**	1000.19
Weight of fruits/plant(g)	2786.30**	21949.92**	452.54
Fruit body length (cm)	0.1998	8.184**	0.229
Fruit stalk length (cm)	0.038	0.087	0.034
Fruit periphery (cm)	0.043	0.089	0.039
Days to 50% Flowering	0.36	17.56**	0.69
Days to 50 % fruit ripening	13.02	102.72	27.66
Root weight (g/p)	22.78	487.32**	14.22
Shoot weight (g/p)	2493.10	22224.92*	3063.33
Per cent fruit Dry weight (%)	12.47	18.36	9.02
Seed weight/100 g fruit	0.218	3.45**	0.249
Husk weight (g)	14.31	24.16	8.55
100 seed weight (mg)	8237.534	4403.50	5980.03
Seed weight/ fruit (mg)	259.97	5475.17**	187.25
No. of seeds/plant	35.17	167.08**	20.934
Seed :husk ratio	0.471	1.32*	0.22
Seed yield per plant (g)	14.71	139.86**	5.093
LCV incidence (%)	49.47	171.01	64.44
Anthracoese (%)	156.34*	5.39	33.52
Incidence of Nematode (%)	18.59	26.12	12.59
Ascorbic acid (mg/100g)	0.0062	31.695**	0.0052
Total fruit yield (q/ha)	446.523**	3517.44**	72.24

\* Significant at 5 % level of significance.

\*\* Significant at 1 % level of significance.

weight, seed weight/ fruit, number of seeds / plant, seed: husk ratio, seed yield /plant, incidence of LCV, anthracnose and nematode, ascorbic acid content were showed non significant differences for block effect. The resulted presented in the table for analysis of variance, showed that there were considerable inherent genetic differences among check cultivars for different characters.

#### 4.3 Estimation of variability

The general mean, range of variation, percent range of variation and phenotypic coefficient of variation (PCV) for different characters are given in table 4.9 while check means and least significant differences are presented in table 4.10, the result obtained for various characters are described as below.

##### Plant height (cm)

Plant height of 90 genotypes ranged from 51.87 to 131.77 cm, with an average of 85.76 cm. however, when calculated in percentage, it ranged from 100.00 to 254.04 with 17.47 percent phenotypic coefficient of variation.

##### Number of branches per plant

Range of variation for this character was 10.44 to 23.61, with an average of 15.81. However, when calculated in percentage, it ranged from 100.00 to 226.15 with 16.99 percent phenotypic coefficient of variation.

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#### Stem diameter (cm)

Stem diameter ranged from 0.75 to 3.01 cm, with an average of 1.77 cm. however, when calculated in percentage, it ranged from 100.00 to 401.6 with 17.91 percent phenotypic coefficient of variation.

#### Shoot weight per plant (g)

Range of variation for this character was 119.49 to 600.46, with an average of 281.64. However, when calculated in percentage it ranged from 100.00 to 502.52, with 35.39 percent phenotypic coefficient of variation.

#### Root weight per plant (g)

Range of variation for this character was 17.68 to 79.13, with an average of 44.60. However, when calculated in percentage, it ranged between 100.00 to 447.57, with 25.79 percent phenotypic coefficient of variation.

#### Days to 50 % flowering

Range of variation for this character was 23.44 to 53.11, with an average of 39.81. However, when calculated in percentage, it varied from 100.00 to 226.58 with 11.43 percent phenotypic coefficient of variation.

#### Days to 50 % ripening

Range of variation for this character was 73.11 to 97.11, with an average of 84.78. However, when calculated in percentage, it ranged from 100.00 to 132.83, with 6.85 percent phenotypic coefficient of variation.

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Table 4.9: General mean, Range of variation, Per cent range of variation, Phenotypic Coefficient of variation for different characters

S. N.	Characters	General mean	Range of variation	Percent range of variation	Phenotypic coefficient of variation (%)
1	Plant height (cm)	85.76	51.87-131.77	100-25404	17.47
2	Stem diameter (cm)	1.774	0.75-3.01	100-401.60	17.91
3	No. of Branches Per plant	15.51	10.44-23.61	100-226.15	16.99
4	No of fruits per plant	106.56	23.31-226.95	100-973.62	37.53
5	Weight of fruits/plant	256.72	79.69-518.58	100-650.75	32.39
6	Fruit body length (cm)	7.601	4.04-13.38	100-331.10	25.37
7	Fruit stalk length (cm)	2.89	1.82-4.28	100-235.16	16.01
8	Fruit periphery (cm)	2.72	1.54-4.79	100-311.04	21.18
9	Days to 50% Flowering	39.81	23.44-53.11	100-226.58	11.43
10	Days to 50 % fruit ripening	84.78	73.11-97.11	100-132.03	6.85
11	Root weight (g/p)	44.60	17.68-79.13	100-447.57	25.79
12	Shoot weight (g/p)	281.63	119.49-600.46	100-502.52	35.34
13	Per cent fruit Dry weight	22.923	13.63-44.27	100-324.79	22.78
14	Seed weight/100 g fruit	6.59	3.67-11.11	100-302.72	21.16
15	Husk weight (g)	16.33	4.68-33.67	100-719.44	28.71
16	100 seed weight (mg)	545.65	208.57-970.34	100-465.23	25.74
17	Seed weight/ fruit (mg)	234.33	115.05-406.45	100-353.28	24.48
18	No. of seeds/plant	44.71	18.72-72.32	100-386.32	25.51
19	Seed :husk ratio	2.537	0.40-4.89	100-1222.5	29.56
20	Seed yield per plant (g)	16.51	5.37-42.81	100-797.21	37.56
21	LCV incidence (%)	17.59	2.19-42.14	100-1924.20	49.93
22	Anthracnose (%)	16.12	2.498-48.68	100-1948.76	46.97
23	Incidence of Nematode (%)	11.08	2.78-20.23	100-727.69	36.78
24	Ascorbic acid (mg/100g)	111.57	35.18-192.56	100-547.36	34.15
25	Total fruit yield (q/ha)	102.69	31.86-207.42	100-651.04	32.39

### Number of fruits per plant

Number of fruits per plant of 90 genotypes of chilli ranged from 23.31 to 226.95, with an average of 106.56. However, when calculated in percentage, it ranged from 100.00 to 973.62 with 37.53 percent phenotypic coefficient of variation.

### Weight of fruits per plant

Weight of fruits per plant of 90 genotypes of chilli ranged from 79.69 to 518.58, with an average of 256.72. However, when calculated in percentage, it ranged from 100.00 to 650.75, with 32.39 percent phenotypic coefficient of variation.

### Fruit body length (cm)

Fruit body length of 90 genotypes of chilli ranged from 4.04 to 13.38 cm, with an average of 7.60 cm. However, when calculated in percentage, it ranged from 100.00 to 331.19, with 25.37 percent phenotypic coefficient of variation.

### Fruit stalk length (cm)

Fruit stalk length ranged from 1.82 to 4.28 cm, with an average of 2.89 cm. However, when calculated in percentage, it ranged from 100.00 to 235.16, with 16.01 percent phenotypic coefficient of variation.

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### Fruit periphery (cm)

Fruit periphery ranged from 1.54 to 4.79 cm, with an average of 2.72 cm. However, when calculated in percentage, it ranged between 100.00 to 311.04, with 21.18 percent phenotypic coefficient of variation.

### Per cent fruit dry weight

Percent fruit dry weight of 90 chilli genotypes ranged from 13.63 to 44.27, with an average of 22.92. However, when calculated in percentage, it ranged from 100.00 to 324.79, with 22.78 percent phenotypic coefficient of variation.

### Seed weight in 100 g of fruits

Seed weight in 100 g of fruits of 90 genotypes of chilli varied from 3.67 to 11.11, with an average of 6.59. However, when calculated in percentage it ranged between 100.00 to 302.72, with 21.16 percent phenotypic coefficient of variation.

### Husk weight

Husk weight of 90 genotypes of chilli ranged from 4.68 to 33.67, with an average of 16.33 however, when calculated in percentage, it ranged from 100.00 to 719.44, with 28.71 percent phenotypic coefficient of variation.

### 100 seed weight (g)

100 Seed weight of 90 genotypes of chilli ranged from 208.57 to 970.34, with an average of 545.65. However, when calculated in percentage, it ranged from 100.00 to 465.23, with 25.74 percent phenotypic coefficient of variation.

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#### Seed weight per fruit (mg)

Seed weight per fruit of 90 genotypes of chilli varied between 115.05 to 406.45, with a mean of 234.33. However, when calculated in percentage it varied from 100.00 to 353.28, with 24.48 percent phenotypic coefficient of variation.

#### Number of seeds per fruit

Number of seeds per fruit of 90 genotypes of chilli ranged between 18.72 to 72.32, with the mean value of 44.71. However, when calculated in percentage, it ranged from 100.00 to 386.32, with 25.51 percent phenotypic coefficient of variation.

#### Seed: husk ratio

Seed: husk ratio of 90 genotypes of chilli ranged from 0.40 to 4.89, with an average of 2.54. However, when calculated in percentage, it varied between 100.00 to 1222.5, with 29.56 percent phenotypic coefficient of variation.

#### Seed yield per plant (g)

Seed yield per plant of 90 genotypes of chilli ranged between 5.37 to 42.81, with mean value of 16.51. However, when calculated in percentage, it varied between 100.00 to 797.21, with 37.66 percent phenotypic coefficient of variation.

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### Total fruit yield (q/ha)

Total fruit yield (q/ha) of 90 genotypes of chilli ranged from 31.86 to 207.42 q/ha, with an average of 102.69 q/ha. However, when calculated in percentage, it varied between 100.00 to 651.04, with 32.39 percent phenotypic coefficient of variation.

### Ascorbic acid content (vitamin 'C' mg/100 g of edible part)

The mean value of Ascorbic acid (vitamin 'C') was 111.57, while it ranged between 35.18 to 192.56. However, when calculated in percentage, it varied from 100.00 to 547.36, with 34.15 percent phenotypic coefficient of variation.

### Incidence of Leaf Curl Virus (%)

LCV incidence of 90 genotypes of chilli ranged from 2.19 to 42.14, with an average of 17.59. However, when calculated in percentage, it ranged from 100.00 to 1924.20, with 49.93 percent phenotypic coefficient of variation.

### Incidence of Anthracnose (%)

Anthracnose incidence of 90 genotypes of chilli ranged from 2.49 to 48.68, with an average of 16.12. However, when calculated in percentage, it varied from 100.00 to 1948.76, with 46.97 percent phenotypic coefficient of variation.

### Incidence of Nematodes (%)

Percent incidence of Nematode of 90 genotypes of chilli ranged from 2.78 to 20.23, with an average of 11.08. However, when calculated

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**Least significant differences in chilli genotypes**

Sl. No.	Characters	Genotypes (90)		Checks (3)				LSD			
		Mean	Range	1	2	3	CV (%)	CM	AVSB	AVDB	AVAC
1	Plant height (cm)	85.76	51.87-131.77	84.11	91.81	97.29	9.27	11.33	27.74	32.03	24.47
2	Stem diameter (cm)	<b>1.774</b>	<b>0.75-3.01</b>	<b>1.86</b>	<b>1.95</b>	<b>1.83</b>	<b>11.65</b>	<b>0.28</b>	<b>0.69</b>	<b>0.79</b>	<b>0.61</b>
3	No. of Branches Per plant	<b>15.81</b>	<b>10.44-23.61</b>	<b>16.68</b>	<b>18.10</b>	<b>19.04</b>	<b>10.79</b>	<b>2.48</b>	<b>6.09</b>	<b>7.03</b>	<b>5.37</b>
4	No of fruits per plant	<b>106.56</b>	<b>23.31-226.95</b>	<b>154.997</b>	<b>103.27</b>	<b>173.11</b>	<b>6.96</b>	<b>12.86</b>	<b>31.50</b>	<b>36.38</b>	<b>27.78</b>
5	Weight of fruits/plant	<b>256.72</b>	<b>79.69-518.58</b>	<b>284.33</b>	<b>216.34</b>	<b>336.98</b>	<b>7.62</b>	<b>27.36</b>	<b>67.01</b>	<b>77.38</b>	<b>59.11</b>
6	Fruit body length (cm)	<b>7.601</b>	<b>4.04-13.38</b>	<b>4.79</b>	<b>7.00</b>	<b>6.54</b>	<b>7.83</b>	<b>0.62</b>	<b>1.51</b>	<b>1.74</b>	<b>1.33</b>
7	Fruit stalk length (cm)	<b>2.89</b>	<b>1.82-4.28</b>	<b>2.62</b>	<b>2.55</b>	<b>2.78</b>	<b>7.33</b>	<b>0.25</b>	<b>0.61</b>	<b>0.71</b>	<b>0.54</b>
8	Fruit periphery (cm)	<b>2.72</b>	<b>1.54-4.79</b>	<b>2.53</b>	<b>2.29</b>	<b>2.39</b>	<b>8.28</b>	<b>0.26</b>	<b>0.63</b>	<b>0.72</b>	<b>0.55</b>
9	Days to 50% Flowering	<b>39.81</b>	<b>23.44-53.11</b>	<b>41.67</b>	<b>40.67</b>	<b>44</b>	<b>1.97</b>	<b>1.07</b>	<b>2.61</b>	<b>3.02</b>	<b>2.31</b>
10	Days to 50 % fruit ripening	<b>84.78</b>	<b>73.11-97.11</b>	<b>87.17</b>	<b>79.17</b>	<b>85.00</b>	<b>6.28</b>	<b>6.76</b>	<b>16.57</b>	<b>19.13</b>	<b>14.61</b>
11	Root weight (g/p)	<b>44.60</b>	<b>17.68-79.13</b>	<b>40.43</b>	<b>54.71</b>	<b>57.10</b>	<b>7.43</b>	<b>4.85</b>	<b>11.88</b>	<b>13.72</b>	<b>10.48</b>
12	Shoot weight (g/p)	<b>281.64</b>	<b>119.49-600.46</b>	<b>274.53</b>	<b>384.60</b>	<b>284.55</b>	<b>17.595</b>	<b>71.18</b>	<b>174.35</b>	<b>201.32</b>	<b>153.76</b>
13	Percent fruit Dry weight	<b>22.92</b>	<b>13.63-44.27</b>	<b>22.88</b>	<b>22.05</b>	<b>25.41</b>	<b>12.81</b>	<b>3.86</b>	<b>9.46</b>	<b>10.92</b>	<b>8.34</b>
14	Seed weight/100 g fruit	<b>6.59</b>	<b>3.67-11.11</b>	<b>7.78</b>	<b>6.39</b>	<b>6.57</b>	<b>7.22</b>	<b>0.64</b>	<b>1.57</b>	<b>1.82</b>	<b>1.39</b>
15	Husk weight (g)	<b>16.33</b>	<b>4.68-33.67</b>	<b>15.09</b>	<b>15.71</b>	<b>18.84</b>	<b>17.67</b>	<b>3.76</b>	<b>9.21</b>	<b>10.64</b>	<b>8.12</b>
16	100 seed weight (mg)	<b>545.65</b>	<b>208.57-970.34</b>	<b>578.795</b>	<b>627.09</b>	<b>581.68</b>	<b>12.98</b>	<b>99.45</b>	<b>243.60</b>	<b>281.29</b>	<b>241.84</b>
17	Seed weight/ fruit (mg)	<b>234.33</b>	<b>115.05-406.45</b>	<b>260.23</b>	<b>230.10</b>	<b>199.82</b>	<b>5.95</b>	<b>17.597</b>	<b>43.11</b>	<b>49.77</b>	<b>38.02</b>
18	No. of seeds/plant	<b>44.71</b>	<b>18.72-72.32</b>	<b>45.23</b>	<b>36.83</b>	<b>35.50</b>	<b>11.68</b>	<b>5.88</b>	<b>14.41</b>	<b>16.64</b>	<b>12.71</b>
19	Seed :husk ratio	<b>2.54</b>	<b>0.40-4.89</b>	<b>1.94</b>	<b>2.48</b>	<b>2.87</b>	<b>19.21</b>	<b>0.60</b>	<b>1.47</b>	<b>1.699</b>	<b>1.298</b>
20	Seed yield per plant (g)	<b>16.51</b>	<b>5.37-42.81</b>	<b>22.23</b>	<b>13.78</b>	<b>22.06</b>	<b>11.68</b>	<b>2.90</b>	<b>7.11</b>	<b>8.21</b>	<b>6.27</b>
21	LCV incidence (%)	<b>17.59</b>	<b>2.19-42.14</b>	<b>15.35</b>	<b>19.47</b>	<b>8.88</b>	<b>55.11</b>	<b>10.32</b>	<b>25.29</b>	<b>29.199</b>	<b>22.30</b>
22	Anthracnose (%)	<b>16.12</b>	<b>2.498-48.68</b>	<b>14.64</b>	<b>12.76</b>	<b>13.90</b>	<b>42.05</b>	<b>7.45</b>	<b>18.24</b>	<b>21.06</b>	<b>16.09</b>
23	Incidence of Nematode (%)	<b>11.08</b>	<b>2.78-20.23</b>	<b>11.98</b>	<b>9.196</b>	<b>7.90</b>	<b>36.61</b>	<b>4.56</b>	<b>11.18</b>	<b>12.91</b>	<b>9.86</b>
24	Ascorbic acid (mg/100g)	<b>111.57</b>	<b>35.18-192.56</b>	<b>141.57</b>	<b>145.83</b>	<b>142.20</b>	<b>0.50</b>	<b>0.93</b>	<b>0.23</b>	<b>0.26</b>	<b>0.20</b>
25	Total fruit yield (q/ha)	<b>102.69</b>	<b>31.86-207.42</b>	<b>113.73</b>	<b>86.50</b>	<b>134.79</b>	<b>7.61</b>	<b>10.93</b>	<b>26.77</b>	<b>30.92</b>	<b>23.61</b>

**Note: CM-LSD between check mean**

**AVSB – LSD between adjusted mean of two test genotypes in the same block**

**AVDB – LSD between adjusted mean of two test genotypes in the different block**

**AVAC – LSD between adjusted mean of test genotypes against the check mean.**

in percentage, it ranged from 100.00 to 727.69, with 36.78 percent phenotypic coefficient of variation.

#### 4.4 Parameter of variability

The parameter of variability viz, mean range, coefficient of variability at genotypic (GCV), phenotypic (PCV), heritability in broad sense and genetic advance were statistically worked out to facilitate selection for various traits and has been presented in table 4.11:

##### 4.4.1 Coefficient of variation:

Maximum phenotypic variance were observed for incidence of Leaf Curl Virus (49.93), incidence of anthracnose(46.97), seed yield /plant (37.66) , incidence of nematode (36.78), number of fruits /plant (37.53), shoot weight /plant (35.39),ascorbic acid content (34.15), weight of fruits per plant (32.39), fruit yield /plant (32.39), seed: husk ratio (29.56), husk weight (28.71), seed weight /fruit (26.48), 100 seed weight (25.74), root weight /plant (25.79),number of seeds/ fruit (25.51), fruit body length (25.37), per cent fruit dry weight (22.78), seed weight / 100 g. of fruit (21.16) , fruit periphery (21.18), stem diameter (17.91), plant height (17.47), number of branches /plant (16.99) , fruit stalk length (16.01), days to 50 % flowering (11.43) and days to 50 % fruit ripening (6.83).

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Maximum genotypic variances were observed for number of fruits /plant (20.88), shoot weight /plant (13.47), root weight /plant (13.12), seed yield /plant (12.79), ascorbic acid content (12.56), fruit body length (10.05), incidence of anthracnose (9.83), number of branches /plant (8.70), husk weight (7.78), seed weight /fruit (7.69), 100 seed weight (6.48), seed weight / 100 g. of fruits (6.45), seed : husk ratio (5.95), percent fruit dry weight (5.28), fruit stalk length (4.69), plant height (4.28), fruit periphery (4.13), weight of fruits /plant (3.92) fruit yield /plant (3.92), stem diameter (3.44), incidence of Leaf Curl Virus (3.19), incidence of nematode (2.24), days to 50 % flowering (1.89), number of seeds/ fruit (1.19), and days to 50 % fruit ripening (1.18).

High PCV was recorded in the incidence of Leaf Curl Virus, incidence of anthracnose, seed yield /plant, incidence of nematode, number of fruits /plant, shoot weight /plant, ascorbic acid content, weight of fruits per plant, fruit yield /plant where as moderate PCV was recorded seed: husk ratio, husk weight, seed weight /fruit, 100 seed weight, root weight /plant, number of seeds/ fruit, fruit body length, per cent fruit dry weight, seed weight / 100 g. of fruits, fruit periphery, stem diameter, plant height, number of branches /plant, fruit stalk length, days to 50 % flowering, and days to 50 % fruit ripening.

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**Table 4.11: Estimation of Heritability, Genetic advance, genotypic and phenotypic coefficient of variation for different characters**

Characters	General mean	sem ±	Heritability (%)	Genetic advance	Genotypic coefficient of Variation (%)	Phenotypic coefficient of variation (%)
Plant height (cm)	85.76	5.93	6.01	1.85	4.28	17.47
Stem diameter (cm)	1.77	0.13	3.60	0.024	3.44	17.91
No. of Branches Per plant	15.81	0.94	26.23	1.45	8.70	16.99
No of fruits per plant	106.56	13.56	30.97	25.51	20.88	37.53
Weight of fruits/plant	256.72	33.70	1.46	2.50	3.92	32.39
Fruit body length (cm)	7.60	0.72	15.69	0.62	10.05	25.37
Fruit stalk length (cm)	2.89	0.18	8.57	0.08	4.69	16.01
Fruit periphery (cm)	2.72	0.24	3.79	0.05	4.13	21.18
Days to 50% Flowering	39.81	1.88	2.76	0.26	1.89	11.43
Days to 50 % fruit ripening	84.78	2.33	3.00	0.36	1.18	6.83
Root weight (g/p)	44.61	4.04	25.86	6.13	13.12	25.79
Shoot weight (g/p)	281.64	37.62	14.49	29.76	13.47	35.39
Per cent fruit Dry weight	22.92	2.19	5.37	0.58	5.28	22.78
Seed weight/100 g fruit	6.59	0.54	9.29	0.27	6.45	21.16
Husk weight (g)	16.33	1.98	7.34	0.71	7.78	28.71
100 seed weight (mg)	545.65	59.12	6.33	18.32	6.48	25.74
Seed weight/ fruit (mg)	234.33	26.38	8.44	10.78	7.69	26.48
No. of seeds/plant	44.71	4.65	0.22	0.051	1.19	25.51
Seed :husk ratio	25.38	0.31	4.05	0.06	5.95	29.56
Seed yield per plant (g)	16.51	2.39	11.53	1.48	12.79	37.66
LCV incidence (%)	17.59	3.22	0.57	0.08	3.19	49.93
Anthracnose (%)	16.12	3.16	4.38	0.68	9.83	46.97
Incidence of Nematode (%)	11.08	1.67	0.37	0.03	2.24	36.78
Ascorbic acid (mg/100g)	111.57	14.46	13.54	10.62	12.56	34.15
Total fruit yield (q/ha)	102.69	13.48	1.47	1.01	3.92	32.39

Moderate GCV was recorded in the number of fruits /plant ; and lowest GCV was recorded in the shoot weight /plant , root weight /plant , seed yield /plant , ascorbic acid, fruit body length , incidence of anthracnose ,number of branches /plant, husk weight , seed weight /fruit , 100 seed weight, seed weight / 100 g. of fruit weight ,seed : husk ratio , per cent fruit dry weight , fruit stalk length , plant height , fruit periphery , weight of fruits /plant , fruit yield /plant , stem diameter , incidence of nematode , days to 50 % flowering, number of seeds/ fruit , incidence of Leaf Curl Virus , and days to 50 % ripening .

#### 4.4.2 Heritability and genetic advance

To estimate the Heritability (broad sense) and genetic advance are presented in table 4.11. Data indicated that the heritability range was observed from 0.22 % to 30.97 %. Maximum heritability was recorded in number of fruits per plant (30.97). followed by number of branches per plant(26.23), root weight (25.86), fruit body length (15.69), shoot weight (14.49), ascorbic acid content (13.54), seed yield /plant (11.53), seed weight /100 g of fruit (9.29), fruit stalk length (8.57), seed weight /fruit (8.44),husk weight (7.34), 100 seed weight (6.33 ), plant height (6.01), per cent fruit dry weight (5.37), incidence of anthracnose(4.38), seed :husk ratio(4.05), fruit periphery(3.79), stem diameter(3.60), weight of fruits /plant(1.46), fruit yield /plant(1.47),incidence of Leaf Curl Virus(0.57), incidence of nematode(0.37), days to 50% fruit ripening(0.36),days to 50% flowering (0.26) and number of seeds /fruit (0.22).

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In the present investigation high genetic advance was not found. Moderate genetic advance was found with shoot weight (29.76), followed by number of fruits per plant (25.51), and low genetic advance was recorded for all the remaining characters such as 100 seed weight (18.32), followed by seed weight / fruit (10.78), ascorbic acid (10.62), root weight /plant (6.13), plant height, stem diameter, number of branches /plant, weight of fruits /plant, fruit body length, fruit stalk length, fruit periphery, days to 50% flowering, days to 50% fruit ripening, percent fruit dry weight , seed weight /100 g of fruit, husk weight , number of seeds per fruit, seed husk ratio, seed yield /plant, incidence of Leaf Curl Virus, incidence of anthracnose, incidence of nematode, and fruit yield /plant.

#### 4.4.3 Correlation coefficient

Correlation is the association between the one character to the other character. In the present investigation 25 characters are taken in 93 genotypes and the phenotypic correlation coefficients between different characters are present in table 4.12.

Data indicated that the fruit yield showed highly significant and positive correlation with the number of fruits per plant ( $r_p = 0.671$ ), weight of fruits per plant ( $r_p = 1.00$ ), fruit body length ( $r_p = 0.428$ ), fruit periphery ( $r_p = 0.394$ ), root weight ( $r_p = 0.356$ ), seed yield per plant ( $r_p = 0.810$ ), and highly significant but negative correlation recorded with percent fruit dry weight ( $r_p = -0.433$ ), husk weight ( $r_p = -0.429$ ), this trait also exhibited positive and significant correlation with fruit stalk length

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( $r=p0.212$ ), seed weight/fruit ( $r=p0.212$ ), Number of seeds per fruit ( $r=p0.239$ ), ascorbic acid content ( $r=p0.218$ ), and it exhibited negative and significant correlation with days to 50 % fruit ripening ( $r=p-0.218$ ). On the other hand, non significant correlation observed with the plant height, stem diameter, number of branches per plant, days to 50 % flowering, and shoot weight per plant.

Plant height showed the highly significant and positive correlation with the stem diameter ( $r=p0.547$ ), number of branches per plant ( $r=p0.564$ ), fruit stalk length ( $r=p0.322$ ), root weight ( $r=p0.294$ ), shoot weight ( $r=p0.523$ ); Plant height showed the non significant association with rest of the other characters such as number of fruits/plant, weight of fruits /plant, fruit body length, fruit periphery, days to 50 % flowering, days to 50 % fruit ripening, percent fruit dry weight, seed weight in 100 g of fruit, husk weight, 100 seed weight, seed weight per fruit, number of seeds per fruit, seed yield per plant, incidence of Leaf Curl Virus, ascorbic acid, and total fruit yield.

Stem diameter showed the highly significant and positive correlation with the number of branches per plant ( $r=p 0.500$ ), shoot weight ( $r=p 0.463$ ), and this traits also exhibited significant and positive correlation with the root weight per plant ( $r=p 0.258$ ); Stem diameter showed the non significant correlation with rest of the characters like number of fruits per plant, weight of fruits per plant, fruit body length, fruit stalk length, fruit periphery, days to 50 % flowering, days to 50 % fruit ripening, percent fruit dry weight, seed weight in 100 g of fruit,

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husk weight, 100 seed weight, seed weight per fruit, number of seeds per fruit, seed yield per plant, incidence of Leaf Curl Virus , Ascorbic acid, and total fruit yield.

Number of branches per plant showed the highly significant and positive association with the root weight per plant ( $r_{=p}$  0.559), shoot weight per plant ( $r_{=p}$  0.0607) ; Number of branches per plant showed the non significant correlation with rest of the characters like number of fruits per plant, weight of fruits per plant, fruit body length, fruit stalk length, fruit periphery, days to 50 % flowering, days to 50 % fruit ripening, percent fruit dry weight, seed weight in 100 g of fruits, husk weight, 100 seed weight, seed weight per fruit, number of seeds per fruit, seed yield per plant, incidence of Leaf Curl Virus, Ascorbic acid content and total fruit yield.

Number of fruits per plant showed the highly significant and positive association with the weight of fruits per plant ( $r_{=p}$  0.671), root weight per plant ( $r_{=p}$  0.449), shoot weight per plant ( $r_{=p}$  0.277), seed yield per plant ( $r_{=p}$  0.428), total fruit yield ( $r_{=p}$  0.671). This trait also exhibited the highly significant but negative correlations with days to 50 % fruit ripening ( $r_{=p}$  -0.280), percent fruit dry weight ( $r_{=p}$  -0.346), and husk weight ( $r_{=p}$  -0.322), incidence of Leaf Curl Virus ( $r_{=p}$  -0.335). And significant but negative correlations was observed with seed weight in 100 g of fruits ( $r_{=p}$  -0.236) and number of fruits per plant showed the non significant correlation with rest of the characters like fruit body length, fruit stalk length, fruit periphery, days to 50 % flowering, 100

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seed weight, seed weight per fruit, number of seeds per fruit, and ascorbic acid content.

Weight of fruits per plant showed the highly significant and positive correlation with the fruit body length ( $r_{=p}$  0.428), fruit periphery ( $r_{=p}$  0.394), root weight per plant ( $r_{=p}$  0.356), seed yield per plant ( $r_{=p}$  0.810), total fruit yield ( $r_{=p}$  1.00). This trait also exhibited the highly significant but negative correlations with days to 50 % fruit ripening ( $r_{=p}$  -0.218), percent fruit dry weight ( $r_{=p}$  -0.433), and husk weight ( $r_{=p}$  -0.429). On the other hand, significant but positive correlation was noted with the fruit stalk length ( $r_{=p}$  0.212), seed weight per fruit ( $r_{=p}$  0.212), number of seeds per fruit ( $r_{=p}$  0.239), ascorbic acid ( $r_{=p}$  0.218), where as significant but negative correlation recorded with the days to 50 % fruit ripening ( $r_{=p}$  -0.218); On the other hand, Weight of fruits per plant showed non significant association with rest of the characters like days to 50 % flowering, shoot weight, seed weight in 100 g of fruits, 100 seed weight and incidence of Leaf Curl Virus.

Fruit body length showed the highly significant and positive correlation with the fruit stalk length ( $r_{=p}$  0.482), fruit periphery ( $r_{=p}$  0.333), total fruit yield ( $r_{=p}$  0.428) and significant but positive correlation with the root weight per plant ( $r_{=p}$  0.220), seed yield /plant ( $r_{=p}$  0.244), and significant but negative correlation with the percent fruit dry weight ( $r_{=p}$  -0.256), seed weight in 100 g of fruits ( $r_{=p}$  -0.228), husk weight ( $r_{=p}$  -0.223) and fruit body length showed the non significant correlation with rest of the characters like number of days to 50 % flowering, days to

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50 % fruit ripening, shoot weight per plant, 100 seed weight, seed weight per fruit, number of seeds per fruit, incidence of Leaf Curl Virus, and ascorbic acid content.

Fruit stalk length showed highly significant and positive correlation with the fruit periphery ( $r_{=p}$  0.267), root weight per plant ( $r_{=p}$  0.315), shoot weight per plant ( $r_{=p}$  0.235) this character also showed significant and positive correlation with the total fruit yield ( $r_{=p}$  0.212) and significant but negative correlation with the percent fruit dry weight ( $r_{=p}$  -0.247), seed weight in 100 g of fruit ( $r_{=p}$  -0.264) and Fruit stalk length showed the non significant correlation with rest of the characters such as days to 50 % flowering, days to 50 % fruit ripening, husk weight, 100 seed weight, seed weight /fruit, number of seeds per fruit, seed yield per plant incidence of Leaf Curl Virus and ascorbic acid content.

Fruit periphery showed the highly significant and positive correlation with the number of seeds per fruit ( $r_{=p}$  0.423), seed yield per plant ( $r_{=p}$  0.286), total fruit yield ( $r_{=p}$  0.394). on the other hand, highly significant but negative correlation recorded with the days to 50 % fruit ripening ( $r_{=p}$  -0.274), where as significant but negative correlation obtained with the 100 seed weight ( $r_{=p}$  -0.205); and fruit periphery showed the non significant correlation with rest of the characters like days to 50 % flowering, root weight per plant, shoot weight per plant, percent fruit dry weight, seed weight in 100 g of fruits, husk weight,

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seed weight per fruit, incidence of Leaf Curl Virus, and ascorbic acid content.

Days to 50 % flowering showed highly significant and positive association with the days to 50 % fruit ripening ( $r_p = 0.314$ ); and it was also showed non significant correlation with rest of the characters like plant height , stem diameter, number of branches per plant, number of fruits per plant, weight of fruits per plant, fruit body length, fruit stalk length, root weight per plant, shoot weight per plant, per cent fruit dry weight, seed weight in 100 g of fruits, husk weight, 100 seed weight, seed weight per fruit, number of seeds per fruit, seed yield/ per plant, incidence of Leaf Curl Virus, ascorbic acid content and total fruit yield.

Days to 50 % fruit ripening showed the highly significant and positive correlation with the Days to 50 % flowering( $r_p = 0.314$ ) ) where as highly significant but negative correlation observed with the fruit periphery ( $r_p = -0.274$ ), number of fruits per plant( $r_p = -0.280$ ) and significant but negative correlation obtained for weight of fruits per plant ( $r_p = -0.218$ ), shoot weight per plant ( $r_p = -0.204$ ), total fruit yield ( $r_p = -0.218$ ). Days to 50 % fruit ripening showed the non significant correlation with rest of the characters like plant height , stem diameter, number of branches per plant, fruit body length, fruit stalk length, root weight per plant, , per cent fruit dry weight, seed weight in 100 g of fruits, husk weight, 100 seed weight, seed weight per fruit, number of seeds per fruit, seed yield per plant, incidence of Leaf Curl Virus and ascorbic acid content.

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Root weight /plant showed the highly significant and positive correlation with the plant height( $r_{=p}$  0.294), number of branches per plant( $r_{=p}$  0.559), number of fruits per plant( $r_{=p}$  0.449), weight of fruits per plant ( $r_{=p}$  -0.356), fruit stalk length( $r_{=p}$  -0.315), shoot weight per plant ( $r_{=p}$  0.604), total fruit yield ( $r_{=p}$  0.356), and highly significant and negative correlation with the incidence of Leaf Curl Virus ( $r_{=p}$  -0.327), and significant but positive correlation with the stem diameter( $r_{=p}$  0.258), fruit body length ( $r_{=p}$  0.220), and significant but negative correlation with the dry fruit weight ( $r_{=p}$  -0.237), husk weight ( $r_{=p}$  -0.216). Root weight per plant showed the non significant correlation with rest of the characters such as fruit periphery, days to 50 % flowering, days to 50 % fruit ripening, seed weight in 100 g of fruits, 100 seed weight, and seed weight per fruit, number of seeds per fruit, seed yield / plant and ascorbic acid content.

Shoot weight per plant showed the positive and highly significant correlation with the plant height ( $r_{=p}$  0.523), stem diameter ( $r_{=p}$  0.463), number of branches/ plant ( $r_{=p}$  0.607), number of fruits per plant ( $r_{=p}$  0.277), root weight per plant ( $r_{=p}$  0.604); Significant and positive correlation observed with the fruit stalk length ( $r_{=p}$  0.235), while significant but negative correlation found with the days to 50 % fruit ripening ( $r_{=p}$  -0.204) ) where as shoot weight per plant showed the non significant correlation with rest of the characters like weight of fruits per plant, fruit body length, fruit periphery, days to 50 % flowering, per cent fruit dry weight, seed weight in 100 g of fruits, husk weight, 100 seed

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weight, seed weight per fruit, number of seeds per fruit, seed yield per plant, incidence of Leaf Curl Virus, Ascorbic acid content, and total fruit yield.

Per cent fruit dry weight showed the highly significant and positive correlation with the seed weight in 100 g of fruits ( $r_{=p} 0.514$ ), husk weight ( $r_{=p} 0.973$ ), and this trait also showed the highly significant and negative correlation with the ascorbic acid content ( $r_{=p} -0.308$ ), weight of fruits per plant ( $r_{=p} -0.433$ ), number of fruits per plant ( $r_{=p} -0.346$ ), total fruit yield ( $r_{=p} -0.433$ ), and significant but negative correlation was found fruit body length ( $r_{=p} -0.256$ ), fruit stalk length ( $r_{=p} -0.247$ ), root weight ( $r_{=p} -0.237$ ); Per cent fruit dry weight showed the non significant correlation with rest of the characters like plant height, stem diameter, number of branches per plant, fruit periphery, days to 50 % flowering, days to 50 % fruit ripening, shoot weight per plant, 100 seed weight, seed weight per fruit, number of seeds per fruit, seed yield per plant and incidence of Leaf Curl Virus.

Seed weight in 100 g of fruits showed the highly significant and positive correlation with the husk weight ( $r_{=p} 0.303$ ), seed yield /plant ( $r_{=p} 0.326$ ), Per cent fruit dry weight ( $r_{=p} 0.514$ ), where as significant and negative correlation noted for the number of fruits per plant ( $r_{=p} -0.236$ ), fruit body length ( $r_{=p} -0.228$ ), fruit stalk length ( $r_{=p} -0.264$ ) while Seed weight in 100 g of fruits showed the non significant correlation with rest of the characters viz plant height, stem diameter, number of branches per plant, weight of fruits per plant, fruit periphery, days to 50

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% flowering, days to 50 % fruit ripening, root weight per plant, shoot weight per plant, 100 seed weight, seed weight per fruit, number of seeds per fruit, ascorbic acid content, incidence of Leaf Curl Virus and total fruit yield.

Husk weight showed the highly significant and positive correlation with the percent fruit dry weight ( $r_{=p}$  0.973), Seed weight in 100 g of fruits ( $r_{=p}$  0.303) where as highly significant but negative correlation observed for seed yield/ plant ( $r_{=p}$  -0.293), number of fruits per plant ( $r_{=p}$  -0.322), ascorbic acid content ( $r_{=p}$  -0.308), total fruit yield ( $r_{=p}$  -0.429), weight of fruit per plant ( $r_{=p}$  -0.429), on the other hand, significant but negative correlation recorded with the root weight per plant ( $r_{=p}$  -0.216), fruit body length ( $r_{=p}$  -0.223); Husk weight showed the non significant correlation with rest of the characters likes plant height, stem diameter, number of branches per plant, fruit stalk length, fruit periphery, days to 50 % flowering, days to 50 % fruit ripening, shoot weight per plant, 100 seed weight, seed weight per fruit, number of seeds per fruit and incidence of Leaf Curl Virus.

100 seed weight showed the highly significant and positive correlation with the seed weight per fruit ( $r_{=p}$  0.562), as well as highly significant and negative correlation recorded with the number of seeds per fruit ( $r_{=p}$  -0.504); and significant but negative correlation observed for the fruit periphery ( $r_{=p}$  -0.212); 100 seed weight showed the non significant correlation with rest of the characters like plant height, stem diameter, number of branches per plant, number of fruits per plant,

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weight of fruits per plant, fruit body length, fruit stalk length, days to 50 % flowering, days to 50 % fruit ripening, root weight per plant, shoot weight per plant, percent fruit dry weight, seed weight in 100 g of fruits, husk weight, seed yield per plant, incidence of Leaf Curl Virus, ascorbic acid content , and total fruit yield.

Seed weight per fruit showed the highly significant and positive correlation with the number of seeds per fruit ( $r_{=p}$  0.382), 100 seed weight ( $r_{=p}$  0.562), and significant but positive correlation with the weight of fruits per plant ( $r_{=p}$  0.212), total fruit yield ( $r_{=p}$  0.212); Seed weight per fruit showed the non significant correlation with rest of the characters like plant height , stem diameter, number of branches per plant, number of fruits per plant, fruit body length, fruit stalk length, fruit periphery, days to 50 % flowering, days to 50 % fruit ripening, root weight per plant, shoot weight per plant, percent fruit dry weight, seed weight in 100 g of fruits, husk weight, seed yield /plant, incidence of Leaf Curl Virus and ascorbic acid content.

Number of seeds per plant showed highly significant and positive association with the seed yield per plant ( $r_{=p}$  0.294), fruit periphery ( $r_{=p}$  0.423), seed weight per fruit  $r_{=p}$  (0.382), and highly significant and negative correlation observed with the 100 seed weight ( $r_{=p}$  -0.504), and significant but positive correlation with the weight of fruits per plant ( $r_{=p}$  0.239), total fruit yield ( $r_{=p}$  0.239); while number of seeds per plant showed the non significant correlation with rest of the characters like plant height , stem diameter, number of branches per plant, number of

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fruits per plant, fruit body length, fruit stalk length, days to 50 % flowering, days to 50 % fruit ripening, root weight per plant, shoot weight per plant, percent fruit dry weight, seed weight in 100 g of fruits, husk weight, incidence of Leaf Curl Virus and ascorbic acid content.

Seed yield per plant showed the highly significant and positive correlation with the total fruit yield ( $r_{=p}$  0.810), number of seeds per fruit ( $r_{=p}$  0.294), Seed weight in 100 g of fruits ( $r_{=p}$  0.326), number of fruits per plant ( $r_{=p}$  0.428), weight of fruits per plant ( $r_{=p}$  0.810), fruit periphery ( $r_{=p}$  0.286); Highly significant and negative correlation recorded with husk weight ( $r_{=p}$  -0.293); and significant but positive correlation with the fruit body length ( $r_{=p}$  0.244); Seed yield per plant showed the non significant correlation with rest of the characters like plant height , stem diameter, number of branches per plant, fruit stalk length, days to 50 % flowering, Days to 50 % fruit ripening, root weight per plant, shoot weight per plant, percent fruit dry weight, 100 seed weight, Seed weight per fruit, incidence of Leaf Curl Virus and ascorbic acid content.

Incidence of Leaf Curl Virus showed the highly significant and negative correlation with the number of fruits per plant ( $r_{=p}$  -0.335), root weight per plant ( $r_{=p}$  -0.327) and incidence of Leaf Curl Virus showed the non significant correlation with the plant height , stem diameter, number of branches per plant, weight of fruits per plant, fruit body length, fruit stalk length, days to 50 % flowering, Days to 50 % fruit ripening, shoot weight per plant, per cent fruit dry weight, seed weight

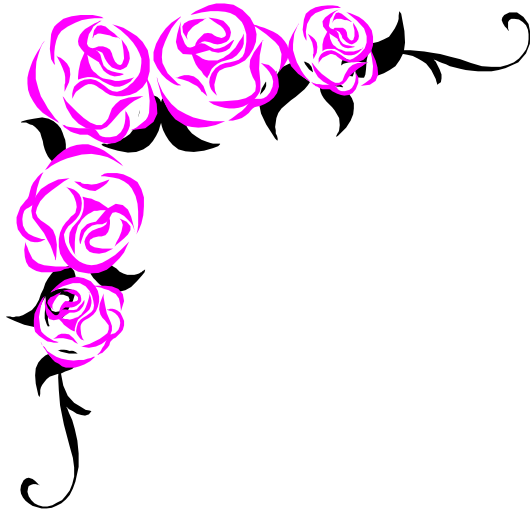
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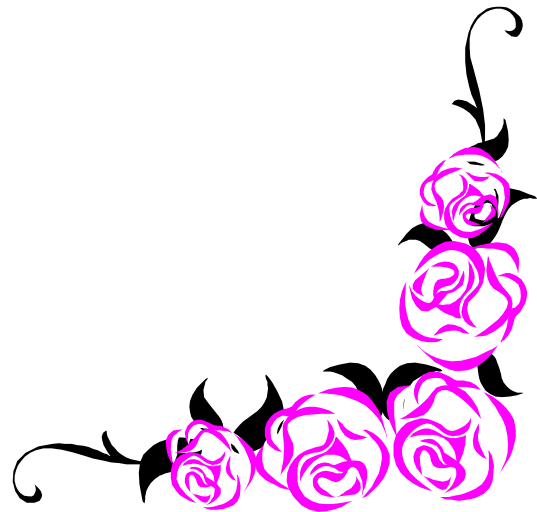
in 100 g of fruits, husk weight, 100 seed weight, Seed weight per fruit, seed yield per plant and ascorbic acid content .

Ascorbic acid content showed the highly significant and negative correlation with the per cent fruit dry weight ( $r_{=p} -0.308$ ), husk weight ( $r_{=p} -0.308$ ), and significant but positive correlation with the weight of fruit per plant ( $r_{=p} 0.218$ ), total fruit yield ( $r_{=p} 0.218$ ); Ascorbic acid showed the non significant correlation with rest of the characters like plant height, stem diameter ,number of branches/plant, number of fruits/plant, fruit body length, fruit stalk length, fruit periphery, days to 50 % flowering, days to 50 % fruit ripening, root weight per plant, shoot weight per plant, seed weight in 100 g of fruits, 100 seed weight, seed weight per fruit, number of seeds per fruit, seed yield/ per plant and incidence of Leaf Curl Virus.

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# *DISCUSSION*



## Chapter 5

## *DISCUSSION*

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The experimental findings obtained during the course of this investigation revealing the performance of different chilli genotypes, in relation to the plant growth and yield attributes, have been presented in the preceding chapter. In this chapter the attempts have been made to examine and elucidate the important observations in terms of course and effect relationship. In any breeding program germplasm evaluation play a vital role for identification of superior genotypes for different qualitative and quantitative characters which may be further used to create variability by hybridization. The genotypes which are suitable at present may not be suited in future due to the change in the environment and susceptibility to biotic and abiotic stress. The superiority of genotypes is primarily judged in terms of yield, maturity, fruit quality and resistance against disease and pest. Yield is a complex polygenic character and is resultant of interactions of several genetic and environmental factors. According to the Graffius (1956) and White House *et al.* (1958) there may not be genes for yield per se but for their components, the multiplicative interactions result in ultimate yield. It would be therefore, desirable to have information on component characters and their relationship with yield and among the components. The experimental material for present study

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comprised of 90 germplasm lines along with 3 check cultivars namely., Pant C-1, JCA-283, and LCA-206.

Federer (1956) developed the augmented design in which large number of lines can be evaluated. This design was used in present study in which data were recorded on twenty five characters. The nature and extent of variability was studied along with the correlations among the yield and yield contributing characters. In view of above aspects, the present investigation was undertaken to:

- Evaluated the extent of genetic variability
- Determine the character association

### 5.1 Genetic variability

It is established fact that greater variability would lead to better scope for selection. However, the phenotypic variability arises due to genotype and environmental influences. So high phenotypic variability dose not guarantee for effective selection unless it is genetic in nature. More especially additive genetic variability ensures high scope for efficient selection. Therefore, an appropriate breeding strategy and information about the extent of variability is very essential.

The estimation of variability is of utmost importance in a crop for the identification of lines which can generate further variability so that selection of desirable genotype may be made. In the present investigation analysis of variance for check entries showed highly significant difference with respect to number of fruits/plant, weight of

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fruits/plant, fruit body length, days to 50 % flowering, root weight/plant, seed weight/ 100 g, of fruit, seed weight /fruit, number of seeds/fruit, seed yield/plant, ascorbic acid content, and total fruit yield while significant differences were observed for stem diameter, shoot weight and seed: husk ratio. Block effects were highly significant for various characters like number of fruits/plant, weight of fruits/plant and total fruit yield, While significant differences were observed for anthracnose and rest of the other characters namely plant height, stem diameter, number of branches/plant, fruit body length, stalk length, fruit periphery, days to 50 % flowering, days to 50 % ripening, root weight/plant, shoot weight / plant, dry fruit weight, seed weight in 100 g of fruits, husk weight in 100 g of fruits, 100 seed weight, seed weight/ fruit, number of seeds / plant, seed: husk ratio, seed yield /plant, incidence of Leaf Curl Virus, anthracnose and nematodes and ascorbic acid content were showed non significant differences for block effect.

The mean range of genotypes for various characters (table 4.2) revealed that highest range in 100 seed weight (208.57- 970.34 mg), the difference being 761.77 mg. comparatively high range of variability was also recorded for fresh weight of shoot / plant i.e. (119.49 - 600.46 g), weight of fruits /plant (79.69 – 510.58 g), weight of seeds /fruits (115.05 – 406.45mg), number of fruits /plant (23.31 – 226.95 ), total fruit yield /plant (31.86 – 207.42 q/ha), ascorbic acid content

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(35.18 – 192.56 mg/100 g), plant height (51.87 – 131.77 cm), and root weight /plant (7.68 – 79.13 g). Exhibiting differences of 480.97, 438.89, 291.40, 203.64, 175.56, 157.38, 79.90 and 61.45, respectively.

Similar to the present finding, the high range of variability was reported for weight of fruits per plant by Singh *et al.* (1994) and Sachan (1997) , for fresh fruit weight and yield per plant (Chandra *et.al.*, 1990), for fruit yield /plant , individual fruit weight, fresh fruit yield /plant, 100 seed weight and number of seeds per fruit (Adamu and Ado 1988), for fruit yield /plant, mean fruit weight, fruit yield per plant, weight of seeds per fruits, 100 seed weight and dry matter production (Rani and Singh, 1996).

The characters showing relatively low variability range were anthracnose incidence (2.49 – 48.68 %), incidence of Leaf Curl Virus (2.19 – 42.14 %), seed yield /plant (5.37 – 42.81), percent fruit dry weight (13.63 – 44.27), days to 50 % flowering (23.44 – 53.11), husk weight (4.68 – 33.67), days to 50 % fruit ripening (73.11 – 97.11), incidence of nematode (2.78 – 20.23), no. of branches/ plant (10.44 – 23.61), fruit body length (4.04 – 13.38 cm), seed weight in 100 g of fruits (3.67 – 11.11), no. of seeds /plant (18.72 – 72.32), seed husk ratio (0.40 – 4.89), fruit stalk length (1.82 – 4.28 cm), stem diameter (0.75 – 3.01 cm).these results are in accordance with the findings of Pandita *et al.* (1991) and Gupta (2003),who had observed minimum

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range of variability for fruit periphery, fruit length, fruit stalk length and fruit diameter.

## 5.2 Analysis of heritability and genetic advance:

The study of genotypic coefficient of variation helps to measure the range of genotype variation existing at specified environmental site for a particular character and to compare the variability existing in various characters. However, it cannot measure the heritable variation; the genotypic coefficient of variation together with heritability estimates would give reliable indication of the expected improvement through selection (Burton and De Vane, 1953).

In the present investigation, heritability was low for all the characters like plant height, stem diameter, number of branches/plant, number of fruits/plant, weight of fruits/plant, fruit body length, fruit stalk length, days to 50 % flowering, days to 50 % ripening, root weight/plant, shoot weight/plant, seed: husk ratio, seed weight/ 100 g, of fruits, seed weight /fruit, number of seeds/fruit, seed yield/plant, incidence of Leaf Curl Virus, Anthracnose, nematode, ascorbic acid content, and total fruit yield. High heritability estimates coupled with high genetic advance were observed for ascorbic acid content was reported by Rani and Singh (1996). The results were not in agreement with the present finding where low heritability with low genetic advance was observed.

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High heritability for fruit circumference was reported by Ghidhyal *et al.* (1996). But in the contrast in this result was not in agreement with present finding where low heritability for fruit periphery was observed. High heritability coupled with genetic advance for dry weight of roots per plant reported by Rani and Singh (1996). This result was also not in agreement with present finding where low heritability with low genetic advance was observed.

From the above study on mean performance and other genetic parameter of different plant characters, it was revealed that Number of fruits/plant (30.97 %), Number of branches/plant (26.23 %) and fruit body length (15.69 %) are the important traits for the selection. These characters may be considered and utilized for the crop improvement programme.

### 5.3 Correlation:

The extent of variability either naturally occurring induced in the genetic material for various characters would provide an important opportunity to plant breeder for any crop improvement programme. The knowledge regarding inter relation ship among characters would direct the breeder to select specific component characters whose selection would result in simultaneous improvement for the complex characters which are positively correlated with their component traits. Selection for yield per se may not be effective, since, the expression of yield is multiplicative

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interaction of several fitness characters. This expression is not only polygenically governed but it also influence by the fluctuating environmental factors. It would be, therefore, imperative to have adequate information on the correlation among different components as well as the association of these components with the yield. Grafius (1956) stated that there are no genes for yield per se but only for the components of the yield. Any improvement in a positive component of a yield or combinations of components would results in the improvement of yield. Thus, the knowledge of yield contributing components and their interrelations are important for improving the efficiency of selection.

In the present experiment, the study of correlation among different characters revealed that, in general, the genotypic correlation coefficient was somewhat more than the phenotypic correlation. This indicated that little role of environment in the expiration of genetic relationship of the characters in the phenotype. Similar finding was reported by Legg and Lippert (1966), Ram (1982), .Rathod *et al.* (2002) and Kumar *et al.* (2003).

In the present investigation, positive and significant correlation of fruit yield was recorded with the number of fruits per plant , weight of fruits per plant , fruit body length, fruit periphery , root weight ,seed yield per plant, fruit stalk length, seed weight per fruit, Number of seeds per fruit, and ascorbic acid content. On the other hand,

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significant but negative correlation recorded with percent fruit dry weight, husk weight, days to 50 % fruit ripening. These results are conformity with the results obtained by Pawarde *et al.* (1995), Mohammed *et al.* (2001), and Rathod *et al.* (2002). They reported positive correlation between plant height and number of fruits per plant and Chouvey *et al.* (1986), Dahiphale *et al.* (1991) found significant correlation between fruit yield per plant and number of fruits per plant and they also reported that number of seeds per fruit, fruit circumference and fruit stalk length had direct positive effect on the yield. Whereas Stem diameter has positive and non significant association with total fruit yield, weight of fruits per plant, fruit body length, and fruit stalk length. These results are in accordance with the findings of Rani and Singh (2000) who have reported that stem diameter has indirect effect on fruit stalk and root mass. Stem diameter confirmed the importance in influencing the total fruit yield. The similar types results were also reported by Gupta (2003). Number of branches per plant showed the significant and positive correlation with the root weight per plant, and shoot weight per plant. Whereas Number of fruits per plant showed the highly significant and positive association with the weight of fruits per plant, root weight per plant, shoot weight per plant, seed yield per plant and total fruit yield. These results are in agreement with the findings of the results of Pawade *et al.* (1995), Rani (1997) and Munshi *et al.* (2000); according to them,

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numbers of fruits per plant were positively and significantly correlated with weight of fruits per plant and red ripen fruit yield.

Weight of fruits per plant was positively and significantly correlated with the total fruit yield per plant. Similar results have also been reported by Das and Chaudhary (1999), Munshi *et al.* (2000), they concluded that number of fruit per plant and weight of fruits per plant should be selected when breeding done for higher yield.

Fruit body length was positively and significantly correlated with the fruit stalk length, fruit periphery and total fruit yield. These results are in accordance with the findings of Singh *et al.* (1992) who have obtained the similar type results, that fruit length was positively correlated with total fruit yield /plant which were also supported by Dahiphale *et al.* (1991), Kurana *et al.* (1993), and Pawade *et al.* (1995).

Per cent fruit dry weight was positively and significantly correlated with the seed weight in 100 g of fruits, husk weight. This indicated that dry chilli yield depends upon the characters like husk weight and seed weight where as seed weight or seed yield was associated with the Percent fruit dry weight. Whereas Seed yield per plant showed the highly significant and positive correlation with the total fruit yield, number of seeds per fruit, Seed weight in 100 g of fruits, number of fruits per plant, weight of fruits per plant, fruit periphery, and fruit body length.

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On the basis of present study, it may be concluded that for Seed yield per plant, number of seeds per fruit, Seed weight in 100 g of fruits, number of fruits per plant, weight of fruits per plant, fruit periphery, and fruit body length should be given important while selecting the genotypes for higher yield. Based on the estimates of correlation coefficient, Number of branches per plant weight of fruits per plant, number of fruits per plant, fruit body length, seed yield per plant, Per cent fruit dry weight may be judged as the fruit yield is a contributing character which needs attention of the breeder during selection. To select a specific genotype on the basis of the above attributes.

The result and discussion of the present study leads to following general conclusions:

1. Fruit yield showed highly significant and positive correlation with the number of fruits per plant, weight of fruits per plant, fruit body length, fruit periphery, root weight, seed yield per plant. This trait also exhibited positive and significant correlation with, fruit stalk length, seed weight per fruit, Number of seeds per fruit, ascorbic acid content. Therefore, it is suggested that these traits may be given due consideration during selection.
  2. Among all the genotypes, SKAU-101(207.420q/ha), EC-519625 (199.51 q/ha), Selection-11 (183.69 q/ha), PC-2057(162.42
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**SKAU-101**



**Pant Chilli-7**



**PC-2057**



**Selaction-11**



**JCA-283**

**Fig. 4.7-High yielding genotypes and check cultivar**

- q/ha), Indo Sem Yeda (159.05 q/ha), HDC-75(103.10 q/ha) were top yielder. The genotype HDC-75 was found promising for seven characters followed by PC-7-1-2-1 which had high value of five yield characters, and five genotypes which was found promising for four characters these genotypes are Selection-11, IC-422010, Indo Sem Yeda, PC-2057, EC-519625 and nine genotypes which had high value of three characters that are SKAU-101, PC-1-20-UP, PC-2-UP-DG, PC-7-1-2-UP, Pant Sel-31-1, IC-383136, IC-313389, PC-4 and Pant Sel-18. Based on overall performance the lines viz., HDC-75, PC-7-1-2-1, PC-2057, EC-519625, Indo Sem Yeda, SKAU-101 and Selection-11 were found promising for cultivation under Tarai conditions of Uttarakhand ( Fig – 5.1).
- Out standing genotypes in respect to various characters have been presented in table 5.1. These genotypes may be effectively used as doner for various characters in yield improvement programme.

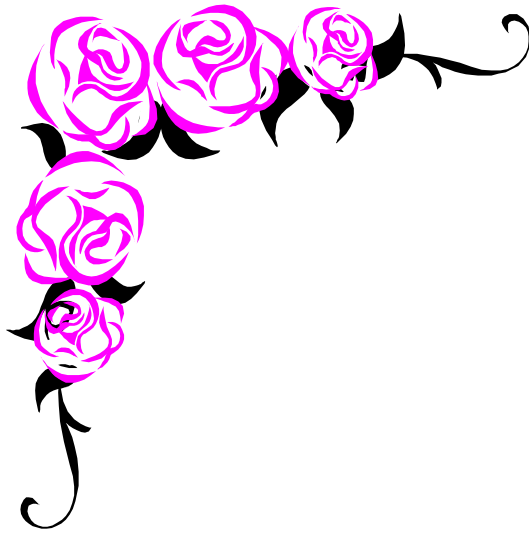
Table 5.2 : List of outstanding genotypes in respect of various characters

S.N.	Characters	Genotypes	Entry number	Top Ranking
		Rank (1 <sup>st</sup> to 5 <sup>th</sup> )		
1	Plant height (cm)	HDC- 75	7	131.77
		SKJ-2004-2	77	115.07
		PC-7-1-2-1	35	114.07
		BC-40-2	17	113.04
		IC-313389	84	111.67

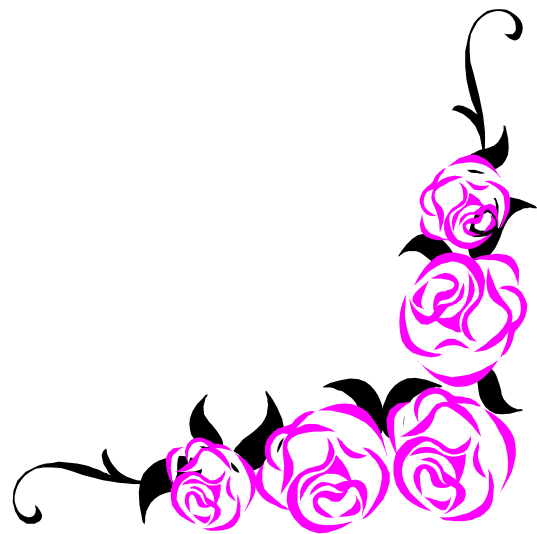
2	Stem diameter(cm)	HDC- 75 PC-2064 PC-4 PC-2062 PC-2006-50	7 25 26 24 33	3.01 2.79 2.57 2.47 2.45
3	Number of Branches Per plant	PC-2064 HDC- 75 PC-7-1-2-1 EC-519636-UP PC-4	25 7 35 40 26	23.60 23.57 21.24 21.24 21.20
4	Number of fruits per plant	PC-2-1-UP-Df PC-1-20-UP Pant Sel-15 PC-7-1-2-UP Israil -2003	55 53 73 56 59	226.94 191.05 188.95 188.94 173.00
5	Weight of fruits/plant (g)	SKAU-101 EC-519625 Selection-11 PC-2057 Indo Sem Yeda	20 69 3 23 27	518.57 498.79 459.24 406.07 397.64
6	Fruit body length (cm)	Pant Chilli -7 Indo Sem Yeda EC-519637 Selection-11 PC-7-1-2-1	6 27 61 3 35	13.37 13.2 13.10 13.05 11.30
7	Fruit stalk length (cm)	Pant Chilli -7 HDC- 75 Indo Sem Yeda EC-519637 Pant Guchhadar-P	6 7 27 61 42	4.28 4.18 4.07 4.06 3.97
8	Fruit periphery (cm)	PC-2057-B AC-800-2 DLC-352 EC-519636-1 EC-519640	60 88 9 65 41	4.78 4.26 4.18 4.16 4.09
9	Days to 50% Flowering	IC-313389 IC-422010 Pant-Sel-13-2 IC-383136 AC-800-3	84 81 72 83 89	23.44 23.44 27.44 27.44 28.44
10	Days to 50 % ripening	HSHP-154 HSHP-1111 Israil-2003 AC-510 PC-7-1-2-UP	5 4 59 58 56	73.11 73.11 73.77 73.77 73.77
11	Root weight (g/plant)	CO-4 PC-2-1-UP-DG	22 55	79.12 79.00

		HDC- 75 BC-25 PC-2057	7 16 23	73.81 70.72 69.18
12	Shoot weight (g/plant)	HDC- 75 PC-2-1-UP-DG PC-7-1-2-1 IC-383136 SKJ-UP-2	7 55 35 83 36	600.46 580.09 483.20 476.69 471.96
13	Per cent fruit Dry weight	Pant Sel-31-1 Pant Sel-18 IC-422010 KA-2 IC-276575	79 76 81 78 85	44.26 40.74 38.32 36.59 36.24
14	Seed weight/100 g of fruits	Pant Sel-31-1 IC-383136 DLC-1 IC-398082 Utkal Yellow	79 83 11 86 1	11.11 10.74 10.43 10.14 10.01
15	Husk weight/100 g of fruits	Pant Sel-18 Pant Sel-31-1 IC-422010 KA-2 IC-276575	76 79 81 78 85	33.66 33.16 31.99 28.75 28.49
16	100 seed weight (mg)	PC-3 DSC-2 PC-7-1-2-1 EC-519636-UP PC-2004-UP-13-a	75 12 35 40 46	970.33 901.75 845.45 841.78 769.24
17	Seed weight/ fruit (mg)	EC-519625-1 EC-519636-D-UP PC-3 DSC-2 EC-519636-1-1	63 39 75 12 66	406.45 384.85 358.61 355.78 346.45
18	Number of seeds/fruit	PC-2057-b SKJ-2004-2 EC-519636-1 IC-313389 EC-519625	60 77 65 84 69	72.32 69.38 68.05 65.58 65.45
19	Seed: husk ratio	IC-422010 Pant Sel-18 PJ Sel-1 PC-6 PC-2006-2	81 76 32 13 34	4.89 4.67 4.57 4.38 4.08
20	Seed yield per plant	EC-519625 Selection-11 SKAU-101	69 3 20	42.80 37.05 29.57

		PC-2057 EC-519636-2	23 68	29.05 27.15
21	Incidence of Leaf Curl Virus incidence (%)	Pc-56 Kcs-2013 PC-7-1-2-UP PC -2004-UP PC-2006-UP-3	82 13 87 15 86	2.19 2.24 2.57 2.57 3.46
22	Incidence of Anthracnose (%)	HSHP-154 HDC-75 Utkal Yellow DCL-524 PC-1-20-UP	5 7 1 10 53	2.49 3.47 3.47 5.82 6.72
23	Incidence of Nematode (%)	Indo Sem Dona PC-4 KCS-2013 PC-56 Ajeet-3	28 26 21 2 15	2.78 2.78 2.78 3.01 3.79
24	Ascorbic acid (mg/100 g) of fruit	Pant Chilli-12 PC -1-20-UP PC-2006-UP-12 SKJ-2004-2 Indo Sem Dona	64 53 52 77 28	192.56 187.45 165.62 165.18 163.00
25	Total fruit yield (q/ha) (red ripen)	SKAU-101 EC-519625 Selection-11 PC-2057 Indo Sem Yeda	20 69 3 23 27	207.41 199.50 183.68 162.41 159.04



# *SUMMARY*



## Chapter 6

## *SUMMARY AND CONCLUSION*

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The present experiment entitled “to study the genetic variability in chilli (*Capsicum annum*. L.) genotypes under Tarai conditions of uttaranchal” was conducted during spring-summer season of 2006 at the Vegetable Research Center, of G. B. P. U. A. & T., Pantnagar. The experiment was carried out in Augment Block Design with 93 genotypes of chilli and three checks namely, Pant C-1, JCA-283, and LCA-206. The observations were recorded in various plant growth attributes like 22 qualitative characters viz., growth habit , stem colour, stem surface, stem type , leaf colour, leaf size , lamina margin , inflorescence, calyx type , corolla colour , pedicel size, fruit position , fruit size , fruit surface , fruit tip, fruit base, fruit colour (immature), fruit colour (mature), fleshiness of pericarp , pericarp thick ness, seediness, pungency of fruit, fruit shape and seed size and 25 quantitative characters viz., plant height, stem diameter, number of branches / plant, number of fruits/ plant , weight of fruits/ plant, fruit body length, fruit stalk length, fruit periphery, days to 50 % flowering , days to 50 % ripening , root weight/ plant, shoot weight /plant , per cent fruit dry weight, seed weight /100 g of fruits , husk weight/100 g of fruits, 100seed weight, seed weight /fruit, number of seeds /fruit, seed : husk ratio , seed yield /plant ,vitamin C content,

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incidence of disease like anthracnose, Leaf Curl Virus and nematode and total fruit yield .The data were analyzed statistically to work out genetic variability, genotypic and phenotypic coefficient of variation, heritability, genetic advance and correlation coefficients.

The results obtained in the present study are summarized as follows:

1. Analysis of variance resulted the highly significant differences among the check cultivars for number of fruits/plant, weight of fruits/plant, fruit body length, days to 50 % flowering, root weight/plant, seed weight per 100 g of fruits, seed weight /fruit, number of seeds/fruit, seed yield per plant, ascorbic acid content, and total fruit yield where as significant differences were observed for stem diameter, shoot weight/ plant and seed: husk ratio.
  2. The maximum phenotypic variability was recorded for incidence of LCV, anthracnose, seed yield /plant, nematode incidence, number of fruits /plant, shoot weight /plant, ascorbic acid content, weight of fruits /plant, total fruit yield. The phenotypic variability was moderate for seed: husk ratio, husk weight /100 g of fruit, seed weight /fruit, 100 seed weight, root weight /plant, number of seeds /fruit, fruit body length, percent fruit dry weight, seed weight /100 g of fruits, fruit periphery, stem diameter, plant height, number of branches/ plant, fruit stalk length, days to 50%flowering.and Days to 50 % ripening.
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3. Wide range of variability (percent ) was observed for anthracnose incidence, LCV incidence, seed :husk ratio, number of fruits /plant, seed yield /plant, nematode incidence, husk weight /100 g of fruits, total fruit yield , weight of fruits /plant, ascorbic acid content, shoot weight /plant, 100 seed weight , root weight /plant, stem diameter , number of seeds /fruit, seed weight /fruit, fruit body length, per cent fruit dry weight, fruit periphery, seed weight /100 g of fruits, plant height, fruit stalk length, days to 50%flowering , number of branches/ plant and days to 50 % ripening.
  4. Characters association revealed that the number of fruits/plant , weight of fruits /plant , fruit body length, fruit periphery , root weight ,seed yield/ plant exerted highly significant and positive correlation with the total fruit yield and highly significant but negative correlation with percent dry fruit weight, husk weight, this trait also exhibited positive and significant correlation with fruit stalk length , seed weight/fruit , number of seeds / fruit ,ascorbic acid ,and total fruit yield exhibited negative and significant correlation with days to 50 % ripening. On other hand, non significant correlation found with plant height, stem diameter, number of branches /plant, days to 50 % flowering and shoot weight/plant.
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5. Plant height showed the highly significant and positive correlation with the stem diameter, number of branches /plant, fruit stalk length, root weight /plant, and shoot weight/plant.
  6. Stem diameter showed the highly significant and positive correlation with the number of branches /plant, shoot weight, and this trait also exhibited significant and positive correlation with the root weight/plant.
  7. Weight of fruits/plant showed the highly significant and positive correlation with the fruit body length ,fruit periphery ,root weight/plant ,seed yield/plant , total fruit yield , This trait also exhibited highly significant but negative correlations with days to 50 % ripening , per cent fruit dry weight , and husk weight , And significant but positive correlation observed with the fruit stalk length , seed weight /fruit ,number of seeds/fruit , ascorbic acid content, and significant but negative correlation with the days to 50 % fruit ripening.
  8. Fruit body length showed the highly significant and positive correlation with the fruit stalk length , fruit periphery , total fruit yield; and significant but positive correlation observed with seed yield /plant, and significant but positive correlation noted with per cent fruit dry weight , seed weight /100 g of fruits and husk weight.
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9. Highest Genotypic Coefficient of Variation was recorded in the number of fruits/plant and highest phenotypic Coefficient of Variation was recorded in the incidence of Leaf Curl Virus.
  10. Lowest genotypic and phenotypic Coefficient of Variation was recorded in the days to 50 % fruit ripening.
  11. The maximum heritability was recorded in number of fruits per plant.
  12. The high genetic advance was found with shoot weight followed by number of fruits /plant.
  13. Some genotypes showed superiority for more than one characters. HDC-75 was found superior for plant height, stem diameter, No. of branches/ plant, Fruit stalk length, Root weight and Shoot weight/plant and incidence of anthracnose. While PC-7-1-2-1 was found superior for Plant height, No. of Branches/ plant, Fruit body length, Shoot weight/ plant and 100 seed weight.
  14. Selection-11 was found superior for Weight of fruits/plant, Fruit body length, Seed yield per plant and total fruit yield. Whereas EC-519625 was found superior for Total fruit yield, Seed yield per plant, No. of seeds/fruit and Weight of fruits/plant. While Indo Sem Yeda was found superior for Total fruit yield, Weight of fruits/plant, Fruit body length and Fruit stalk length.
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15. PC-2057 was found superior for Total fruit yield, Weight of fruits/plant, Root weight, and Seed yield per plant. While IC-422010 was found superior for per cent fruit dry weight, Husk weight, seed: husk ratio, and days to 50 % flowering. While SKAU-101 was found superior for Total fruit yield, Weight of fruits/plant and Seed yield per plant.
  16. PC-1-20-UP was found superior for number of fruits /plant, incidence of anthracnose and ascorbic acid content. While PC-7-1-2-UP was found superior for number of fruits /plant, days to 50 % ripening and incidence of Leaf Curl Virus. While IC-383136 was found superior for days to 50 % flowering, Shoot weight/plant and seed weight /100g of fruits. While IC-313389 was found superior for plant height, number of seeds/fruit and days to 50 % flowering.
  17. While Pant Sel -18 was found superior for seed weight /100g of fruits, Husk weight and seed: husk ratio. While Pant Sel-31-1 was found superior for per cent fruit dry weight, seed weight /100g of fruits, and Husk weight.
  18. PC-2-UP-DG was found superior for number of fruits /plant, root weight /plant and shoot weight /plant. While PC-4 was found superior for Stem diameter, incidence of nematode and No. of Branches per plant. .
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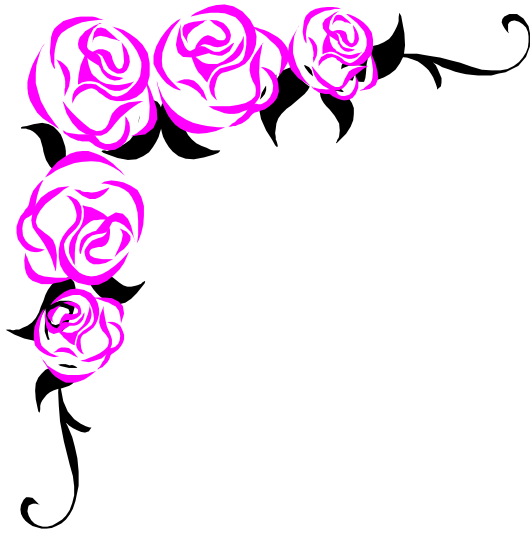
19. DSC-2 was found superior for 100 seed weight, and seed weight /fruit. While KCS-2013 was found superior for incidence of Leaf Curl Virus and incidence of nematode. While PC-56 was found superior for incidence of Leaf Curl Virus and incidence of nematode.
20. While EC-519636-1 was found superior for fruit periphery, and no. of seeds /plant. While Utkal Yellow was found superior for seed weight /100g of fruits, and incidence of anthracnose. While Indo Sem Dona was found superior for incidence of nematode and ascorbic acid content in fruit.
21. PC-2064 was found superior for Stem diameter and No. of Branches per plant. While EC-519637 was found superior for fruit body length and fruit stalk length. Whereas PC-3 was found superior for 100 seed weight and seed weight /fruit. While KA-2 was found superior for Dry fruit weight and Husk weight.

#### CONCLUSION:

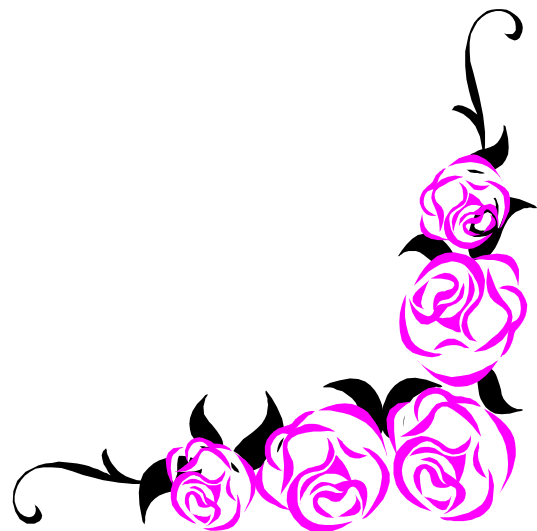
- Out of 93 genotype, SKAU-101, EC-519625, Selection-11, PC-2057, and Indo Sem Yeda were found top yielder than other genotypes.
  - The ninety three genotypes had wide range of variation for most of the characters. The traits varied in terms of their behavior and extent of genetic variability. One hundred seed
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weight showed highest and stem diameter showed lowest range of variability.

- The nature and extent of correlation among various characters, varied in most of the cases positive association was observed between number of branches/plant, number of fruits /plant, weight of fruits /plant fruit body length and total fruit yield. This indicates importance of these characters in yield improvement.
  - High heritability along with high genetic advance was observed for number of fruits /plant, shoot weight/plant and ascorbic acid content.
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# *LITERATURE CITED*



## LITERATURE CITED

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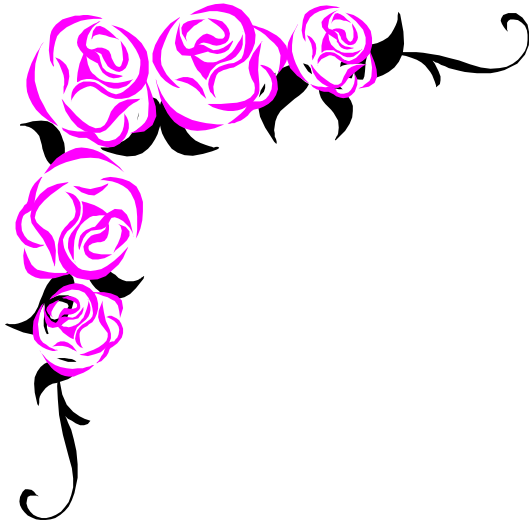
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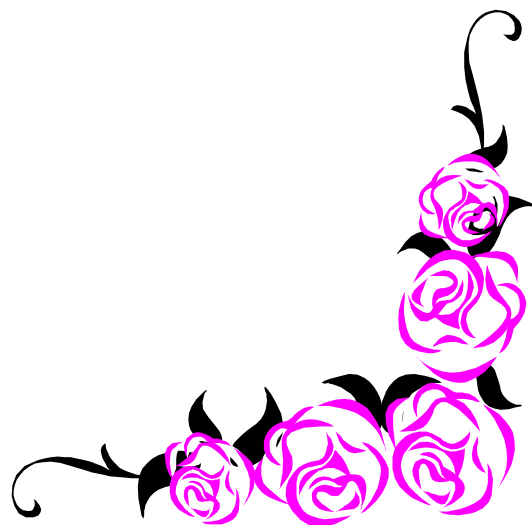
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# *APPENDICES*



## Appendix I

### Standard meteorological week's average weather data from January 2007 to December 2007

Week no. & Month	Date with duration	Max. Temp. (°C)	Min. Temp. (°C)	Rel. Hum (%)		Total rainfall (mm)	No. of Bright sunsh. (hrs)
				I half	II half		
1 Jan	1 – 7J	17.9	3.7	93	62	00.0	6.1
2	8-14	19.4	2.5	91	47	00.0	6.4
3	15-21	20.0	4.6	92	51	00.0	5.5
4	22-28	21.9	5.9	92	48	00.0	5.5
5	29-4F	25.0	10.5	90	43	Trace	5.7
6 Feb	5-11	20.3	11.6	92	71	81.6	1.8
7	12-18	20.8	7.6	92	58	69.4	8.0
8	19-25	23.6	8.0	87	44	00.0	7.8
9	26-4M	23.2	10.4	94	53	33.8	7.1
10 Mar	5-11	25.4	10.4	89	46	05.0	8.1
11	12-18	23.5	8.7	89	54	46.0	8.1
12	19-25	29.0	15.3	90	51	13.4	9.3
13	26-1A	32.8	16.0	89	35	00.0	9.9
14 Apr	2-8	33.8	14.6	76	21	Trace	9.4
15	9-15	35.1	20.1	73	28	03.2	8.8
16	16-22	34.4	20.8	76	39	13.0	8.6
17	23-29	37.2	20.7	57	27	Trace	10.1
18	30-6M	34.5	23.2	64	36	01.4	7.8
19 May	7-13	34.4	22.0	69	37	21.4	9.8
20	14-20	35.2	21.3	70	40	09.2	8.6
21	21-27	38.5	22.9	63	24	07.2	9.6
22	28-3J	39.1	21.5	63	21	00.0	10.8
23 June	4-10	38.8	26.6	60	34	00.0	9.3
24	11-17	29.3	24.9	87	75	124.0	1.3
25	18-24	32.0	24.9	87	64	57.2	6.1
26	25-1J	33.4	26.1	84	63	101.0	6.7
27 July	2-8	31.8	26.4	84	72	79.8	5.4
28	9-15	32.8	26.3	85	66	13.6	7.8
29	16-22	33.1	26.0	84	62	82.0	5.4
30	23-29	28.2	23.0	95	80	233.2	1.2
31	30-5A	29.2	23.9	96	81	178.4	2.8
32 Aug	6-12	33.3	26.6	88	65	83.6	6.4
33	13-19	30.2	24.1	94	80	146.2	3.9
34	20-26	32.3	25.9	88	67	15.6	5.1
35	27-2S	30.5	24.8	79	74	114.2	3.7
36 Sep	3-9	31.5	24.9	92	69	52.0	6.3
37	10-16	32.7	23.2	88	59	00.0	9.2
38	17-23	34.0	24.0	84	60	10.8	9.3
39	24-30	28.1	22.2	94	73	121.2	3.2
40 Oct	1-7	32.2	19.9	89	51	00.0	9.9
41	8-14	31.4	16.9	89	45	00.0	9.8
42	15-21	29.1	17.6	87	51	13.2	8.2
43	22-28	29.7	15.6	84	46	00.0	8.2
44	29-4N	29.4	15.3	88	46	00.0	7.1
45 Nov	5-11	27.8	13.7	90	48	00.0	5.7
46	12-18	26.8	10.9	88	43	00.0	8.2
47	19-25	27.1	10.2	90	35	00.0	8.8
48	26-2D	25.0	10.5	89	43	00.0	5.7
49 Dec	3-9	22.1	7.7	89	45	00.0	4.5
50	10-16	21.0	8.6	92	49	Trace	3.9
51	17-23	21.5	5.4	91	44	00.0	6.1
52	24-31	21.0	2.3	93	45	00.0	6.7

## APPENDIX-2

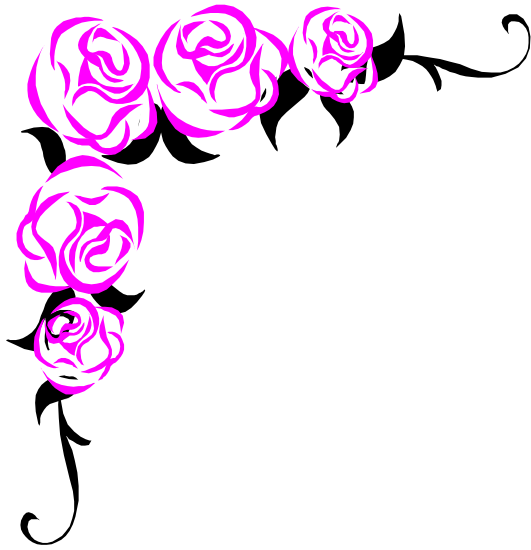
Mean of chilli genotypes (adjusted of 90) for different character

S. N.	Genotype	Plant height (cm)	Stem Diameter (cm)	No. of Branches Per plant	No of fruits per plant	Weight of fruits/ Plant (g)	Fruit body length (cm)	Fruit stalk length (cm)	Fruit periphery (cm)	Days to 50% Flowering	Days to 50 % ripening	Root weight (g/plant)	Shoot weight (g/plant)	Dry fruit weight (%)
1	Utkal yellow	97.17	1.75	16.57	60.21	144.84	7.15	2.80	2.12	46.11	86.11	51.81	435.06	29.27
2	PC- 56	73.57	1.67	11.37	132.26	283.07	7.67	3.34	2.62	42.11	81.1	40.21	231.26	18.82
3	Selection - 11	94.67	2.39	12.37	123.50	459.24	13.05	3.22	3.46	42.11	78.11	41.61	268.66	19.37
4	HSHP -1111	61.07	1.33	13.17	91.09	214.13	6.29	2.18	3.18	41.11	73.11	33.81	280.86	14.22
5	HSHP-154	90.17	1.79	16.57	63.14	148.37	7.43	3.66	2.38	41.11	73.11	45.61	322.66	19.57
6	Pant Chilli-7	95.77	2.07	15.77	141.27	388.37	13.37	4.28	3.34	41.11	81.11	42.21	353.06	15.32
7	HDC-75	131.77	3.01	23.57	81.68	257.78	7.61	4.18	2.76	49.11	88.11	73.81	600.46	14.87
8	LCA - 353	92.77	1.77	19.77	104.06	215.68	8.51	3.16	2.10	45.11	86.11	58.21	409.06	13.62
9	DCL- 352	68.77	1.45	14.37	116.03	233.65	5.51	1.82	4.18	42.11	84.11	44.61	167.06	23.27
10	DCL- 524	80.97	1.55	13.77	77.49	298.13	9.03	3.50	2.46	46.11	86.11	43.81	204.86	15.72
11	DLC- 1	62.87	1.57	13.97	112.10	210.13	5.31	3.28	2.48	52.11	91.11	50.31	378.66	31.02
12	DSC- 2	77.17	1.41	13.37	55.99	195.41	5.21	2.78	2.24	53.11	93.11	36.51	318.96	29.17
13	Pant Chilli- 6	65.87	1.48	11.17	73.23	265.96	8.43	3.14	2.28	53.11	91.11	31.41	181.46	27.92
14	Indra Chilli	62.57	1.55	16.97	41.69	121.30	5.15	2.54	1.84	48.11	93.11	35.21	279.06	21.07
15	Ajeet- 3	88.17	1.51	13.97	41.83	125.76	7.43	2.68	2.08	52.11	93.11	32.51	217.46	22.17
16	BC- 25	73.04	1.55	16.60	95.45	294.17	10.16	3.69	3.16	42.11	89.11	70.72	230.62	28.49
17	BC-40-2	113.04	1.47	19.40	64.25	192.01	6.86	3.55	3.30	42.11	89.11	30.72	152.42	29.44
18	ACS - 2002 - 6	70.64	2.35	18.40	85.66	163.19	8.82	2.67	2.00	49.11	94.11	45.12	140.72	33.11
19	F- 112 -5-83	87.54	1.59	16.20	91.66	344.27	9.70	2.77	3.38	49.11	94.11	48.92	154.42	25.59

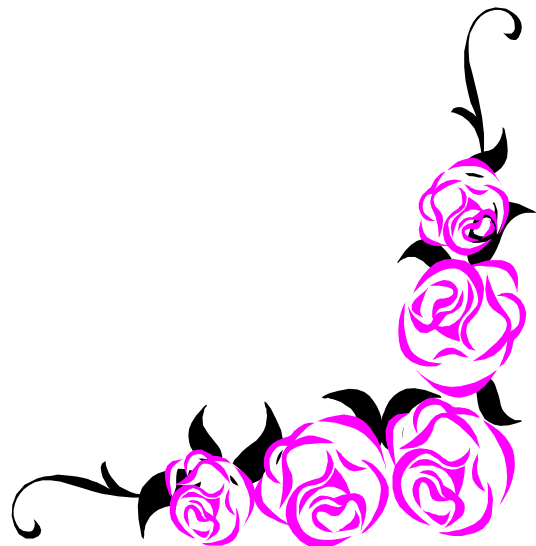
20	SKAU-101	81.94	1.35	16.60	158.99	518.57	9.88	2.95	2.78	42.11	79.11	56.72	308.42	19.54
21	KCS- 2013	101.74	1.77	15.40	92.04	301.95	10.72	3.39	2.72	44.11	82.11	67.32	318.02	16.19
22	CO-4	104.64	1.51	19.10	73.66	271.57	5.72	3.01	2.38	41.11	97.11	79.12	272.02	19.09
23	PC-2057	65.84	2.41	14.40	145.36	406.07	8.22	2.73	2.92	44.11	85.11	69.18	436.82	21.49
24	PC-2062	96.25	2.47	16.40	102.91	326.63	7.78	2.71	2.30	42.11	79.11	40.68	229.48	23.29
25	PC-2064	84.04	2.79	23.60	118.85	247.57	6.14	2.59	2.30	44.11	85.11	48.12	347.02	23.04
26	Pant Chilli-4	107.64	2.57	21.20	117.72	299.65	10.40	3.37	2.90	46.11	82.11	66.72	374.44	20.14
27	Indo Sem Yeda	86.24	1.60	14.30	93.74	397.64	13.2	4.07	3.42	38.11	92.11	36.32	193.62	18.09
28	Indo Sem Dona	86.04	1.77	17.40	67.07	372.01	8.46	2.63	2.16	36.11	93.11	39.92	160.68	17.14
29	PC- 2005-6-P	70.84	1.65	16.20	110.45	214.07	6.28	2.45	2.32	36.11	94.11	33.72	132.02	25.64
30	PC-2006-B	83.64	1.64	15.80	95.6	189.70	7.94	2.81	2.24	36.11	93.11	41.74	167.42	14.04
31	Pant Chilli-10	68.66	1.83	16.44	85.93	232.21	8.60	2.25	2.47	35.77	90.77	34.41	197.36	18.89
32	P.J- Sel -1	68.86	1.71	16.24	101.91	275.78	8.66	2.49	2.69	35.77	88.77	66.41	260.18	34.49
33	PC-2006-50	107.27	2.45	19.44	65.23	180.40	7.48	2.55	2.63	35.77	88.77	45.99	352.96	16.64
34	PC-2006-2	78.86	1.84	17.24	153.13	360.07	9.24	2.37	2.81	35.77	78.77	36.01	242.16	27.04
35	Pc-7-1-2-1	114.07	1.90	21.24	98.41	276.83	11.3	3.83	2.85	35.77	81.77	64.47	483.20	25.34
36	SKJ-UP-2 -Sel	87.07	2.18	20.04	63.11	186.25	9.10	2.65	2.67	44.77	78.77	51.01	471.96	22.89
37	PC-2004-UP	99.86	2.26	18.24	115.45	280.90	7.64	3.21	3.35	44.77	78.77	58.23	356.16	19.14
38	EC-519621-UP	75.66	1.84	17.24	113.27	290.78	8.54	2.95	3.15	35.77	78.77	51.81	301.80	20.54
39	EC-519636-D-UP	92.66	1.79	14.44	154.89	343.20	7.04	2.81	3.37	35.77	86.77	43.81	204.38	18.99
40	EC-519636-UP	105.07	2.00	21.24	170.83	378.20	6.62	3.01	2.51	37.77	84.77	48.41	405.76	19.44
41	EC-519640	103.07	1.82	20.44	103.83	377.57	11.02	2.25	4.09	35.77	78.77	38.81	364.36	22.24
42	Pant Guchadar-P	97.27	2.07	19.04	150.23	316.25	8.42	3.97	3.21	35.77	88.77	60.21	370.02	21.64
43	PC-2004-UP-S.P.	101.07	1.78	19.44	93.112	206.25	6.98	3.33	2.83	44.77	91.77	47.83	438.36	20.34
44	PC-7-1	89.47	1.96	16.04	91.062	207.89	8.44	2.97	3.51	44.77	92.77	45.01	385.96	18.44
45	PC-2006-UP-5	84.26	1.80	16.24	102.39	219.45	9.06	2.55	2.61	37.77	88.77	34.45	201.76	22.24
46	PC-2004-UP-13-1	71.47	1.54	12.64	120.38	226.81	7.90	3.25	3.16	37.11	85.77	45.56	174.09	20.87

47	PC-2004-UP-13-2	74.07	0.82	17.64	146.81	262.43	8.32	3.05	2.60	36.11	73.77	55.14	326.29	18.07
48	Pant Guchadar-UP	53.67	1.31	11.44	82.319	182.31	7.10	3.61	3.06	36.11	83.77	50.14	170.09	20.37
49	Pant Sel-15-1-up	53.07	1.18	11.24	158.77	202.30	5.26	2.57	1.98	38.11	85.77	34.76	122.71	21.22
50	PC-2006-UP-3	51.87	1.18	13.24	107.79	251.54	5.18	2.75	2.44	38.11	86.77	37.54	147.69	21.97
51	SKJ-UP-D.f.	67.07	1.35	10.44	86.339	127.35	9.02	2.67	2.40	38.11	85.77	45.74	134.49	19.07
52	PC-2006-UP-12	71.07	1.36	13.44	136.13	274.93	9.46	3.03	3.50	36.11	83.77	43.56	176.49	20.07
53	PC-1-20-UP	90.87	1.67	15.44	191.05	338.39	6.26	2.81	3.14	36.11	73.77	61.20	256.37	20.32
54	PC-2-UP	71.47	1.28	13.24	110.94	180.73	4.03	2.19	2.04	38.11	85.77	39.34	186.51	21.77
55	PC-2-1-UP-D-f	99.47	1.68	19.64	226.94	396.81	10.4	3.13	3.44	37.11	83.77	79.00	580.09	19.97
56	PC-7-1-2-UP	86.07	1.78	17.44	188.94	323.68	7.70	3.43	2.94	38.11	73.77	65.60	462.25	19.77
57	Pant Sel-50-SP	71.27	1.63	15.24	158.44	264.93	5.92	2.65	3.38	38.11	80.77	63.14	404.53	20.27
58	AC-510	70.47	1.25	12.64	155.25	329.51	7.94	2.77	3.12	38.11	73.77	45.80	184.71	18.52
59	Israil-2003	63.47	0.75	14.44	173.00	348.30	6.90	2.77	2.94	38.11	73.77	35.34	240.29	17.97
60	PC-2057-b	57.87	1.44	11.84	84.38	369.06	11.04	3.23	4.78	37.11	81.77	44.56	186.09	18.32
61	Ec-519637	88.77	1.63	11.70	86.25	295.10	13.1	4.06	3.50	35.44	86.77	37.87	248.96	15.86
62	Pant C-2 (p)	85.17	1.95	14.50	166.72	324.63	5.54	2.30	2.26	35.44	87.77	39.41	411.18	18.01
63	EC-519625-1	84.17	1.77	11.50	83.64	301.29	8.74	2.73	2.14	33.44	76.77	34.07	254.96	17.11
64	Pant Chilli-12	86.57	2.26	14.30	68.47	214.63	11.16	2.96	2.24	35.44	88.77	47.41	265.08	20.51
65	EC-519636-1	59.97	1.64	10.90	26.57	292.32	11.30	3.38	4.16	44.44	94.77	26.21	165.56	16.86
66	EC-519636-1-1	67.57	1.95	10.90	59.31	185.63	6.70	2.98	1.98	44.44	94.77	21.81	175.76	15.26
67	Pant Chilli -25	76.37	1.63	11.30	67.14	182.09	8.58	2.66	2.24	44.44	86.77	31.81	199.38	15.51
68	EC-519636-2	99.57	1.71	13.90	137.82	377.09	6.78	2.66	2.34	35.44	88.77	32.63	201.76	15.86
69	EC-519625	93.176	1.67	12.70	150.89	498.79	7.54	2.64	3.32	35.44	76.77	35.61	349.24	23.11
70	Pant-Sel -7-1-2	77.776	1.64	14.30	86.79	243.96	8.60	2.80	2.30	37.44	87.77	35.27	330.96	34.86
71	Pant-Sel -13	73.37	1.94	15.10	100.39	285.96	7.54	2.62	2.78	37.44	90.77	40.41	261.76	16.16
72	Pant-Sel -13-2	94.37	1.87	14.30	119.52	278.96	5.68	2.88	2.40	27.44	86.77	35.41	307.08	15.81
73	Pant-Sel-15	97.976	1.88	15.30	188.95	218.37	7.34	2.78	2.66	36.44	86.77	39.67	321.36	21.06

74	Pant -Sel-42	91.576	1.64	16.10	43.95	107.96	8.46	2.70	2.16	37.44	88.77	36.03	300.96	25.26
75	Pant Chilli- 3	83.176	2.17	14.10	58.05	179.88	6.46	2.68	2.24	37.44	88.77	26.09	275.38	29.41
76	Pant Sel -18	84.06	1.71	12.02	49.78	113.38	6.31	2.61	2.86	38.44	90.44	30.28	251.09	40.74
77	SKJ-2004-2	115.07	2.09	15.62	66.85	215.02	8.43	3.25	2.68	41.44	75.44	47.08	418.89	22.89
78	Kashi Anmol-2	55.46	1.38	10.82	92.79	179.48	6.45	2.05	2.24	38.44	90.44	17.68	119.49	36.59
79	Pant-Sel-31-1	68.469	1.30	14.42	31.65	94.046	7.49	2.39	2.74	38.44	82.44	21.94	169.31	44.26
80	IC-292480	98.069	1.67	12.42	23.29	104.14	7.97	2.63	2.54	38.44	85.44	28.08	195.35	29.67
81	IC-422010	101.47	1.91	12.22	43.48	111.55	6.37	2.65	2.50	23.44	82.44	38.88	225.89	38.32
82	IC-266832	102.47	1.97	16.42	122.65	361.91	6.93	3.21	3.24	36.44	85.44	41.28	245.69	25.87
83	IC-383136	106.67	1.83	16.82	76.40	110.80	6.49	2.27	1.54	27.44	89.44	47.08	476.69	35.83
84	IC-313389	111.67	1.68	10.42	34.53	79.68	7.27	3.39	2.34	23.44	75.44	28.08	177.49	30.50
85	IC-276575	104.67	1.90	17.82	37.00	107.34	6.37	3.25	2.16	36.44	80.44	32.28	313.31	36.24
86	IC-398082	107.27	1.74	16.62	78.22	244.05	6.07	2.87	2.82	36.44	75.44	37.08	243.09	35.38
87	IC-368781	73.069	1.61	14.02	46.43	101.61	5.67	2.59	2.96	47.44	89.44	22.08	142.89	25.50
88	AC-800-2	99.269	1.85	18.02	50.95	173.20	5.67	2.87	4.26	28.44	75.44	35.08	248.89	22.75
89	AC-800-3	90.069	1.82	14.02	40.37	173.23	5.59	3.19	4.00	28.44	85.44	29.34	212.29	31.12
90	AC-800-4	61.87	1.41	11.22	61.90	231.55	5.63	3.09	3.52	36.44	75.44	17.88	188.89	20.45



*VITA*



Geeta Gaur the author of this manuscript, was born on 11<sup>th</sup> Jan 1982 at Pantnagar (Uttarakhand) she passed her high school examination in 1997 and intermediate examination in 1999 from Government Girls Inter College, Pantnagar. She earned her B. Sc. Ag. Degree from G. B. Pant University of Agriculture and Technology, Pantnagar, in Dec. 2004. Then she joined the M. Sc. Ag. degree programme with major in Vegetable Science and minor in Horticulture at Govind Ballabh Pant University of Agriculture and Technology, Pantnagar in July 2006. During her M.Sc. Ag. Degree programme she was recipient of university graduate teaching research assistantship

*Mailing Address:*

*D/o Sri G. L. Gaur*

*Q. No. IV/ 1142*

*Jha colony Pantnagar*

*U.S. Nagar, Uttarakhand*

*Pin-263 145*

*Ph. No. : 05944 - 234494*

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Name : Geeta gaur Id. No. : 27279  
Sem. & year of admission : I Sem., 2006-07 Degree : M.Sc.Ag.  
Major : Vegetable Science Minor : Horticulture  
Deptt. : Vegetable Science  
Thesis Title : GENETIC VARIABILITY IN CHILLI (*Capsicum annum L.*)”  
Advisor : Dr. Durvesh K. Singh

### ABSTRACT

An experiment involving ninety three genotypes of chilli was carried out during spring summer season of the year 2007 at Vegetable Research Centre, G.B.P.U.&T, Pantnagar to determine the most promising and high yielding genotypes of chilli for cultivation and to select the important genotypes suitable to this area on the terms of their phenotypic and genotypic characteristics. The extent of genetic variability, heritability, genetic advance and correlation coefficient in respect of twenty five different characters regarding growth, yield, quality and incidence of diseases were studied under Tarai region of Uttarakhand. Wide variations were observed for all the characters indicating diverse genetic nature of the base population. The genotypes viz., SKAU-11, EC-519625, Selection-11, PC-2057, Indo Sem Yeda, HDC-75 and PC-7-1-2-1 were promising as they had more than two desirable traits. They produced higher yield over the checks Pant C-1, JCA-283 and LCA-206, respectively. There was high phenotypic variability was recorded for incidence of Leaf Curl Virus (49.93), followed by incidence of anthracnose (46.97) and seed yield /plant (37.66). Heritability estimates were high along with high genetic advance was observed for number of fruits/plant, shoot weight/plant and ascorbic acid content which could be improved by simple selection.

The significant positive association of economic traits like number of branches/plant, number of fruits/plant, weight of fruits/plant, fruit body length and total fruit yield (q/ha) was recorded, suggesting that selection for these characters could lead to improvement in yield. Thus, emphasis should be given on these characters to improve yield potential. Incidence of anthracnose disease was found minimum in HSHP-154, HDC-75, DLC-524 and UtkalYellow and PC-56, KCS-2013, PC-7-1-2-UP and PC-2004-UP-13(a) should low incidence of leaf curl virus. However, nematode incidence was minimum in Indo Sem Dona, Pant Chilli-4, KCS-2013 and PC-56. These genotypes may be used in resistance breeding programme. The traits such as fruit yield, number of fruits/plant, weight of fruits/plant, seed weight/100 g of fruits are important yield attributing characters and deserved due weightage, while formulating selection strategies for improvement of chilli crop.

(Durvesh K. Singh)  
Advisor

(Geeta gaur)  
Authoress