

**GENETIC STUDIES IN F₅ AND F₆ GENERATIONS OF
MUSKMELON (*Cucumis melo* L.)**

A Thesis submitted to the

MAHATMA PHULE KRISHI VIDYAPEETH
RAHURI - 413 722, DIST. AHMEDNAGAR
MAHARASHTRA INDIA

in partial fulfilment of the requirements for the degree

of

DOCTOR OF PHILOSOPHY (HORTICULTURE)

in

VEGETABLE SCIENCE

by

MISS. GAIKWAD SHILPA DEORAM

(Reg.No. 012/081)

DEPARTMENT OF HORTICULTURE

**POST GRADUATE INSTITUTE
MAHATMA PHULE KRISHI VIDYAPEETH
RAHURI - 413 722, DIST. AHMEDNAGAR
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2016

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APPROVED BY

Dr. A. M. Musmade
(Chairman and Research Guide)

Dr. R. S. Patil
(Committee Member)

Dr. S. A. Ranpise
(Committee Member)

Dr. M. N. Bhalekar
(Committee Member)

Dr. N. S. Kute
(Committee Member)

**DEPARTMENT OF HORTICULTURE
POST GRADUATE INSTITUTE
MAHATMA PHULE KRISHI VIDYAPEETH
RAHURI - 413 722, DIST. AHMEDNAGAR
MAHARASHTRA INDIA
2016**

CANDIDATE'S DECLARATION

*I hereby declare that this thesis or part
thereof has not been submitted
by me or any other person to any
other University or Institute
for a Degree or
Diploma*

Place : MPKV, Rahuri

(S.D. Gaikwad)

Dated : / /2016

Dr. A. M. Musmade

Professor,
Department of Horticulture,
Mahatma Phule Krishi Vidyapeeth
Rahuri - 413 722, Dist. Ahmednagar
Maharashtra India

CERTIFICATE

This is to certify that the thesis entitled, **GENETIC STUDIES IN F₅ AND F₆ GENERATIONS OF MUSKMELON (*Cucumis melo* L.)**, submitted to the Faculty of Agriculture, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar, Maharashtra State, India in partial fulfilment of the requirement for the degree of **DOCTOR OF PHILOSOPHY (HORTICULTURE)** in **VEGETABLE SCIENCE**, embodies the results of a *bona fide* research carried out by **MISS. GAIKWAD SHILPA DEORAM**, under my guidance and supervision and that 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 have been acknowledged.

Place : MPKV, Rahuri.

(A. M. Musmade)

Dated : / /2016

Research Guide

Dr. B. R. Ulmek,
Associate Dean
Post Graduate Institute
Mahatma Phule Krishi Vidyapeeth
Rahuri - 413 722 Dist. Ahmednagar
Maharashtra India.

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Place : MPKV, Rahuri

Dated : / /2016

(B. R. Ulmek)

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CONTENTS

CANDIDATE'S DELARATION	iii
CERTIFICATES	
1. Research Guide	Iv
2. Associate Dean (PGI)	V
ACKNOWLEDGEMENT	Vi
LIST OF TABLES	xii
LIST OF PLATES	xiv
LIST OF ABBREVIATIONS	Xv
ABSTRACT	Xvii
1. INTRODUCTION	1
2. REVIEW OF LITERATURE	7
2.1 Variability	7
2.2 Heritability and genetic advance	18
2.3 Correlation coefficient	28
2.4 Per cent incidence of diseases and pests	34
2.5 Fruit characters (Qualitative)	35
3. MATERIAL AND METHODS	37
3.1 Material	37
3.1.1 Details of crosses and generation wise progenies	37
3.1.2 Salient features of parent material	38
3.2 Methods	39
3.2.1 Design and layout of experiment for F ₅ and F ₆ generations	39
3.2.2 Details of Experiment	39
3.3 Observations recorded	40

3.3.1 Growth characters	40
3.3.2 Flowering characters	40
3.3.3 Yield characters	41
3.3.4 Fruit characters (quantitative)	42
3.3.5 Fruit characters (qualitative)	43
3.3.6 Biochemical composition	43
3.3.7 Per cent incidence of diseases and pests	44
3.4 Statistical methodology	45
3.4.1 Estimation of mean and range	45
3.4.2 Estimation of components of variations	46
3.4.3 Estimation of coefficient of variations	46
3.4.4 Estimation of heritability	47
3.4.5 Estimation of genetic advance	48
3.4.6 Estimation of correlation of coefficient	49
4. EXPERIMENTAL RESULTS	52
4.1 Genetical parameters of variability, heritability and genetic advance	52
4.1.1 Variability, heritability and genetic advance of cross Durgapura Selection x Punjab Sunheri (C ₁ : 2 x 7) for F ₅ and F ₆ generations.	53
4.1.2 Variability, heritability and genetic advance of cross Hara Madhu x IVMM-3 (C ₂ : 3 x 4) for F ₅ and F ₆ generations.	67
4.1.3 Variability, heritability and genetic advance of cross Hara Madhu x Punjab Sunheri (C ₃ : 3 x 7) for F ₅ and F ₆ generations.	80
4.1.4 Variability, heritability and genetic advance of cross IVMM-3 x Pusa Madhuras (C ₄ : 4 x 5) for F ₅ and F ₆ generations.	93
4.1.5 Variability, heritability and genetic advance of cross IVMM-3 x Punjab Sunheri (C ₅ : 4 x 7) for F ₅ and F ₆ generations.	106

4.2 Correlation co-efficient between yield and yield contributing characters.	119
4.2.1 Correlation co-efficient of five crosses in F ₅ and F ₆ generations.	119
4.3 Per cent incidence of diseases and pests	122
4.3.1 Per cent incidence of diseases	123
4.3.2 Per cent incidence of pests	124
4.4 Fruit characters (Qualitative)	122
4.4.1 Fruit shape	125
4.4.2 Fruit colour	125
4.4.3 Rind surface of fruit (Netted or Smooth)	126
4.4.4 Flavor	126
4.4.5 Colour of pulp	126
5. DISCUSSION	128
5.1 Range of the mean values	130
5.2 Variability estimates i.e. genotypic and phenotypic co-efficient of variation	139
5.3 Heritability and genetic advance	147
5.4 Correlation coefficient	161
5.5 Per cent incidence of diseases and pest	163
5.5.1 Per cent incidence of diseases	163
5.5.2 Per cent incidence of pest	164
5.4 Fruit characters (qualitative)	165
5.4.1 Shape of fruit	165
5.4.2 Colour of fruit	165
5.4.3 Rind surface of fruit(Netted or Smooth)	166
5.4.4 Flavor	166
5.4.5 Colour of pulp	166

6. SUMMARY AND CONCLUSIONS	168
6.1 Variability, heritability and genetic advance	168
6.2 Correlation coefficient	170
6.3 Per cent incidence of diseases and pests	171
6.4 Qualitative traits	172
6.5 Conclusion	173
7. LITERATURE CITED	175
8. VITA	187

LIST OF TABLES

Table No.	Title	Between pages
3.1.1	Details of crosses and generation wise progenies.	37
3.1.2	Salient features of parent material.	38
4	Mean, range, GCV, PCV, ECV, heritability, genetic advance and per cent mean of genetic advance of two parents and F ₅ population of cross Durgapura Selection x Punjab Sunheri (C ₁ : 2 x 7).	54-55
5	Mean, range, GCV, PCV, ECV, heritability, genetic advance and per cent mean of genetic advance of two parents and F ₆ population of cross Durgapura Selection x Punjab Sunheri (C ₁ : 2 x 7).	54-55
6	Mean, range, GCV, PCV, ECV, heritability, genetic advance and per cent mean of genetic advance of two parents and F ₅ population of Hara Madhu x IVMM-3 (C ₂ : 3 x 4).	68-69
7	Mean, range, GCV, PCV, ECV, heritability, genetic advance and per cent mean of genetic advance of two parents and F ₆ population of Hara Madhu x IVMM-3 (C ₂ : 3 x 4).	68-69
8	Mean, range, GCV, PCV, ECV, heritability, genetic advance and per cent mean of genetic advance of two parents and F ₅ population of cross Hara Madhu x Punjab Sunheri (C ₃ : 3 x 7).	81-82
9	Mean, range, GCV, PCV, ECV, heritability, genetic advance and per cent mean of genetic advance of two parents and F ₆ population of cross Hara Madhu x Punjab Sunheri (C ₃ : 3 x 7).	81-82
10	Mean, range, GCV, PCV, ECV, heritability, genetic advance and per cent mean of genetic advance of two parents and F ₅ population of cross IVMM-3 x Pusa Madhuras (C ₄ : 4 x 5).	94-95
11	Mean, range, GCV, PCV, ECV, heritability, genetic advance and per cent mean of genetic advance of two parents and F ₆ population of cross IVMM-3 x Pusa Madhuras (C ₄ : 4 x 5).	94-95
12	Mean, range, GCV, PCV, ECV, heritability, genetic advance and per cent mean of genetic advance of two parents and F ₅ population of cross IVMM-3 x Punjab Sunheri (C ₅ : 4 x 7)	107-108

13	Mean, range, GCV, PCV, ECV, heritability, genetic advance and per cent mean of genetic advance of two parents and F ₆ population of cross IVMM-3 x Punjab Sunheri (C ₅ : 4 x 7)	107-108
14	Correlation co-efficients for yield and yield contributing characters in F ₅ generation of cross Durgapura Selection x Punjab Sunheri (C ₁ : 2 x 7).	119-120
15	Correlation co-efficients for yield and yield contributing characters in F ₆ generation of cross Durgapura Selection x Punjab Sunheri (C ₁ : 2 x 7).	119-120
16	Correlation co-efficients for yield and yield contributing characters in F ₅ generation of cross Hara Madhu x IVMM-3 (C ₂ : 3 x 4).	119-120
17	Correlation co-efficients for yield and yield contributing characters in F ₆ generation of cross Hara Madhu x IVMM-3 (C ₂ : 3 x 4).	119-120
18	Correlation co-efficients for yield and yield contributing characters in F ₅ generation of Hara Madhu x Punjab Sunheri (C ₃ : 3 x 7).	120-121
19	Correlation co-efficients for yield and yield contributing characters in F ₆ generation of Hara Madhu x Punjab Sunheri (C ₃ : 3 x 7).	120-121
20	Correlation co-efficients for yield and yield contributing characters in F ₅ generation of cross IVMM-3 x Pusa Madhuras (C ₄ : 4 x 5).	120-121
21	Correlation co-efficients for yield and yield contributing characters in F ₆ generation of cross IVMM-3 x Pusa Madhuras (C ₄ : 4 x 5).	120-121
22	Correlation co-efficients for yield and yield contributing characters in F ₅ generation of cross IVMM-3 x Punjab Sunheri (C ₅ : 4 x 7).	121-122
23	Correlation co-efficients for yield and yield contributing characters in F ₆ generation of cross IVMM-3 x Punjab Sunheri (C ₅ : 4 x 7).	121-122
24	Per cent incidence of different diseases and pest of muskmelon in F ₅ and F ₆ generations.	122-123
25	Muskmelon fruit characters (qualitative) in F ₅ and F ₆ generations.	124-125

LIST OF PLATES

Plate No.	Title	Between pages
I.	Promising selections of cross Durgapura Selection x Punjab Sunheri 1 (C ₁ : 2 x 7) in F ₆ generation.	59-60
II.	Promising selections of cross Hara Madhu x IVMM-3 (C ₂ : 3 x 4) in F ₆ generation.	73-74
III.	Promising selections of cross Hara Madhu x Punjab Sunheri (C ₃ : 3 x 7) in F ₆ generation.	86-87
IV.	Promising selections of cross IVMM-3 x Pusa Madhuras (C ₄ : 4 x 5) in F ₆ generation.	99-100
V.	Promising selections of cross IVMM-3 x Punjab Sunheri (C ₅ : 4 x 7) in F ₆ generation.	112-113
VI.	Promising selections of cross IVMM-3 x Punjab Sunheri (C ₅ : 4 x 7) in F ₆ generation.	114-115
VII.	Promising selections of cross IVMM-3 x Punjab Sunheri (C ₅ : 4 x 7) in F ₆ generation.	115-116

LIST OF ABBREVIATIONS

σ^2	:	Variance
C ₁	:	Cross number-1
C ₂	:	Cross number-2
C ₃	:	Cross number-3
C ₄	:	Cross number-4
C ₅	:	Cross number-5
cm	:	Centimeter (s)
cv.	:	Cultivar
d.f.	:	Degrees of freedom
DAS	:	Days after sowing
ECV	:	Environment coefficient of variation
F ₄	:	Selfed of F ₃
F ₅	:	Selfed of F ₄
F ₆	:	Selfed of F ₅
FYM	:	Farm yard manure
G	:	Genotypic (correlation coefficient)
G. A.	:	Genetic advance
GAM	:	Per cent mean of genetic advance
GCV	:	Genotypic coefficient of variation
H ² _{bs}	:	Broad sense heritability
MT	:	Metric tonne
P	:	Phenotypic (correlation coefficient)
P ₂	:	Parent two
P ₃	:	Parent three
P ₄	:	Parent four

P ₅	:	Parent five
P ₇	:	Parent seven
PCV	:	Phenotypic coefficient of variation
PDI	:	Per cent disease incidence
S	:	Symbol
Sr. No.	:	Serial number
Sig.	:	Significant
T.S.S.	:	Total soluble solids
<i>viz.</i>	:	Namely

ABSTRACT

GENETIC STUDIES IN F₅ AND F₆ GENERATIONS OF MUSKMELON (*Cucumis melo* L.)

by

Miss. Gaikwad Shilpa Deoram

A candidate for the degree
of
DOCTOR OF PHILOSOPHY (HORTICULTURE)
in
VEGETABLE SCIENCE
Mahatma Phule Krishi Vidyapeeth,
Rahuri – 413722
2016

Research Guide : Dr. A. M. Musmade

Department : Horticulture

The present investigation entitled “Genetic studies in F₅ and F₆ generation of muskmelon (*Cucumis melo* L.)” was conducted during *kharif* 2014 and summer 2015. Fifteen selfed progenies of five hybrid derivatives [Cvs. (Durgapura Selection x Punjab Sunheri (C₁: 2 x 7), Hara Madhu x IVMM-3 (C₂: 3 x 4), Hara Madhu x Punjab Sunheri (C₃: 3 x 7), IVMM-3 x Pusa Madhuras (C₄: 4 x 5) and IVMM-3 x Punjab Sunheri (C₅: 4 x 7)] were evaluated for yield and yield contributing characters in F₅ and F₆ generation. This investigation has highlighted the magnitude of variability, heritability, genetic advance and correlation coefficient in F₅ and F₆ generations of muskmelon. Wide range of variability was observed in all quantitative characters for all the progenies of five crosses in F₅ and F₆ generations. Phenotypic coefficient of variation (PCV) was higher than the respective genotypic coefficient of variation (GCV) for all the studied characters in both F₅ and F₆ generation indicating role of environmental in the phenotypic expression of the traits.

All the fifteen progenies of five crosses were recorded high values of the GCV and PCV in both the F_5 and F_6 generations for most of the characters *viz.* vine length, number of primary branches per vine, number of male flowers per vine, number of female flowers per vine, sex ratio, number of fruits per vine, fruit yield per vine, average weight of fruit, average rind thickness, average fruit cavity, average weight of pulp per fruit, average weight of seeds per fruit and T.S.S., which showed greater phenotypic and genotypic variability among the accessions and sensitiveness of the attributes for making further improvement by selection.

High heritability coupled with high genetic advance as per cent of mean was observed for most of the characters i.e. vine length, number of primary branches per vine, number of fruits per vine, fruit yield per vine, average weight of fruit, average pulp and rind thickness, average fruit cavity, average weight of pulp per fruit, average weight of seeds per fruit and T.S.S. in most of the crosses of F_5 and F_6 progenies which indicates preponderance of additive gene action. These characters could be improved by pure line selection or mass selection method.

High heritability combined with low genetic advance was observed for some of the traits for which simple selection would not be rewarding. More the less, they could be utilized as a inbred lines in the hybrid development programme.

In all five crosses of F_5 and F_6 generations significant and positive correlation was observed both at phenotypic and the genotypic level between fruit yield per vine and the yield contributing characters such as vine length, number of primary branches per vine, number of female flowers per vine, number of fruits per vine, average weight of fruit, average length of fruit, average diameter of fruit and average weight of pulp per fruit. Most of these characters were also positively associated

among them.

Round fruit shape is an important fruit character in muskmelon as compared to round flat. In the present investigation, among the F_5 and F_6 segregating progenies of the five crosses most of the progenies produced orange colour pulp with round shape and netted fruit surface (rind).

Among the five crosses, three crosses *viz.*, Durgapura Selection x Punjab Sunheri (C_1 : 2 x 7), Hara Madhu x IVMM-3 (C_2 : 3 x 4) and Hara Madhu x Punjab Sunheri (C_3 : 3 x 7) showed yellowish colour fruits with green ridges, while the remaining two crosses *viz.*, IVMM-3 x Pusa Madhuras (C_5 : 4 x 5) and IVMM-3 x Punjab Sunheri (C_4 : 4 x 7) showed greenish yellow with ridges fruits. In case of pulp flavor the F_5 and F_6 progenies of all five crosses were observed pleasant musky pulp flavor.

In present study, the five crosses involving both parents with orange pulp colour were evaluated. The most of progenies of all five crosses *viz.*, Durgapura Selection x Punjab Sunheri (C_1 : 2 x 7), Hara Madhu x IVMM-3 (C_2 : 3 x 4) and Hara Madhu x Punjab Sunheri (C_3 : 3 x 7), IVMM-3 x Pusa Madhuras (C_4 : 4 x 5) and IVMM-3 x Punjab Sunheri (C_5 : 4 x 7) showed orange pulp colour in F_5 and F_6 generations.

From the present investigation seven superior progenies were selected for future crop improvement i.e. raising of F_7 generation based on more than 2.80 to 3.00 kg fruit yield per vine, round fruit shape, greenish yellow fruit colour with ridges fruit, netted fruit surface (rind), good T.S.S., pleasant musky pulp flavor with orange pulp colour through selectivity.

1. INTRODUCTION

Muskmelon (*Cucumis melo* L.) is a beautiful, juicy, tasty and delicious fruit popular and commercial crop of the tropics and sub tropics, grown all over the world for its nutritive and medicinal properties. The family cucurbitaceae includes squash, pumpkins, cucumbers, muskmelon, watermelon and gourds. Muskmelon is one of the most important cultivated cucurbits, which is native to India and Africa. It grows well in all tropical and subtropical areas of the world, but prefers hot climate. Muskmelon was first described by Linne in the year 1753 in species planetarum. It is member of family cucurbitaceae represented by some 118 genera and 825 species (Parle and Singh 2011).

Muskmelon is one of the most valued summer fruit because of its high nutritive and medicinal value, musky flavor, sweetness and aroma. It is a medium duration crop requiring a fairly long growing season from seed to marketable fruit. The ripe fruits used as dessert fruits (Reddy *et al.* 2013).

Muskmelon ($2n=24$) subdivided into 6-cultivar groups cantaloups, inodorus, flexusus, conomon, chita-dudaim and momordica (Munger and Robinson, 1991).

In India it is popular in Northern part of the country especially in Uttar Pradesh and Punjab and is grown in almost every place in the plains. It has many vernacular names, such as 'Kharbooz' (Hindi), 'Kharbuz' (Punjabi), 'Sakkatoli' (Gujarati), 'Kalinga' (Sanskrit) and 'Dangar' (Marathi). It is said to be a

native of tropical Africa more specifically in the Eastern region and South of Sahara desert. Central Asia comprising some parts of Southern Russia, Iran, Afghanistan, Pakistan and North-West India may be regarded as secondary centres of origin (Whitaker and Devis, 1962).

Muskmelon ($2n=24$) belongs to the family Cucurbitaceae and edible melons belong to either *Cucumis melo* var. *reticulatus* or *Cucumis melo* var. *cantaloupensis*. Plants are either monoecious or andromonoecious annuals with long trailing vines with shallow lobed round leaves. There is considerable variation in fruit size and shape. Fruits may be smooth or rough with or without netting. The skin colour may be white, green, yellow, yellowish brown or orange with green or yellow background. Upon ripening, fruits soften and musky aromatic essences are formed.

It is used as a dessert fruit and its juice has cooling effect and at green stage used as vegetable purpose for cooking in rural areas. The fruit juice is nutritive and acts as demulcent and diuretic drink. Juice is also remedy for skin diseases, tan freckles and in case of dyspepsia. The seeds are edible and its kernel is rich in oil (40-44%). The oil is useful in overcoming the problems like painful discharge and suppression of urine. The roots of melon have purgative and vomit causing properties. Fruits are good source of vitamins and minerals and relatively low in protein. The yellow and orange fleshed melons contain β -carotene, particularly cantaloupes are high in provitamin A (4200 IU/100g). Melons are also high in Vitamin C (26mg/100g).

edible portion). For every 100 g edible portion, melons provide 26 to 27 calories of energy, 0.3mg calcium, 1.4 mg iron and 14 mg phosphorus (Chakrabarti, 2001). Muskmelon annual production of 29.46 million MT in the world (Anonymous 2016). In India, it is cultivated on an area of 42 thousand ha with annual production of 868 thousand tonnes (Anonymous 2016).

In India muskmelon is commonly grown during summer season in river beds and also cultivated in fields. It is a cross-pollinated crop; hence, genetically pure strains are rather rare. Crop improvement in muskmelon resulted in the development of several improved varieties in the country. Many local strains like *Cucumis melo* var. *conomon* (oriental pickling melon or Chinese white cucumber), and *Cucumis melo* var. *utilissimum* (long melon or kakri) are being grown in some parts of Maharashtra and neighboring states. The poor yield, susceptibility to fruit fly and downy mildew have limitation for expansion of area under this crop.

Though, there is a wide range of genetic variability available in India it has not yet fully exploited. Estimation of genetic parameters is useful to understand the genetic architecture of yield and yield contributing components. Information about the mode of inheritance, type of gene action (Hayman, 1958) and heritability (Warner, 1952) of all the yield contributing components would be of immense importance for a plant breeder to decide about the breeding procedures to be adopted and

the characters on which the selection has to be made. This can enhance the effectiveness of selection for yield, fruit quality and their contributing factors.

Large amount of variation provides the better chance for selecting the desired genotypes (Vavilov, 1951). The response to selection of the traits would depend upon the continuous variation (Fisher, 1918). Selection towards this is depends upon the nature and magnitude of the variability present in the material for the desired characters and the extent to which it is heritable. Burton (1952) suggested that genetic variation together with heritability estimates would give the best estimate of genetic advance expected from the selection. Johnson *et al.* (1955a) also reiterated the above fact and stressed the need for genetic advance to assess the maximum effect of selection. Since the heritable and non heritable components of variation are important to assess the true breeding. Such information on heritability is prerequisite for improving the character and the productivity of the crop through the planned breeding programme.

High heritability accompanied with high genetic advance indicates the predominance of additive gene action whereas high heritability accompanied with low genetic advance indicates the predominance of epistasis and dominant gene action (Panse and Khargonkar, 1957). High heritability along with high genetic advance is usually more useful in predicting gain under selection than the heritability estimates alone (Johnson *et al.*, 1955).

Direct selection for yield is often misleading as yield is a polygenically controlled and also subjected to the effect of fluctuating environment. Efficiency of selection in any breeding programme is enhanced and mainly depends on the knowledge of association of characters. The phenotypic correlation shows the extent of observed relationship between the two characters, while the genotypic correlation provides an estimate of inherent association between the genes responsible for controlling the two characters.

The essential prerequisite for breeding programme is the presence of genetic variability in the breeding material. Morphological differences between characters such as size, colour, yield, resistance to pest and diseases are of immense importance to the breeder. An ideal cultivar should be high yielder, early maturing with attractive fruit of uniform size and shape (round) having netting on fruit surface, high musky flavor, more T.S.S. and resistant to pest and diseases.

Muskmelon is monoecious, andromonoecious and highly cross pollinated crop in which large amount of variation has been observed for many economically important characters. The genetic parameters such as phenotypic coefficient of variation, genotypic coefficient of variation, heritability, genetic advance as per cent mean, genotypic and phenotypic correlation coefficients provides an effective tool in the hands of a breeder to select a genotype having the most desirable characters.

Considering the importance of genetic variability and its utilization for crop improvement, the present investigation on

“Genetic studies in F₅ and F₆ generations of muskmelon (*Cucumis melo* L.)” was undertaken with the following objectives:

1. To assess the variability for important qualitative and quantitative traits in F₅ and F₆ generations.
2. To estimate heritability and genetic advance for yield contributing characters in F₅ and F₆ generations.
3. To study the correlation between yield and yield contributing characters in F₅ and F₆ generations.

2. REVIEW OF LITERATURE

Improvement of quantitative and qualitative characters of a crop is the objective of any breeding programme. Information on inheritance of various quantitative traits, particularly of economic importance will be most useful in planning and successful implementation of breeding programme. Slow progress in improvement of muskmelon for yield and quality improvement could be attributed to little attention of the breeders towards this compared as to other major food crop species. Thus, genetic information on variability, heritability, genetic advance and correlation for growth, yield and fruit quality in muskmelon are rather limited. The available literature on these aspects in muskmelon and related cucurbitaceous crops like bottle gourd, bitter gourd, ridge gourd, snake gourd, cucumber, ash gourd, melons, pumpkin has been reviewed and presented under the following sub-headings.

2.1 Genetic variability

2.2 Heritability and genetic advance

2.3 Correlation coefficient

2.4 Per cent incidence of diseases and pests

2.5 Fruit characters (Qualitative).

2.1 Genetic variability

The study of genetic variability is an important prerequisite in any successful breeding programme. The knowledge of the nature and magnitude of genetic variation in respect of quantitative plant growth characters coupled with

yield and its components is essential in efficient crop improvement programme.

The variability in the population can be estimated by genetic variability parameters like mean, range, genotypic and phenotypic coefficient of variation *i.e.* GCV and PCV along with heritability and genetic advance. Genetic variability is the most important parameter of variability helpful for improvement of particular character. Phenotypic coefficient of variation (PCV) represents total variability which normally includes both genotypic and environmental variations.

The genotypic variation refers to genetic or inherent variability which remains unaltered by environmental conditions. Therefore, PCV values more to less equal to GCV values denotes that the character is less influenced by environmental factors. High estimates of PCV than the GCV indicating that the trait is particularly affected by environment (Reddy, 1989). High PCV and GCV estimates facilitates more scope for selection of individuals among the population.

2.1.1 Muskmelon

Dahiya *et al.* (1989) studied genetic variability in muskmelon and revealed the high estimates of genotypic coefficient of variation and phenotypic coefficient of variation for vine length, days required for first female flower appearance, number of male and female flowers per vine, nodal position of first female flower appearance, number of fruits per vine, fruit yield per vine and average weight of fruit indicated great scope of genetic improvement for these characters.

Somkumar *et al.* (1997) recorded highest PCV and GCV in muskmelon for per cent disease intensity of downy mildew. The other characters *viz.* average fruit weight, number of fruits per vine and fruit yield per vine recorded high PCV and GCV estimates. Low GCV and PCV estimate was recorded for days to first harvest.

Tarsem and Sanjay (1997) studied genetic variability in muskmelon and reported that high values of variability (PCV & GCV) were recorded for node at which first female flower appeared, average weight of fruit, marketable yield per vine and total yield per vine. Also reported that estimates of PCV were higher than GCV.

Rakhi and Rajamony (2005) revealed the high estimates of GCV and PCV in muskmelon for fruit yield per plant followed by average fruit weight, number of fruits per plant, keeping quality of fruits and 100-seed weight. Also observed the high estimates of PCV than GCV with high magnitudinal differences.

Chamnan and Kasem (2006) Studied two inbred lines (RM1 and LM2) of slicing melon and their related progenies. The results indicated that heritability based on fruit width, fruit length, fruit shape index, and fruit weight were relatively high. The heritability for fruit number per plant and yield were also high. The performance of fruit characters of F₁ hybrid was not exceeding over that of the better parent or equal to the mid-parent values.

Torkadi and Musmade (2007) studied fifty one genotypes of muskmelon for genetic variability and reported that, the PCV was higher than GCV for all the characters with more magnitudinal differences between PCV and GCV. This might be due to effect of environment in the expression of traits. The high phenotypic as well as genotypic coefficient of variation was observed for economically important characters such as number of fruits per vine, average weight of fruit, fruit cavity, average weight of pulp per fruit and average rind thickness. The high mean estimates were recorded for average fruit weight and yield per vine.

Mehta *et al.* (2010) reported that high genotypic and phenotypic coefficient of variation was observed for fruit yield per plant followed by acidity percentage, number of fruits per plant and total soluble solids, while moderate estimates were obtained for number of node at which first female flower appeared and fruit weight. Higher estimate of PCV were observed as compared to GCV. Besides high mean estimates were obtained for average fruit length, number of fruits per vine and fruit yield.

Choudhary *et al.* (2011) studied genetic variability seventy genotypes of muskmelon for fifteen character. The study indicated existence of considerable amount of genetic variability for all the characters studied. Yield per plant, flesh weight per fruit and average fruit weight exhibited higher values of genotypic and phenotypic coefficient of variation. High estimates of genotypic coefficient of variation were observed for yield per

plant and average fruit weight. These characters can be effectively improved through selection.

Ibrahim (2012) reported high estimates of PCV and GCV for fruit weight followed by fruit yield per plant and fruit length in muskmelon. The estimates of PCV in general were higher than GCV for all the characters, which suggested that the apparent variation is not only due to the genotypes but also due to the influence of environment. Thus, caution has to be exercised during the selection programme because the environmental variations are unpredictable in nature and may mislead the results. The more magnitudinal differences were observed between PCV and GCV estimates.

Reddy *et al.* (2013) reported that highest estimates of PCV and GCV were obtained for fruit yield (28.30 % and 26.08 %) followed by fruit cavity length (28.20 % and 26.66 %), rind thickness (26.39 % and 22.14 %) and average fruit weight (24.01 % and 22.82 %) in muskmelon. The estimates of GCV signify that there is greater potential for favorable advance in selection. In general magnitude of PCV was higher than the corresponding GCV all the traits, indicated that these attributes had to some extent interacted with the environment. The PCV and GCV values were close to one another, implying that genotype contributed more to the expression of these characters than environment, suggesting greater possibilities of improvement through selection.

Mali *et al.* (2015) studied variability, heritability and genetic advance for twenty four characters of seven genotypes of

muskmelon in F_3 generation and reported that high genotypic and phenotypic coefficients of variation and high heritability estimates associated with high values of genetic advance as percent of mean were observed for final vine length, number of primary branches per vine, number of male and female flowers per vine, sex ratio, node at which first female flower appeared, number of fruits per vine, fruit yield per vine, average weight of fruit, average length of fruit, average rind thickness, average pulp thickness, average fruit cavity, average weight of pulp per fruit, average weight of seed per fruit, T.S.S. and non reducing sugar which indicated additive gene action for these characters, which could be improved by simple selection method. Beside this high estimates were observed for PCV as compared to GCV estimates.

Mali (2015) reported that in F_4 generation of muskmelon high estimate of variability (GCV and PCV) along with high estimate of heritability with high genetic advance of percent of mean were observed for all character studied i.e final vine length, number of primary branches per vine, number of male and female flowers per vine, sex ratio, node at which first female flower appeared, number of fruits per vine, fruit yield per vine, average weight of fruit, average length of fruit, average rind thickness, average pulp thickness, average fruit cavity, average weight of pulp per fruit, average weight of seed per fruit, T.S.S. and non reducing sugar could which indicate preponderance of additive gene action which could be improved by pure line selection method.

2.1.2 Other cucurbits

2.1.2.1 Watermelon

Kadam (1997) evaluated variability in seven cultivars of watermelon for growth and yield attributes. The estimates of PCV were slightly higher than GCV for all the traits studied indicating the minor role of environment in the expression of traits. The estimates of PCV and GCV were high for average number of fruits per vine followed by average weight of fruit, average fruit yield per vine, average weight of flesh, average number of seeds per fruit, average length of fruit and shelf life of fruits whereas, average diameter of flesh, average number of primary branches, average diameter of fruit, total soluble solids, days required for 50 per cent harvest and female flowering recorded low estimates of PCV and GCV.

Rolania *et al.* (2004) studied the genetic variation in fifteen genotypes of watermelon. Analysis of variance revealed significant difference among the genotypes for the traits studied. The PCV and GCV were moderate for vine length, number of primary branches per plant, internodal length, number of nodes per plant and fruit yield. High estimates of heritability were recorded for days to first fruit harvest. Moderate heritability coupled with moderate genetic advance was observed for number of primary branches per plant, internodal length and number of nodes per plant.

Gusmini and Wehner (2007) studied genetic variance in watermelon and reported that high estimates of GCV and PCV were observed for number of fruits per vine, average weight of

fruit, average fruit yield per vine, average weight of flesh and average number of seeds per fruit. Comparatively higher estimates were observed for phenotypic coefficient of variations than the genotypic coefficient of variations.

2.1.2.2 Cucumber

Joshi *et al.* (2005) reported that genotypic coefficients of variation and phenotypic coefficients of variation in cucumber were ranged from 9.48 % to 93.76 %, showing sufficient genetic diversity among the genotypes. The traits such as node number with first fruit, number of fruits per vine, fruit yield, fruit circumference and fruit length had high estimates of PCV and GCV indicated scope for improvement by selection. PCV estimates were higher than GCV estimates.

Gaikwad (2007) observed high degree of variation in all the characters studied in cucumber. The estimates of GCV were low as compared to PCV. The high GCV and PCV was observed for length of fruit, number of fruits per vine, fruit weight and node number of first female flower appearance.

Arunkumar *et al.* (2011) studied the genetic variability in F₂ population of BGDL x White long, BGDL x Hot season and BGDL x Hyderabad cucumber. The high variability in the form of PCV and GCV was observed in BGDL x White long for number of misshaped fruits per vine, whereas moderate PCV and GCV was observed for number of good fruits per vine and total number of fruits per vine followed by BGDL x Hyderabad cucumber and BGDL x Hot season.

Azcon (2012) reported that highest variability (PCV and GCV) was recorded for fruit length, fruit shape index, number of fruits per plant and total fruit yield per plant in snake cucumber genotypes. The estimation of PCV were higher than the GCV estimation.

2.1.2.3 Bitter gourd

Fifty five progenies of bitter gourd were studied for genotypic and phenotypic coefficient of variability. The high estimates of GCV and PCV were recorded for yield per vine, weight of fruits and number of fruits per vine (Chaudhary *et al.*, 1991).

Rajput (2012) assessed the variability in F₂ and F₃ generations of bitter gourd and reported that wide range of variability was observed in all quantitative traits. Phenotypic coefficient of variation was noticed higher than genotypic coefficient of variation. The high estimates for both GCV and PCV were observed for number of primary branches per vine, number of female flowers per vine, sex ratio, number of fruits per vine, fruit yield per vine, average yield per vine, average weight of fruit and fruit flesh thickness in F₂ and F₃ generations. Thus, presence of greater amount variability particularly for yield attributes can be further improved by simple selection method.

2.1.2.4 Bottle gourd

Pandit *et al.* (2009) studied on fifteen genotypes of bottle gourd (*Lagenaria siceraria* Molina. Standl.) were evaluated. There was considerable variability in all traits except fruit/plant. The moderate GCV and GA in fruit length and fruit weight

indicate the probable likelihood of additive gene action. Thus improving these characters should be effective and rewarding during selection.

Patil (2010) evaluated twenty five genotypes of bottle gourd for variability analysis and reported that high estimates of GCV and PCV were observed for average fruit weight, number of fruits per vine and fruit yield per vine. Whereas the character days to first harvest showed low estimates of GCV and PCV. The wide range of variability was observed for all the characters. The estimates of GCV were lower than that of PCV for all characters.

Arvindkumar *et al.* (2011) studied the magnitude of genetic variability in bottle gourd. Analysis of variance revealed the adequate variability among all genotypes for all characters. The PCV was slightly higher than their corresponding GCV for all characters. The estimates of GCV & PCV were high for fruit yield per vine followed by fruit length and number of seeds per fruit.

Husna *et al.* (2011) conducted experiment on Variability, among different characters of thirty one bottle gourd genotypes were studied. There was a great deal of significant variation for all the characters among the genotypes. High genotypic co-efficient of variation (GCV) was observed for yield per plant, fruit weight whereas low genotypic co-efficient of variation was observed fruit breadth. In all cases, phenotypic variances were higher than the genotypic variance. Differences between genotypic and phenotypic co-efficient revealed that the major portion of the phenotypic variance was genetic in nature.

Yadav and Kumar (2012) reported that highest estimates of PCV and GCV were recorded for vine length, number of primary branches, node number of first female flower appearance, number of fruits per vine, average weight of fruit and yield per vine in bottle gourd. PCV estimate was higher than GCV estimate for all the studied traits.

2.1.2.5 Ridge gourd

Choudhary and Kumar (2011) conducted genetic study in ridge gourd and reported that the range of variation was higher in fruit length followed by node at which first female flower appeared and fruit weight. The minimum range of variability was recorded in days to first female flower. The height GCV and PCV were recorded for node at which first female flower appeared followed by number of marketable fruits per plant. High magnitude of GCV is an indication of high genetic variability among the genotypes which provides ample scope for improvement of these characters through selection. Also reported that the PCV estimates were higher than the GCV estimates.

Rabbani *et al.* (2012) reported that high PCV and GCV was recorded for vine length, petiole length, number of primary branches at harvest, sex ratio, fruit length, fruit circumference, peduncle length, dry weight of flesh, number of fruits per vine, average fruit weight and fruit yield per vine in ridge gourd. The values of GCV were smaller than PCV, indicating the effect of environment to some extent in the expression of the characters.

2.2 Heritability and genetic advance

Phenotype of an individual is determined by genotype and environment in which it grows. Success of breeder in changing and improving the heredity of character depends upon the degree of correspondence between phenotypic and genotypic value. Heritability is a measure that provides this information.

Heritability in broad sense or degree of genetic determination is proportion of total hereditary variance to phenotypic variance. The more useful estimate *i.e.* narrow sense heritability or degree of resemblance between relatives is ratio of additive genetic variance to phenotypic variance (Falconer, 1981). The most important function of heritability in the genetic studies is its predictive role in expressing the reliability of phenotypic value as a guide to breeding value (Falconer, 1981). A brief summary of work done for estimating heritability and genetic advance of yield and yield contributing characters is reviewed as below.

2.2.1 Muskmelon

Singh *et al.* (1989) reported that broad sense heritability estimates were moderate for days required for first female flower appearance, node at which first female flower appeared, fruit length, pulp weight and fruit diameter characters in muskmelon.

Somkumar *et al.* (1997) studied heritability and genetic advance as per cent of mean in muskmelon and obtained high heritability and moderate genetic advance as per cent mean for F:C ratio, per cent disease intensity of downey mildew, fruit

yield per vine, number of fruits per vine and fruit weight indicated that hybridization followed by selection will be effective for genetic improvement.

Tarsem and Sanjay (1997) studied heritability and genetic advance in muskmelon and reported that high values of heritability coupled with high genetic advance as per cent of mean were recorded for node at which first female flower appeared, average weight of fruit, marketable yield per vine and total yield per vine.

Vishwanatha (2003) reported that high heritability was observed for fruit yield per vine, average fruit weight, number of fruit per vine and days to first male and female flowering in muskmelon. When heritability and genetic gain were considered together fruit yield per vine, average fruit weight, number of fruit per vine recorded the highest values; however, the number of primary branches, vine length, T.S.S. and flesh thickness recorded high heritability with moderate genetic gain.

Moon *et al.* (2004) recorded high heritability (broad sense) along with low genetic advance as percent of mean in muskmelon for node number of first female flower appearance, days to first female flower opening, days to first fruit maturity, number of fruits per vine, average fruit weight, fruit diameter, flesh thickness, fruit cavity and average yield per vine.

Prasad *et al.* (2004) reported that heritability and genetic advance as per cent of mean in muskmelon was higher for days to appearance of first female flower, number of male and

female flower per vine, node at which male flower appeared and yields per plot.

Arvindakumar (2005) evaluated 49 hybrids along with their 14 parents to assess heritability and genetic advance of 15 quantitative traits in muskmelon and reported that high heritability along with high genetic advance as per cent of mean was recorded for sex ratio, number of fruits per vine, average fruit weight, fruit length, fruit diameter, rind thickness and flesh thickness. The study indicated that these traits were under the control of additive gene action which is more useful in predicting gain under selection.

Pandey *et al.* (2005) recorded the high heritability along with high expected genetic advance for number of days to 50 per cent female flower anthesis, T.S.S. and number of days to first male flower anthesis while the characters such as average fruit length and average fruit diameter showed high heritability and low expected genetic advance.

Rakhi and Rajamony (2005) revealed the high heritability coupled with high genetic advance as per cent of mean for number of primary branches per vine, fruit length, 100-seed weight, average fruit weight and keeping quality of fruits. This might be due to high additive gene effects and consequently the scope for improvement of yield through selection.

Singh and Lal (2005) revealed that high heritability coupled with high genetic advance as per cent of mean was observed for node at which first female flower opens followed by rind thickness and fruit weight which implies that these traits

are more reliable for improvement through selection in muskmelon. The characters viz., total sugar contents, average rind and pulp thickness recorded high heritability with low genetic advance as per cent of mean.

Torkadi and Musmade (2007) studied genotypes of muskmelon for estimation of heritability and genetic advance as a per cent mean and reported that, high heritability (broad sense) coupled with high genetic advance as a per cent mean was recorded for days to first male flower opening, days to first female flower opening, days to first harvest of fruit, fruit length, fruit diameter, number of fruits per vine, average weight of fruit, fruit yield per vine, flesh thickness, fruit cavity size, average weight of pulp per fruit, average rind thickness and total soluble solids. The presence of high heritability along with high genetic advance as per cent mean for the above traits might be attributed due to additive gene effects and is desirable for effective selection in breeding programme. Also recorded high heritability along with low genetic advance as per cent mean for total sugars and acidity percentage.

Tomar *et al.* (2008) studied fifty genotypes of muskmelon and found that the heritability (broad sense) for days to first female flower opens, fruit diameter, acidity and total sugar characters was moderate, suggesting that non-additive genetic variance was largely predominating.

Mehta *et al.* (2010) conducted experiment on heritability and genetic advance for 12 quantitative characters in 44 diverge genotypes of muskmelon and reported that high

estimates of heritability accompanied with high genetic advance was observed for node number at which first female flower appeared, number of fruits per vine, fruit yield per vine, average fruit weight and total soluble solid which indicated the importance of additive gene effects and selection based on this would bring significant improvement in the genotypes of muskmelon.

Choudhary *et al.* (2011) studied heritability and genetic advance for fifteen yield contributing traits in seventy genotypes of muskmelon. The study indicated existence of considerable amount of high estimates of heritability, genotypic coefficient of variation and genetic advance were observed for yield per plant and average fruit weight. These characters can be effectively improved through selection.

Ibrahim (2012) obtained high estimates of heritability associated with high genetic advance for fruit weight, number of fruits per vine, fruit length, fruit width, flesh thickness and total fruit yield per vine. This indicated the presence of large number of fixable additive factors. Breeding methods based on progeny testing and mass selection could be useful in improving these traits.

Mishra *et al.* (2012) studied the thirty strains of long melon and reported that all the characters showed moderate to high heritability. Heritability estimates was high for length of vine, days to first female flower appearance and length of fruit. The highest and lowest estimate of genetic advance as a per cent

mean was observed for number of nodes per vine and width of fruit respectively.

Reddy *et al.* (2013) reported that the traits like days to appearance of first staminate flower, fruit length, average fruit weight, fruit cavity length and width, rind thickness, T.S.S. and seed yield in muskmelon recorded high genetic advance as a per cent of mean coupled with high heritability estimates, indicating that these traits were under the strong influence of additive gene action and hence selection based on phenotypic performance of these traits would be more effective. While high heritability and low genetic advance as per cent of mean was observed for days to first fruit harvest, indicated that the character is highly influenced by environmental effects and selection would be ineffective.

Patil (2014) reported that in muskmelon high heritability accompanied with high genetic advance was observed in the cross 5 (IVMM-3 x Punjab Sunheri) for most of the characters like vine length, days required for initiation of male and female flowering, number of female flowers per vine, node at which first female flower appeared, days required for first harvest of fruits, yield per vine, weight of fruit, length of fruit, diameter of fruit, rind thickness, pulp thickness, fruit cavity, weight of pulp per fruit, weight of seed per fruit, total soluble solids, acidity, downey mildew, powdery mildew, fruit fly and leaf miner. It indicated that most likely the heritability is due to additive gene effects and selection may be effective. Whereas highest heritability coupled with lowest genetic advance was observed for

the number of primary branches per vine, ascorbic acid, total sugar, reducing sugar, non reducing sugar it indicated that non additive effects involved in controlling the inheritance of characters.

Mali *et al.* (2015) studied heritability and genetic advance analysis for twenty four characters of seven genotypes of muskmelon of the cross Hara Madhu x IVMM-3 in F₃ generation. High heritability estimates were associated with high values of genetic advance as percent of mean were observed for final vine length, number of primary branches per vine, number of male and female flowers per vine, sex ratio, node at which first female flower appeared, number of fruits per vine, fruit yield per vine, average weight of fruit, average length of fruit, average rind thickness, average pulp thickness, average fruit cavity, average weight of pulp per fruit, average weight of seed per fruit, T.S.S. and non reducing sugar which indicated additive gene action for these characters, which could be improved by simple selection method.

Mali (2015) reported that in F₄ generation of muskmelon high estimate of heritability with high genetic advance of percent of mean were observed for all character studied i.e. final vine length, number of primary branches per vine, number of male and female flowers per vine, sex ratio, node at which first female flower appeared, number of fruits per vine, fruit yield per vine, average weight of fruit, average length of fruit, average rind thickness, average pulp thickness, average fruit cavity, average weight of pulp per fruit, average weight of

seed per fruit, T.S.S. and non reducing sugar could which indicate preponderance of additive gene action which could be improved by pure line selection method

2.2.2 Other cucurbits

2.2.2.1 Watermelon

Krishna *et al.* (2002) conducted experiment on adaptive response and diversity in watermelon and reported that high heritability coupled with high genetic advance were observed for number of nodes, days to female flowers appearance, yield per plot and number of fruits per vine.

Rolania *et al.* (2004) an experiment was conducted to study the genetic variation in fifteen genotypes of watermelon. They observed that, High estimates of heritability were recorded for days to first fruit harvest. Moderate heritability coupled with moderate genetic advance was observed for number of primary branches/plant, internodal length and number of nodes/plant.

Gusmini and Wehner (2007) studied heritability and genetic advance as per cent mean in watermelon and reported that high estimates of heritability along with high estimates of genetic advance as per cent mean were observed for number of fruits per vine, average weight of fruit, average fruit yield per vine, average weight of flesh and average number of seeds per fruit.

2.2.2.2 Cucumber

Joshi *et al.* (2005) reported that the high heritability accompanied with high genetic advance as per cent of mean was observed for vine length, number of primary branches, node

number of first fruit, fruit length, fruit circumference, number of fruits per vine and fruit yield revealed the considerable effect of additive genes in these traits.

Kumar and Syamal (2007) reported that range of heritability values were recorded from 12.50 % to 100.00 % for the studies characters in cucumber. The heritability estimate were high for fruit length, node number bearing first male flower and fruit weight while moderate estimates of heritability were observed for number of days to first female flower anthesis, number of days to 50 per cent germination. The high estimate of genetic advance was recorded for number of days to first fruit harvest, while low estimate of genetic advance were recorded for fruit cavity, number of days to germination and vine length.

Kumar and Syamal (2010) observed low narrow sense heritability for fruit length, fruit diameter, fruit weight, and vine length in cucumber. This might be attributed due to presence of non-additive gene action.

Arunkumar *et al.* (2011) reported that high heritability coupled with moderate genetic gain was noticed for number of good fruits per vine and total number of fruits per vine in F₂ population of bottle gourd.

Azcon (2012) reported that the broad sense heritability was higher for fruit length, fruit shape index, number of fruits per vine and total fruit yield per vine but it was moderate for fruit diameter in snake cucumber genotypes. Higher values of heritability indicated that phenotypic selection for these traits could be highly efficient.

2.2.2.3 Bitter gourd

The high heritability and high genetic gain was recorded for fruit yield per vine, weight of fruits and number of fruits per vine in bitter gourd indicating the additive gene effects and these economic traits can be improved by adopting proper selection methods (Chaudhary *et al.*, 1991).

Rajput (2012) assessed heritability and genetic advance as a per cent of mean in F₂ and F₃ generations of bitter gourd and reported that high estimates of heritability coupled with high genetic advance as per cent of mean was observed for the characters number of primary branches per vine, number of female flowers per vine, sex ratio, average yield per vine and number of fruits per vine in both F₂ and F₃ generations. Whereas the high heritability with low genetic advance as percent of mean was observed for other characters.

2.2.2.4 Bottle gourd

Husna *et al.* (2011) reported that on Variability for different characters of thirty one bottle gourd genotypes. High heritability with low genetic advance in percent of mean among most of the characters of thirty one bottle gourd genotypes were observed. High heritability with high genetic advance in percent of mean was observed for yield per plant and days of first male flowering indicated that this trait was under additive gene control and selection for genetic improvement for this trait would be effective.

Yadav and Kumar (2012) reported that highest estimates of heritability coupled with highest genetic advance as

per cent of mean were recorded for vine length, number of primary branches, node number of first female flower appearance, number of fruits per vine, fruit length, and yield per vine. This might be due to additive gene effects in their inheritance and indicated scope for improvement through selection.

2.3 Correlation coefficient

Direct selection for yield is often misleading as yield is a polygenically controlled and also subjected to the effect of fluctuating environment. Efficiency of selection in any breeding programme is enhanced and mainly depends on the knowledge of association of characters. The work done for association of relationship between yield and yield contributing characters is reviewed as below.

2.3.1 Muskmelon

Monila *et al.* (1989) observed the significant and positive correlation between total fruit yield with average weight of fruit, fruit length, fruit width, flesh thickness and rind thickness in muskmelon.

Choudhary *et al.* (2003) observed that fruit yield per vine had significant and positive correlation with average fruit weight, number of fruits per vine, harvest duration, rind thickness, shelf life and vine length in muskmelon.

Chamnan and Kasem (2006) studied the correlation coefficient in F₂ generation of muskmelon and revealed that fruit yield per vine had positive and significant correlation with number of fruits per vine. The results indicated that number of

fruits per vine had a close association with the yield. Thus, components of fruit number per vine should be considered for yield improvement in muskmelon breeding programme.

Jagtap (2010) showed positive and significant association with number of fruits per vine, diameter of fruit, pulp thickness and pulp weight per fruit in both summer and *kharif* seasons.

Naroui *et al.* (2010) reported that fruit yield had significant and positive correlation with fruit weight and flesh diameter.

Cheema *et al.* (2011) studied correlation based on 11 morphological traits in muskmelon and reported that fruit yield per vine was positively correlated with number of lateral branches per vine, number of green leaves per vine, fruit weight, number of fruits per vine and total number of leaves per vine. Numbers of green leaves per plant was positively correlated with total soluble solids (T.S.S.) and yield per vine.

Mali *et al.* (2015) studied that correlation in muskmelon for twelve characters of seven genotypes of muskmelon and from the cross Hara Madhu x IVMM-3 in F₃ generation. Fruit yield per vine showed highly significant positive correlation with final vine length, number of primary branches per vine, number of female flowers per vine, number of fruits per vine, average weight of fruit, average length of fruit, average diameter of fruit and average weight of pulp per fruit. It is suggested that characters viz., number of female flowers per vine, number of fruits per vine, average weight of fruit, average

length of fruit, average rind and pulp thickness, average weight of pulp per fruit should be given priority for selecting high yielding genotypes.

2.3.2 Other cucurbits

2.3.2.1 Watermelon

Kadam (1997) studied phenotypic and genotypic correlation coefficient between yield and yield contributing characters in watermelon and revealed that average fruit yield per vine was highly and positively correlated with average length of main vine, average number of primary branches, average length of fruit, average diameter of fruit, average weight of fruit, average diameter of flesh, average number of seeds per fruit and average weight of flesh.

Rolania *et al.* (2003) reported that fruit yield was positively correlated with main vine length, number of primary branches per vine, number of nodes per vine, number of female flowers per vine, number of fruits per vine and harvest duration in watermelon.

2.3.2.2 Cucumber

Rao *et al.* (2003) reported that fruit yield was positively correlated with fruit weight, fruit length and flesh thickness at both genotypic and phenotypic levels in cucumber.

Joshi *et al.* (2005) reported that correlation coefficient of fruit yield was observed positive with vine length, number of primary branches, node number of first fruit, fruit length, fruit circumference and number of fruits per vine in cucumber.

Bhande *et al.* (2012) revealed that fruit yield per vine in cucumber showed highly significant positive association with number of fruits per vine, volume of fruit, length of fruit, weight of fruit and girth of fruit where as other traits *viz.*, node at first pistillate flower and days to first harvest exhibited negative and significant association with fruit yield per vine at both genotypic and phenotypic level.

2.3.2.3 Bitter gourd

Dey *et al.* (2005) studied the correlation in bitter gourd and revealed that the fruit yield had the highest positive correlation with fruit weight followed by number of fruits per vine, flesh thickness, days from fruit set to maturity, fruit index, fruit length and fruit diameter where as other traits like number of male flowers per vine, ascorbic acid, total carotenoids content and days to first male flower exhibited negative correlation coefficient with fruit yield.

Botau *et al.* (2010) demonstrated that the fruit yield per vine had significant and positive correlation with number of fruits per vine, fruit weight, fruit length and fruit diameter in bitter gourd.

2.3.2.4 Bottle gourd

Pandit *et al.* (2009) studied on fifteen genotypes of bottle gourd (*Lagenaria siceraria* Molina. Standl.) were evaluated correlation between both genotypes and phenotypes indicate the overriding importance of fruit length and fruit width in determining the average fruit weight, which in turn adequately describes the increase in fruit yield/plant.

Yadav *et al.* (2010) reported that fruit yield per plant in bottle gourd had positive and significant phenotypic and genotypic correlation coefficient with number of fruits per vine, weight per fruit, length of fruits, number of primary branches per vine, number of nodes per vine, vine length and days to first female flower anthesis.

Kumar *et al.* (2012) studied correlation in bottle gourd and noticed that fruit yield per vine had highly significant positive association with days to fruit setting, days to maturity and number of fruits per vine at genotypic and phenotypic level.

Sharma and Sengupta (2012) reported that fruit yield per vine exhibited significantly positive correlation with vine length, number of primary branches per vine, number of female flowers per vine, number of fruits per vine and fruit length in bottle gourd.

Yadav and Kumar (2012) studied phenotypic and genotypic correlation coefficient in 15 genotypes of bottle gourd and revealed that fruit yield per vine had positive and highly significant correlation coefficient with average fruit weight followed by days to first female flower anthesis, number of fruits per vine, length of fruit, node number of first female flower and number of primary branches per vine at phenotypic and genotypic level.

Deepthi *et al.* (2014) conducted experiment on bottle gourd genotypes to assess the nature and magnitude of association among yield and its contributing traits in bottle gourd. Correlation studies revealed that yield per vine had

significant positive association with tendril length (cm), number of nodes per vine, number of primary branches per vine, total vine length (m), internodal length (cm), number of fruits per vine, fruit weight (g), fruit diameter (cm), number of seeds per fruit and 100 seed weight (g) both at phenotypic and genotypic levels indicating the importance of these traits in selection for yield and are identified as yield attributing characters. The character association revealed the overriding importance of fruit length and diameter in determining the average fruit weight. Hence, direct selection for total vine length (cm), number of fruits per vine and fruit weight (g) may be reliable for yield improvement in bottle gourd.

2.3.2.4 Ridge gourd

Choudhary and Kumar (2011) investigated correlation of different yield and yield contributing characters of ridge gourd and revealed that the marketable fruit yield per vine had positive and significant correlation with fruit weight and fruit length at phenotypic level. Days to first fruit harvest exhibited positive and highly significant correlation with days to first female flower opening and node at which first female flower appeared. Also reported that the magnitude of genotypic correlation coefficients was higher than respective phenotypic correlation coefficients which establishes inherent relationship among the characters.

Hanumegowda *et al.*(2012) studied the correlation coefficients in ridge gourd and revealed that fruit yield per vine showed positive and significant correlation with number of fruits per vine, average fruit weight, fruit length, fruit diameter, per

cent fruit set, number of seeds per fruit, 100 seed weight, seed yield per fruit and rind thickness at genotypic level. Thus, the association of these characters are in the desirable direction, selection for these traits may improve the yield per vine.

Rabbani *et al.* (2012) studied correlation coefficients in 60 genotypes of ridge gourds for yield versus eight important yield contributing traits and reported that fruit yield per vine had highly significant positive relationship with the number of fruits per vine, average fruit weight, vine length at harvest and length of fruit. While sex ratio and circumference of fruit exhibited negative association with fruit yield.

2.4 Per cent incidence of diseases and pests

Jagtap (2010) reported that by considering overall performance coupled with the minimum incidence of disease (downy mildew, fusarium wilt and gummosis) and pests (fruit fly and leaf miner) in muskmelon the crosses $P_4 \times P_6$ (IVMM-3 x MHY-3), $P_4 \times P_7$ (IVMM-3 x Punjab Sunheri), $P_2 \times P_7$ (Durgapura Sel. x Punjab Sunheri), $P_1 \times P_3$ (GMM-3 x Hara Madhu) and $P_3 \times P_4$ (Hara Madhu x IVMM-3) could be effectively exploited for heterosis breeding programme. Whereas the parents Durgapura Selection (P_2), Hara Madhu (P_3), IVMM-3 (P_4) and Punjab Sunheri (P_7) were identified as the best combiner and could be used in further breeding programme for improvement of (OP) cultivars in muskmelon.

Patil (2014) reported the cross 5 (IVMM-3 x Punjab Sunheri) showed the least incidence of downey mildew (26.04 & 29.11%), powdery mildew (13.34 & 22.14%), fusarium wilt (5.00

and 5.00%), fruit fly (7.71 & 13.05 %) and leaf miner (17.51 & 20.84 %) in both summer and *kharif* seasons, respectively in F₂ generation which can be further exploited for obtaining tolerant variety against them.

Mali *et al.* (2015) reported that least incidence of downey mildew (22.14 and 25.48%) was recorded in IVMM-3 x Punjab Sunheri (C₅: 4 x 7), fusarium wilt (each 5.00 and 5.00 %) at field condition in cross Hara Madhu x IVMM-3 (C₂: 3 x 4), IVMM-3 x Pusa Madhuras (C₄: 4 x 5) and IVMM-3 x Punjab Sunheri (C₅: 4 x 7), least infestation of leaf minor was observed in Durgapura selection (12.24 and 16.51 %) followed by Punjab Sunehari (14.15 and 18.72 %) in both F₃ generations respectively.

2.5 Fruit characters (Qualitative)

Ramaswamy *et al.* (1977) studied oblong x flat, flat x round and oblong x round and concluded that fruit shape in muskmelon was inherited in a simple way, and several genes may be involved. The crosses were made between crossed netted type with smooth type of muskmelon and observed netted character was dominant over smoothness. Also made crosses between green fleshed fruit (Durgapura Madhu) with white fleshed (Lucknow Safeda) fruit and obtained all white fleshed fruit in F₁.

Jagtap (2010) conducted experiment on heterosis and combining ability in muskmelon and reported that the progenies of crosses P₄ x P₆ (IVMM-3 x MHY-3), P₄xP₇ (IVMM-3 x Punjab Sunheri), P₂xP₇ (Durgapura Sel x Punjab Sunheri), P₁xP₃ (GMM-

3 x Hara Madhu) and $P_3 \times P_4$ (Hara Madhu x IVMM-3) were found superior in case of qualitative traits like round fruit shape, greenish yellow with ridges fruit colour, netted fruit surface, flavor and orange pulp colour.

Patil (2014) reported that the cross 1 (Durgapura Selection x Punjab Sunheri), cross 3 (Hara Madhu x Punjab Sunheri) and cross 5 (IVMM-3 x Punjab Sunheri) were found superior for further selection of desirable muskmelon cultivars with high yield and best quality in respect of round fruit shape, greenish yellow with ridges fruit colour, netted fruit surface, flavor and orange pulp colour.

Mali (2015) studied genetics in F_3 and F_4 generation of muskmelon and reported that among the segregating progenies of the five crosses most of the progenies produce orange pulp colour with round shape and netted fruit surface (rind).

3. MATERIAL AND METHODS

The present investigation entitled “Genetic studies in F₅ and F₆ generations of muskmelon (*Cucumis melo* L.)” was carried out at the Instructional cum Research Farm, Department of Horticulture, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar (Maharashtra) during the *kharif* 2014 and summer 2015. The details of material used and procedure adopted for the present investigation are given below.

3.1 Material

The seeds of fifteen F₄ plant progenies from five crosses along with five parents were obtained from Department of Horticulture, MPKV, Rahuri.

Parents involved in the crosses are as below:

1. Durgapura Selection (2),
2. Hara Madhu (3),
3. IVMM-3 (4),
4. Pusa Madhuras (5) and
5. Punjab Sunheri (7)

Table 3.1.1 Details of crosses and generation wise progenies

Cross	Symbol	Progenies for F ₅ and F ₆ generation
C ₁ Durgapur Selection x Punjab Sunheri	2 x 7	3
C ₂ Hara Madhu x IVMM-3	3 x 4	2
C ₃ Hara Madhu x Punjab Sunheri	3 x 7	4
C ₄ IVMM-3 x Pusa Madhuras	4 x 5	3
C ₅ IVMM-3 x Punjab Sunheri	4 x 7	3
Total		15

The details of parents of Muskmelon, source and salient features are given in Table 3.1.2

Table 3.1.2. Salient features of parents

Code No.	Parent	Source	Salient features
P ₂	Durgapur Selection	ARS, Durgapura, Rajasthan	Vigorous vine, fruits are round, rind colour yellowish with green ridges, smooth surface of fruits, flesh colour green yellow, flavored, T.S.S. 10%. Average weight of fruit 400-500g.
P ₃	Hara Madhu	PAU, Ludhiana	Highly vigorous vine, fruits are round, rind colour yellowish with green ridges, smooth surface of fruits, flesh colour pale green yellow, flavored, T.S.S.12-15%. Average weight of fruit 600-800g., poor transportability, poor keeping quality, susceptible to PM and DM.
P ₄	IVMM-3	IIVR, Varanasi	Medium vigorous vine, fruits are roundish flat, rind colour greenish with ridges, netted surface, flesh colour orange red, flavored, T.S.S. 10.5%. Average weight of fruit 500-600g
P ₅	Pusa Madhuras	IARI, New Delhi	A Mid season variety, vigorous vine, fruits are round, rind colour pale yellow with dark green stripes sparsely netted surface, flesh colour salmon orange, juicy red, flavored, T.S.S.12-14%. Average weight of fruit 500-600g, poor keeping quality, moderately resistant to <i>Fusarium</i> wilt
P ₇	Punjab Sunehari	PAU, Ludhiana	Vigorous vine, fruits are round, rind colour greenish yellow with green netted surface, flesh colour orange red, flavored, T.S.S.11-12%, medium seed cavity. Average weight of fruit 400-500g., excellent transportability, moderately resistant to fusarium wilt, tolerant to PM and DM.

3.2 Methods

3.2.1 Design and layout of experiment

- a. Design : Randomized Block Design
- b. Replications : Two
- c. Number of progenies : 15 for F₅ and F₆ generation.
- d. Number of parents : 5
- e. Total number of : 20 for F₅ and F₆ generation
genotypes (15 progenies + 5 parents).
- f. Number of F₅/F₆ : 375
plants per replication

3.2.2 Details of Experiment

F₄ progenies from the five crosses were selected on the basis of earliness, shape of fruit, rind surface, yield per plant and TSS content.

Initially, fifteen F₄ progenies of five crosses along with five parents were evaluated during *Kharif* 2014 for F₅ generation. Again same fifteen F₅ progenies (selections) of five crosses were evaluated along with their parents during summer 2015 for F₆ generation. Total 375 plants of fifteen progenies (25 plants/progeny) were sown along with their parents in randomized block design with two replications in both the F₅ and F₆ generations for recording the observations. FYM of 25 tones and the 50 per cent recommended dose of nitrogen (50 kg/ha) and full dose of phosphorus (50kg/ha) and potassium (50 kg/ha)

were incorporated in the furrows and mixed in the soil during both seasons. Seeds of these generations were sown at a spacing of 2m x 0.60m. Thinning was done so that one seedling per hill was maintain after germination. The remaining 50 per cent of nitrogen (50 kg/ha) was applied as a top dress on 30th day after sowing. Irrigation, weed control and other cultural practices were followed as per the package of practices. The vines were allowed to trail on the ground itself.

3.3 Observations recorded

In F₅ and F₆ generations 750 plant populations, of all fifteen progenies five crosses and their parents were taken for observation to study the variability, heritability, genetic advance and correlation for various yield contributing traits. The observations were recorded for the following characters.

3.3.1 Growth characters

3.3.1.1 Vine length (cm)

The length of vine was measured in centimeter from the base of the vine to the growing tip of the vine at end of the cycle.

3.3.1.2 Number of primary branches per vine

All the branches on shoot of each of the vine were recorded at the final harvest of the crop.

3.3.2 Flowering characters

3.3.2.1 Days to first female flower appearance

The number of days required for the appearance of first female flower from date of sowing was recorded separately for each parents and progenies.

3.3.2.2 Number of male and female flowers per vine (sex ratio)

The number of male and female flowers produced by each vine during its life cycle were counted and the ratio of female to male flower was calculated.

3.3.2.3 Node at which first female flower appeared

The node number at which the first female flower appears gives an indication of early maturity in cucurbits (Swarup, 1977). Therefore the node at which the first pistillate flower appeared was noted for all the observational plants and mean was calculated.

3.3.2.4 Days required for first harvest of fruit

The number of days required to first fruit harvesting from the date of sowing was recorded for each parent and progenies.

3.3.3 Yield characters

3.3.3.1 Number of fruits per vine

Number of fruits per vine were recorded for each picking from all the observational plants separately and summed up after last picking and the average number of fruits per vine was worked out.

3.3.3.2 Yield per vine (kg)

The yield of harvested fruits of all pickings from each observational plant was summed up and the average fruit yield per vine was calculated.

3.3.4 Fruit characters (quantitative)

3.3.4.1 Average weight of fruit (g)

The weight of five individual fruits harvested at the full maturity stage was recorded and the average weight of fruit was calculated.

3.3.4.2 Average length of fruit (cm)

The length of each fruit was measured from the peduncle to the distant end by cutting the fruit longitudinally into two halves.

3.3.4.3 Average diameter of fruit (cm)

The diameter of each fruit was measured at the centre after cutting the fruit longitudinally into two halves and average diameter was worked out.

3.3.4.4 Average rind thickness (cm)

Rind thickness was measured at four different places after cutting the fruit longitudinally and average rind thickness was worked out.

3.3.4.5 Average pulp thickness (cm)

Pulp thickness was measured at four different places after cutting the fruit longitudinally and average pulp thickness was worked out.

3.3.4.6 Average fruit cavity (cm²)

The fruit cavity was calculated by multiplying length of cavity and equatorial width of cavity by cutting the fruit length wise and average fruit cavity was worked out.

3.3.4.7 Average weight of pulp per fruit (g)

Pulp of each fruit was separated and weighed and then average weight of pulp was worked out.

3.3.4.8 Average weight of seed per fruit (g)

The seed extracted from each fruit was separated, dried and weighed.

3.3.5 Fruit characters (qualitative)

3.3.5.1 Shape of fruit

Fruit shape of each generation was recorded at full slip stage by visual observation.

3.3.5.2 Colour of fruit

Colour of the fruit (rind) of each generation was recorded at full slip stage by visual observation.

3.3.5.3 Rind surface of fruits (netted or smooth)

Nature of outer surface of the fruit (rind) of each genotype was recorded at full slip stage after harvest by visual observation.

3.3.5.4 Flavor

Flavor of pulp of each generation was recorded by smell after cutting the fruit into two halves.

3.3.5.5 Colour of pulp

Colour of pulp of each genotype was recorded by visual observation.

3.3.6 Biochemical composition

Homogeneous sample of ripe pulp from each genotype and replication was prepared with the help of mixer. This sample was used for determination of the biochemical parameters.

3.3.6.1 Total soluble solids (° Brix)

A total soluble solid (TSS° Brix) for each ripe fruit was estimated by hand refractometer (Erma- Japan).

3.3.6.2 Acidity (%)

Titrateable acidity was worked out by titrating the pulp extract against 0.1N NaOH using Phenolphthalein as an indicator. Weight of sample taken was 5.0g. (Ranganna, 1977).

3.3.6.3 Ascorbic acid (mg/ 100 g of pulp)

Ascorbic acid content of pulp extract was estimated by 2, 6, Dichlorophenol-Indo-phenol visual titration method. Weight of the sample taken was 5.0 g. (Ranganna, 1977).

3.3.6.4 Total sugar (%)

Total sugar content was determined by the volumetric method by Ranganna (1977).

3.3.6.5 Reducing sugar (%)

The reducing sugar content was determined by the volumetric method by Ranganna (1977).

3.3.6.6 Non- reducing sugar (%)

The non-reducing sugar calculated by subtracting reducing sugar from total sugar (Ranganna 1977).

3.3.7 Per cent incidence of diseases and pests

3.3.7.1 Per cent incidence of diseases

Number of plants affected by incidence of downey mildew and Fusarium wilt were counted and the per cent disease incidence (PDI) was worked out. The percentage of disease incidence was calculated by the following formula.

$$\text{PDI} = \frac{\text{Number of infected plants}}{\text{Total number of plants}} \times 100$$

3.3.7.2 Per cent incidence of pest

Number of plants affected by incidence of leafminer were counted and the per cent incidence was worked out. The percentage of pest incidence was calculated by the following formula.

$$\text{PPI} = \frac{\text{Number of infected plants}}{\text{Total number of plants}} \times 100$$

3.4 Statistical methodology

The individual plant data was used for statistical and genetical analysis. These have been presented under the following sub-headings.

- 3.4.1 Mean and range
- 3.4.2 Estimation of components of variation
- 3.4.3 Estimation of coefficient of variation
- 3.4.4 Estimation of heritability percentage
- 3.4.5 Estimation of genetic advance
- 3.4.6 Estimation of correlation of coefficient

3.4.1 Mean and range

The mean value for each character was worked out by using following formula.

$$\bar{X} = \frac{1}{n} \left(\sum_{i=1}^n X_i \right)$$

Where,

$\sum X_i$ = Sum of total of the character

n = Number of observations

The lowest and the highest value from mean of each character were recorded as range.

3.4.2 Estimation of components of variation

The phenotypic and genotypic variances were calculated by respective mean square values (Johnson *et al.*, 1955a).

i. Environmental variance (σ^2_e) = MSe

$$\text{MSg} - \text{MSe}$$

ii. Genotypic variance (σ^2_g) = -----

$$r$$

iii. Phenotypic variance (σ^2_p) = $\sigma^2_g + \sigma^2_e$

Where,

MSg = Genotypic mean sum of squares

MSe = Error mean sum of squares

r = Number of replications

3.4.3 Estimation of coefficient of variation

The genotypic and phenotypic coefficients of variation were calculated as per Burton and De Vane (1953).

i. **Phenotypic coefficient of variation (PCV)**

$$\text{PCV}(\%) = \frac{\sigma^2_p}{\bar{X}} \times 100$$

Where,

σ^2_p = Phenotypic variance

$\bar{X}$ = General mean of the character

ii. Genotypic coefficient of variation (GCV)

$$\text{GCV}(\%) = \frac{\sigma^2_g}{\bar{X}} \times 100$$

Where,

σ^2_g = Genotypic variance

$\bar{X}$ = General mean of the character

The PCV and GCV values are categorized by Sivasubramanian and Madhamenon (1973) as follows,

Low : Less than 5 %

Moderate : 5 – 10 %

High : More than 10 %

3.4.4 Estimation of heritability

Heritability is the ratio of genotypic variance to the phenotypic variance in the population. Heritability percentage in broad sense was estimated for various characters as per Lush (1949).

$$h^2 \text{ (b.s.)} = \frac{\sigma^2_g}{\sigma^2_p} \times 100$$

Where,

σ^2_g = Genotypic variance

σ^2_p = Phenotypic variance

The heritability in broad sense values are categorized by Johnson *et al.* (1955) as follows,

Low : Less than 50 %

Moderate : 50 – 75 %

High : More than 75 %

3.4.5 Estimation of genetic advance

The genetic advance was calculated as per Johnson *et al.* (1955).

$$GA = \frac{\sigma^2_g}{\sigma^2_p} \times \sqrt{\sigma^2_p} \times K$$

Or

$$GA = K \cdot h^2 \text{ (b.s.)} \times \sigma^2_p$$

$$GA \text{ as percentage of mean} = \frac{GA}{\bar{X}} \times 100$$

Where,

σ^2_g = Genotypic variance

σ^2_p = Phenotypic variance

σ_p = Phenotypic standard deviation

K = Selection differential at 5 % selection intensity
(i.e. 2.06)

$h^2 \text{ (b.s.)}$ = Heritability broad sense

$\bar{X}$ = Mean of the character

The range of genetic advance as per cent of mean values is categorized by Johnson *et al.* (1955) as follows,

Low : Less than 10 %

Moderate : 10 – 20 %

High : More than 20 %

Genetic advance expressed as percentage of mean was calculated by the following formula.

$$\text{G. A. as percentage of mean} = \frac{\text{Genetic advance}}{\text{Mean of the character}} \times 100$$

3.4.6 Correlations

Analysis of covariance was carried out by taking two characters at a time. The genotypic co-variance was calculated as per Johnson *et al.* (1955) as below:

Source	d.f.	Sum of product	Mean sum of product	Expectation of mean sum of product
Replications	(r-1)	RP	RMP	$\text{COVe}_{1.2} + g\text{COVr}_{1.2}$
Genotypes	(g-1)	GP	GMP	$\text{COVe}_{1.2} + r\text{COVg}_{1.2}$
Error	(r-1) (g-1)	EP	EMP	$\text{COVe}_{1.2}$

$$\text{Environmental covariance (COV. } e_{1.2}) = \text{EMP}$$

$$\text{GMP} - \text{EMP}$$

$$\text{Genotypic covariance (COV. } g_{1.2}) = \frac{\text{GMP} - \text{EMP}}{r}$$

$$\text{Phenotypic covariance (COV. } p_{1.2}) = (\text{COV. } g_{1.2}) + (\text{COV. } e_{1.2})$$

Where,

GMP = Genotypic mean sum of product

EMP = Error mean sum of product

r = Replication

Appropriate variances and co-variances were used for calculating phenotypic and genotypic correlation coefficients (Johnson *et al.*, 1955).

The phenotypic correlation coefficient (r_p) was calculated as:

$$r_{p1.2} = \frac{COV_{.p1.2}}{\sqrt{(\sigma_{p1}^2)(\sigma_{p2}^2)}}$$

Where,

$r_{p1.2}$ = Phenotypic correlation coefficient between character 1 and 2

$COV_{.p1.2}$ = Phenotypic covariance between character 1 and 2.

$\sigma_{p1}^2, \sigma_{p2}^2$ = Phenotypic variance of character 1 and 2 respectively.

The significance of the phenotypic correlation coefficient was tested by referring to Fisher and Yates (1943). The genotypic correlation coefficient (r_g) was calculated as:

$$r_{g1.2} = \frac{COV_{g1.2}}{\sqrt{(\sigma_{g1}^2)(\sigma_{g2}^2)}}$$

Where,

$r_{g1.2}$ = Genotypic correlation coefficient between character 1 and 2

$COV_{g1.2}$ = Genotypic covariance between character 1 and 2

$\sigma_{g1}^2, \sigma_{g2}^2$ = Genotypic variance of character 1 and 2 respectively.

The significance of correlation coefficients was tested from the statistical table of correlation coefficient at 1 and 5 per cent level of significance (Snedcor and Cochran, 1967).

4. EXPERIMENTAL RESULTS

The present investigation was undertaken on “Genetic studies in F₅ and F₆ generations of muskmelon (*Cucumis melo* L.)” to study the variability parameters, heritability, genetic advance and correlation. The selection pressure was applied to identify the genotypes for early fruit harvest, more fruit weight and fruit yield per vine and fruit surface to develop an open pollinated cultivar.

The observations on growth, flowering, yield, fruit quantitative, qualitative characters and incidence of diseases and pest were recorded to study the genetical parameters. The results pertaining to these observations are presented as below.

4.1 **Variability parameters, heritability and genetic advance.**

Success of breeding programme is largely depend on the extent of genetic variability present in the population. Since heritable and non-heritable components of variation are important to assess the true breeding nature of a character. Information on heritability is a prerequisite for improving the characters and the productivity, through a systematic breeding programme. Selected 15 progenies of both F₅ and F₆ generation of five crosses *viz.*, Durgapura Selection x Punjab Sunheri (C₁: 2 x 7), Hara Madhu x IVMM-3 (C₂: 3 x 4), Hara Madhu x Punjab Sunheri (C₃: 3 x 7), IVMM-3 x Pusa Madhuras (C₄: 4 x 5) and IVMM-3 x Punjab Sunheri (C₅: 4 x 7) along with their parents

were studied for growth, yield and quality traits for genetical parameters. (Table 4 to 13).

4.1.1 Variability, heritability and genetic advance of cross Durgapura Selection x Punjab Sunheri (C₁: 2 x 7) for F₅ and F₆ generations.

Three progenies of cross Durgapura Selection x Punjab Sunheri (C₁: 2 x 7) in F₅ and F₆ generation along with their parents were studied for growth, flowering, yield and fruit characters and data are presented in Table 4 and 5.

4.1.1.1 Vine growth characters

4.1.1.1.1 Vine length (cm)

In F₅ generation wide range of vine length (171.34 to 236.14 cm) was recorded with an average value of 201.38 cm. The close association of GCV and PCV 10.76 % and 10.84 % respectively was observed with certain presence of environmental factor ECV (1.91 %). The high estimates of heritability (96.94 %), genetic advance (43.59) and genetic advance as per cent mean (21.16 %) were observed. Whereas in F₆ generation wide range (163.83 to 212.64 cm) with an average value of 205.41 cm was observed for this trait. The GCV (10.94 %) and PCV (11.31 %) were observed with ECV (1.94 %). The high estimates of heritability (98.27%), genetic advance (42.63) and genetic advance as per cent mean (20.85 %) were observed respectively, indicating preponderance of additive gene action and the character can be improved through simple selection.

4.1.1.1.2 Number of primary branches per vine

In F₅ generation the growth character number of primary branches per vine was ranged from 2.31-2.84 with mean value 2.68. The close association of GCV and PCV (11.36 % and 11.68 %) was observed with certain presence of environmental factors ECV (1.74 %). The high estimate of heritability (98.12 %) was associated with low genetic advance (0.59) and high genetic advance as per cent mean (22.01 %). Whereas in F₆ generation it was ranged in between 2.18 to 2.41 with mean value 2.34. Very close values were recorded for GCV (11.15 %) and PCV (11.27 %) with noticeable influence of environmental factor ECV (1.52 %). The high estimate of heritability (98.09 %) was associated with high genetic advance as per cent of mean (23.17 %) and lower value of genetic advance (0.54).

4.1.1.2 Flowering characters

The observations on flowering characters like days to first female flower appearance, number of male and female flowers per vine, sex ratio, node at which first female flower appeared and days required for first harvest of fruits were recorded for F₅ and F₆ progenies.

4.1.1.2.1 Days to first female flower appearance

In cross F₅ generation the character days to first female flower appearance was ranged between 35.14-41.95 days with an average 37.34 days. The close values were recorded for GCV (5.68 %) and PCV (5.76 %) with noticeable influence of environmental factor ECV (1.79 %). The higher estimate of heritability (90.91 %) was observed with moderate values of

genetic advance (4.10) and genetic advance as per cent of mean (10.98%). While in F6 generation it was ranged from 29.09-36.28 days with mean value of 32.00 days. The GCV (6.77%) and PCV (7.04%) were recorded with noticeable influence of environmental factor ECV (1.92 %). The high estimate of heritability (93.64 %) was obtained with moderate estimate of genetic advance as per cent of mean (12.84 %) and low value for genetic advance (4.11).

4.1.1.2.2 Number of male flowers per vine

In F5 generation this character was ranged in between 69.21 to 85.74 with mean value 71.94. The genetical variability contributed as GCV (10.78 %) and PCV (10.89 %) with noticeable environmental variability ECV (0.43 %). The high values were recorded for heritability (99.87 %) and genetic advance (16.12) and genetic advance as per cent of mean (22.04 %). Whereas in F6 generation it was ranged in between 50.58 to 67.51 with mean value of 59.62. The close association of GCV (10.84%) and PCV (10.98%) were recorded with certain presence of environmental variability ECV (0.91%). The high estimates were recorded for heritability (98.42 %) along with genetic advance (12.38) and genetic advance as per cent of mean (20.89 %).

4.1.1.2.3 Number of female flowers per vine

Incase of F5 generation the number of female flowers per vine was ranged in between 11.82 to 12.74 with an average 12.62. The close association of GCV (10.39 %) and PCV (10.51 %) were observed with certain presence of environmental factor ECV (1.65 %). The high values were obtained for heritability (97.64 %) and genetic advance as per cent of mean (21.37 %) with low

genetic advance (2.69). While in F6 generation it was ranged in between 11.05 to 12.36 with an average 11.25. The close association of GCV (11.68 %) and PCV (11.94 %) were observed with certain presence of environmental factor ECV (1.83 %). The high values were obtained for heritability (98.12 %), genetic advance as per cent of mean (21.42%) and low value for genetic advance (2.41) respectively.

4.1.1.2.4 Sex ratio (female : male)

In F5 generation the character sex ratio was ranged in between 5.59 to 7.19 with mean value 5.70. The genetical variability contributed as GCV (10.36 %) and PCV (10.57 %) with noticeable environmental variability ECV (1.86 %). The high values were recorded for heritability (96.98 %) and genetic advance as per cent of mean (22.34 %) with low genetic advance (1.27). In F6 generation it was ranged in between 5.17 to 6.05 with mean of 5.30. The substantial genetical variability were observed as GCV (11.08 %) and PCV (12.20 %) with noticeable environmental variability ECV (5.08 %). The high estimates were recorded for heritability (82.59 %) and genetic advance as per cent of mean (22.06 %).

4.1.1.2.5 Node at which first female flower appeared

Incase of F5 generation the character node at which first female flower appeared was ranged in between 4.15 to 4.67 with an average 4.27. The close association of GCV (6.96 %) and PCV (7.04 %) was observed with certain presence of environmental factor ECV (1.10 %). The high estimate of heritability (97.68 %) was associated with lower genetic advance

(0.62). The moderate value was obtained for genetic advance as per cent of mean (14.51 %). Whereas in case of F₆ generation it was ranged in between 3.86 to 5.13 with an average value of 4.19. The close association of GCV (6.71%) and PCV (6.78 %) were observed with certain presence of environmental factor ECV (1.04 %). The high value was obtained for heritability (97.26 %) whereas low and moderate values were observed for genetic advance (0.59) and genetic advance as per cent of mean (14.18 %) respectively.

4.1.1.2.6 Days required for first harvest of fruit

In F₅ generation the days required for first harvest of fruits was ranged from 70.69 to 84.68 days with an average 71.14 days. The close values of GCV (6.27 %) and PCV (6.31 %) was observed with certain presence of environmental factor ECV (0.91 %). The high estimate of heritability (97.95 %) was observed with moderate values of genetic advance (9.18) and genetic advance as per cent of mean (12.91 %). In F₆ generation it was ranged from 65.13 to 73.23 days with an average 67.32 days. The close association of GCV (5.75 %) and PCV (5.98 %) was observed with certain presence of environmental factor ECV (0.94 %). The higher estimate of heritability observed (98.12 %) with lower genetic advance (8.01) and moderate value of genetic advance as per cent of mean (11.94 %), respectively.

4.1.1.3 Yield and its contributing character

A detailed study of the extent of variability associated with yield and yield contributing characters and knowledge on their heritability in relation to their contribution towards yield

are the prime requisite for an efficient plant breeding programme. Therefore genetical parameters were worked out for number of fruits per vine and fruit yield per vine for crop improvement.

4.1.1.3.1 Number of fruits per vine

In case of F₅ generation the number of fruits per vine was ranged between 2.41 to 2.84 per vine with an average 2.75 per vine. The genetic variability GCV (10.63 %) and PCV (10.89 %) were observed with presence of environmental variability ECV (2.31 %). The high estimates were observed for heritability (95.54 %) and genetic advance as per cent of mean (21.52 %). Whereas in case of F₆ generation it showed range (2.72 to 3.01) per vine with an average value of 2.94 per vine. The significant contribution of genetic variability GCV and PCV (11.47 % and 11.62 % respectively) were observed with environmental variability ECV (1.07 %). The highest estimates of heritability (97.21 %) and genetic advance as per cent of mean (22.10 %) were observed which proves that yield potential can be improved during further selection cycle.

4.1.1.3.2 Fruit yield per vine (kg)

In F₅ generation the character fruit yield per vine showed range (1.64-2.56 kg) per vine with an average 2.30 kg per vine. The close association of genetic variability GCV (14.12 %) and PCV (14.92 %) were observed with influence of environmental variability ECV (5.48 %). The high value of heritability (86.26 %) was associated with high genetic advance as per cent of mean (23.92 %). Whereas in F₆ generation it

showed wide range of variation in between 2.15 to 2.58 kg per vine with an average value of 2.45 kg per vine. The significant contribution of genetic variability GCV (14.21 %) and PCV (15.11 %) were observed with environmental variability ECV (1.03 %). The high estimates of heritability (99.38 %) and genetic advance as per cent of mean (24.10 %) were recorded.

4.1.1.4 Fruit characters (quantitative)

4.1.1.4.1 Average weight of fruit (g)

The average weight of fruit is an important yield contributing character in muskmelon. In case of F₅ generation it showed wide range of variation (611.36-842.12 g) with mean value 759.31 g. The GCV (12.45 %) and PCV (13.35 %) were observed with presence of environmental factor ECV (4.97 %). The high values were recorded for heritability (86.31 %), genetic advance (176.12) and per cent mean of genetic advance (23.25 %). Whereas in case of F₆ generation it showed a wide range of variation (632.48-872.35 g) with mean value 810.00 g. The close association of GCV (12.07 %) and PCV (12.31 %) were observed with certain presence of environmental factor ECV (0.52%). The highest estimates of heritability (98.34 %), genetic advance (182.45) and genetic advance as per cent of mean (22.54 %) were recorded respectively.

4.1.1.4.2 Average length of fruit (cm)

In F₅ generation the average length of fruit was ranged in between 10.11 to 10.87 cm with an average 10.68 cm. The close association of GCV (2.64 %) and PCV (2.68 %) was observed with certain presence of environmental factor ECV

(0.34 %). The high value was obtained for heritability (98.54 %) whereas lower values were recorded for genetic advance (0.58) and genetic advance as per cent of mean (5.42 %). While in F₆ generation it was ranged in between 10.75 cm to 11.02 cm with an average 10.82 cm. The close association of GCV (3.21 %) and PCV (3.38 %) were observed with certain presence of environmental factor ECV (0.39 %). The high value was obtained for heritability (99.15 %). whereas lower values were recorded for genetic advance (0.69) and genetic advance as per cent of mean (6.45 %).

4.1.1.4.3 Average diameter of fruit (cm)

In case of F₅ generation the average diameter of fruit was ranged from 9.42 cm to 11.36 cm with an average 10.81 cm. The genetic variability contributed as GCV (5.06 %) and PCV (5.36 %) with influence of environmental factor ECV (1.79 %). The high heritability (88.86 %) was associated with low value of genetic advance (1.07) and moderate value of genetic advance as per cent of mean (10.29 %). While in case of F₆ generation it showed range of 10.42 cm to 11.28 cm with an average 10.94 cm. The close association of GCV (4.92 %) and PCV (4.96 %) were recorded with influence of environmental factor ECV (0.41 %). The higher estimates of heritability (99.48 %) was observed with low and moderate value for genetic advance (1.11) and genetic advance as per cent of mean (10.18 %) respectively.

4.1.1.4.4 Average rind thickness (cm)

In F₅ generation average rind thickness was showed in ranged in between 0.17 cm to 0.26 cm with mean value 0.25

cm. The genetical variability contributed as GCV (12.81 %) and PCV (14.72 %) with noticeable influence of environmental variability ECV (7.12 %). The high value of heritability (76.45%) was recorded along with high estimate of genetic advance as per cent of mean (28.00 %). Whereas in F₆ generation it was ranged in between 0.21 cm to 0.30 cm with mean value of 0.27 cm. The genetical variability contributed as GCV (14.28 %) and PCV (15.71 %) along with noticeable environmental variability ECV (6.31 %). The high estimates were recorded for heritability (82.67 %) and genetic advance as per cent of mean (22.24 %).

4.1.1.4.5 Average pulp thickness (cm)

The data indicate that average pulp thickness (In F₅ generation) showed wide range (2.17 cm to 2.75 cm) with an average 2.39 cm. The close value of GCV (5.56 %) and PCV (5.59 %) were observed with certain presence of environmental factor ECV (0.71 %). The high and moderate estimates were observed for heritability (98.51 %) and genetic advance as per cent of mean (11.31 %) respectively. In F₆ generation it was ranged in between 2.15 cm to 2.67 cm with an average 2.46 cm. The close associations of GCV (5.81 %) and PCV (5.94 %) were observed with certain presence of environmental factor ECV (0.68 %). The high and moderate estimates were obtained for heritability (97.35 %) and genetic advance as per cent of mean (11.01 %) respectively.

4.1.1.4.6 Average fruit cavity (cm²)

In case of F₅ generation the average fruit cavity was ranged from 39.41 cm to 43.68 cm with an average 41.35 cm.

The close value of GCV (12.58 %) and PCV (12.69 %) were observed with noticeable influence of environmental factor ECV (3.79 %). The high estimates were observed for heritability (90.95 %) and genetic advance as per cent of mean (22.12 %). Whereas in F₆ generation it was ranged from 40.45 cm to 43.61 cm with an average 41.31 cm. The contribution of genetic variability GCV (11.15 %) and PCV (11.92 %) were observed with noticeable influence of environmental factor ECV (4.38 %). The high estimates were observed for heritability (87.38 %) and genetic advance as per cent of mean (21.81 %).

4.1.1.4.7 Average weight of pulp per fruit (g)

In F₅ generation the average weight of pulp per fruit was showed wide range of variability (370.31 to 632.17 g) with mean value 572.65 g. The genetical variability contributed as GCV (13.76 %) and PCV (14.68 %) along with noticeable environmental variability ECV (4.26%). The high values were recorded for heritability (91.45 %), genetic advance (132.26 %) and genetic advance as per cent of mean (23.18 %). In F₆ generation it showed the range between 560.35 to 610.24 g with mean value of 594.35 g. The significant genetical variability was contributed as GCV (18.19 %) and PCV (18.31 %) with noticeable environmental variability ECV (1.16 %). The high value of heritability (99.64 %) was associated with high value of genetic advance as per cent of mean (30.54 %) and genetic advance (181.38) respectively.

4.1.1.4.8 Average weight of seed per fruit (g)

In F₅ generation the average weight of seed per fruit was ranged in between 8.23 to 10.79 g with an average 8.72 g. The close value of GCV (10.74 %) and PCV (10.76 %) were observed with certain presence of environmental factor ECV (0.30 %). The high values were obtained for heritability (99.94 %) and genetic advance as per cent of mean (22.13 %) and low value for genetic advance (1.93). In F₆ generation it was ranged in between 7.86 to 9.15 g with an average 8.12 g. The close association of GCV (11.60 %) and PCV (14.38 %) was observed with certain presence of environmental factor (ECV 0.96 %). The high values were obtained for heritability (99.12 %) and genetic advance as per cent of mean (21.35 %) whereas low value was observed for genetic advance (1.73).

4.1.1.5 Fruit characters (qualitative)

4.1.1.5.1 Total Soluble Solids (T.S.S.°Brix)

T.S.S. content of fruit is an important qualitative character in muskmelon. In F₅ generation it showed a wide range of variation 10.64-11.72° Brix with mean value 11.52° Brix. The genotypic co-efficient of variation GCV (12.24 %) and phenotypic co-efficient of variation PCV (13.15 %) were observed along with presence of environmental factor ECV (4.61 %). The high estimates were recorded for heritability (87.72 %) and genetic advance as per cent of mean (23.00 %) with low value of genetic advance (2.65). While in F₆ generation it showed a wide range of variation 11.86 to 12.48°Brix with mean value of 12.28°Brix. The GCV (12.31%) and PCV (12.64%) were recorded with presence of

environmental factor ECV (3.32%). The high estimates were recorded for heritability and genetic advance as per cent of mean (93.68 % and 21.05 %) respectively.

4.1.1.5.2 Acidity (%)

In F₅ generation acidity percentage was ranged in between 1.15 to 1.31 % along with an average 1.19 per cent. The close association of GCV (12.31 %) and PCV (12.96 %) was observed with certain presence of environmental factor ECV (2.98 %). The moderate values were obtained for heritability (49.39 %) and genetic advance as per cent of mean (19.34 %) with low value for genetic advance (0.23). In F₆ generation it was ranged in between 1.20 to 1.39 % with an average 1.26 per cent. The close association of GCV (5.94 %) and PCV (6.33 %) was observed with certain presence of environmental factor (ECV 2.61 %). The high value was obtained for heritability (82.73 %) whereas lower and moderate values were recorded for genetic advance (0.14) and genetic advance as per cent of mean (11.13 %) respectively.

4.1.1.5.3 Ascorbic acid (mg/100g)

In case of F₅ generation the ascorbic acid content was ranged from 25.36 to 26.42 mg/100g with an average 25.62 mg/100g. The close value of GCV (8.71 %) and PCV (8.75 %) was observed with low influence of environmental factor ECV (1.14 %). The high and moderate estimates were recorded for heritability (98.31 %) and genetic advance as per cent of mean (17.87 %) respectively with low genetic advance (4.58). In case of F₆ generation it was ranged from 24.57 to 26.12 mg/100 g with

an average 25.70 mg/100 g. The close association of GCV (8.27 %) and PCV (8.41 %) was observed with influence of environmental factor ECV (1.24 %). The high estimate was recorded for heritability (97.86 %) whereas lower and moderate values were recorded for genetic advance (4.35) and genetic advance as per cent of mean (16.91 %), respectively.

4.1.1.5.4 Total sugar (%)

In F₅ generation total sugar content was ranged in between 9.27 to 9.59 % with mean value 9.52 %. The genetical variability was contributed as GCV (4.88 %) and PCV (4.82 %) with low influence of environmental variability ECV (1.68 %). The high value of heritability (89.41 %) was recorded with low estimates of genetic advance as per cent of mean (9.62 %). While in F₆ generation it was ranged in between 8.86 to 9.74 % with mean of 9.15 %. The genetical variability contributed as GCV (4.61 %) and PCV (4.78 %) with environmental variability ECV (0.27 %). High value of heritability (99.70 %) was recorded with low estimate of genetic advance (0.92) and genetic advance as per cent of mean (10.01 %).

4.1.1.5.5 Reducing sugar (%)

In case of F₅ generation the reducing sugar content was ranged in between 7.21 to 7.34 % with an average 7.28 %. The close association of GCV (6.34 %) and PCV (6.85 %) were observed with certain presence of environmental factor ECV (0.51 %). The high value was obtained for heritability (82.36 %) whereas low values were obtained for genetic advance (0.51) and genetic advance as per cent of mean (7.02 %). While in case of F₆

generation it was ranged in between 7.23% to 7.84 % with their average mean 7.62 %. The close association of GCV (4.96 %) and PCV (5.18 %) was observed with certain presence of environmental factor (ECV 1.24 %). The high value was obtained for heritability (96.41 %) along with lower estimates of genetic advance (0.78) and genetic advance as per cent of mean (10.21 %) respectively.

4.1.1.5.6 Non reducing sugar (%)

In F₅ generation the non reducing sugar content was ranged from 2.05 % to 2.29 % along with an average 2.23 %. The contribution of genetic variability of GCV (3.78 %) and PCV (4.01 %) were observed with noticeable influence of environmental factor ECV (1.48%). The high estimate for heritability (86.63 %) and low estimates for genetic advance (0.17) and genetic advance as per cent of mean (7.61 %).Whereas in case of F₆ generation it was ranged from 1.36 % to 2.12 % with an average 1.53 %. The GCV (3.34 %) and PCV (4.48 %) was observed with noticeable influence of environmental factor ECV (2.98 %). Moderate and low estimates were observed for heritability (55.27 %) and genetic advance as per cent of mean (7.26 %), respectively.

4.1.2 Variability, heritability and genetic advance of cross Hara Madhu x IVMM-3 (C₂ : 3 x 4) for F₅ and F₆ generations.

Two progenies of F₅ and F₆ along with their parents were studied for growth, flowering, yield and fruit characters and are presented in Table 6 and 7.

4.1.2.1 Vine growth characters

4.1.2.1.1 Vine length (cm)

In case of F₅ generation the vine length was observed in the range of 194.32 to 235.12 cm with an average 218.42 cm. The close value of genotypic co-efficient of variation GCV (11.47%) and phenotypic coefficient of variation PCV (11.82%) were observed along with certain presence of environmental co-efficient of variation ECV (2.78 %). The high estimates of heritability (94.36 %), genetic advance (48.32) and genetic advance as per cent of mean (22.12 %) were observed. Whereas in case of F₆ generation it showed wide range (182.87 to 232.38 cm) with an average 207.35 cm. The contribution of genetic variability GCV (13.42%) and PCV (13.73 %) were observed with environmental co-efficient of variance ECV (3.69 %). The high estimates of heritability (92.89 %), genetic advance (52.27) and genetic advance as per cent of mean (GAM 25.36 %) were observed, indicating better scope for improvement through selection.

4.1.2.1.2 Number of primary branches per vine

In F₅ generation number of primary branches per vine observed wide range of variability, in the range of (2.61 to 2.87) with mean value 2.72. The close association was recorded for GCV (11.60 %) and PCV (11.92 %) with noticeable influence of environmental factor ECV (1.61 %). The high estimate of heritability (97.68 %) was observed with high value of genetic advance as per cent of mean (25.12 %) and low genetic advance (0.68). In F₆ generation it was ranged in between 2.19 to 2.51 with mean value 2.37. The GCV (11.09 %) and PCV (11.34 %) were recorded with noticeable influence of environmental factor ECV (2.09 %). The high estimate of heritability (96.71 %) was recorded with high value of genetic advance as per cent of mean (24.51 %) and low value for genetic advance (0.58).

4.1.2.2 Flowering characters

4.1.2.2.1 Days to first female flower appearance

In F₅ generation the wide range of variability was observed for days to first female flower appearance (36.68-41.34 days) with mean value 37.22 days. The genetic variability recorded for GCV (7.52 %) and PCV (7.84 %) were recorded with noticeable influence of environmental factor ECV (2.21 %). The high estimate of heritability (93.28 %) was associated with high estimate of genetic advance (5.72) and high genetic advance as per cent mean (15.41 %). In F₆ generation it showed range of variability (30.00-36.33 days) with mean value 32.58 days. While very close values were recorded of GCV (8.09 %) and PCV (8.47 %) with noticeable influence of environmental factors ECV (2.58 %). The high estimate of heritability (90.88 %) was associated

with low genetic advance (4.98) and moderate genetic advance as per cent of mean (15.35 %).

4.1.2.2.2 Number of male flowers per vine

In F₅ generation this character was ranged in between 61.81 to 72.34 with mean value 65.41. The close values of GCV (10.88 %) and PCV (11.16 %) was observed with certain presence of environmental variability ECV (2.65 %). The higher estimate of heritability (93.34%) was observed with higher estimates of genetic advance (15.21) and genetic advance as per cent mean (23.32 %). In F₆ generation it was ranged in between 48.94 to 62.38 with mean value 59.14. The close association of GCV (10.82%) and PCV (10.97%) were observed with noticeable environmental variability ECV (1.27%). The high value of heritability (98.71 %) was recorded with high estimates of genetic advance (12.94) and genetic advance as per cent of mean (21.92 %), respectively.

4.1.2.2.3 Number of female flowers per vine

In case of F₅ generation the number of female flowers per vine was ranged in between 11.88 to 13.68 with an average 13.02. The close values of GCV (10.64 %) and PCV (10.78 %) were observed with certain presence of environmental factor ECV (1.63 %). The high values were obtained for heritability (98.70 %) and genetic advance as per cent of mean (22.15 %) with low genetic advance (2.86). Whereas in case of F₆ generation it was ranged in between 9.35 to 11.63 with an average 11.01. The genetical variability as GCV (13.62 %) and PCV (16.21 %) was observed with noticeable influence of environmental factor (ECV

8.64 %). The high values were obtained for heritability (76.52 %) with low genetic advance (2.59) and high genetic advance as per cent of mean (23.51 %).

4.1.2.2.4 Sex ratio (female:male)

In F₅ generation sex ratio was ranged in between 4.98 to 6.24 with mean value 5.02. The genetical variability GCV (11.08 %) and PCV (11.19%) were recorded with environmental variability ECV (1.57 %). High estimate of heritability (98.20 %) was recorded with high estimate of genetic advance as per cent of mean (22.71 %). Whereas in F₆ generation it was ranged in between 5.20 to 5.61 with mean of 5.37. The GCV (11.34%) and PCV (11.47%) were observed with noticeable ECV (1.61%). The high value of heritability (97.65 %) was recorded with high estimates of genetic advance as per cent of mean (23.01 %).

4.1.2.2.5 Node at which first female flower appeared

In case of F₅ generation the node at which first female flower appeared was observed in wider range of 3.86 to 6.44 with an average of 4.12. The close association of GCV (18.87 %) and PCV (18.92 %) was observed with certain presence of ECV (0.53 %). The high estimate was obtained for heritability (99.94 %) along with high genetic advance as per cent mean of (45.40 %) While low value was observed for genetic advance (1.87).Whereas in F₆ generation it was ranged in between 4.07 to 5.34 with an average 4.25 days. The close association of GCV (15.26 %) and PCV (15.34 %) was observed with ECV (0.56 %). The high estimates were obtained for heritability (99.89 %) and genetic advance as per cent of mean (32.51 %).

4.1.2.2.6 Days required for first harvest of fruit

In F₅ generation the wide range of variability was observed for days required for first harvest of fruit (61.83 to 80.31 days) with mean value 73.31 days. The closer value of GCV (5.81 %) and PCV (5.94 %) was observed with certain influence of environmental factor ECV (1.18 %). The high heritability (96.11 %) along with genetic advance (9.54) and moderate genetic advance as per cent mean of (13.01 %) were recorded. In F₆ generation it was ranged from 71.25 to 77.32 days with an average 73.24 days. The close association of GCV (6.49 %) and PCV (6.85 %) was observed with influence ECV (2.12 %). The high value of heritability was observed (91.32%) with moderate genetic advance (9.41) and genetic advance as per cent of mean (12.81%).

4.1.2.3 Yield and it's contributing character

4.1.2.3.1 Number of fruits per vine

The number of fruits per vine in F₅ generation was ranged in between 2.48 to 2.94 per vine with an average 2.78 per vine. For this most important character significant contribution of genetic variability GCV (15.91 %) and PCV (16.25 %) were observed with noticeable value of environmental variability ECV (3.20 %). The high estimates of heritability (96.17 %) and genetic advance as per cent of mean (31.34%) were observed. While in F₆ generation it showed the range in between 2.07-2.74 per vine with an average 2.51 fruits per vine. The closer values of GCV (11.09 %) and PCV (11.12 %) were observed with environmental variability ECV (0.76 %). The high estimates of heritability (99.78

%) and genetic advance as per cent of mean (22.81 %) were observed.

4.1.2.3.2 Fruit yield per vine (kg)

In case of F₅ generation fruit yield per vine was observed in range of 1.94-2.46 kg per vine with an average 2.24 kg per vine. The close association of GCV (15.44 %) and PCV (15.68 %) was observed with noticeable value of environmental variability ECV (2.54%). The high estimates of heritability (97.64 %) along with high genetic advance as per cent of mean (27.21 %). In case of F₆ generation it showed range 1.41 to 2.32 kg per vine with an average 2.11 kg fruits per vine. The contribution of genetic variability GCV (22.39 %) and PCV (22.42 %) were observed with certain influence of environmental variability ECV (1.10 %). The high estimates of heritability (99.84 %) along with high genetic advance as per cent of mean (45.54 %) and low genetic advance (0.96) were observed, respectively.

4.1.2.4 Fruit characters (quantitative)

4.1.2.4.1 Average weight of fruit (g)

Average weight of fruit is an important yield contributing character. In F₅ generation it recorded a wide range of variation 617.92-944.35 g with mean of 898.35 g. The closer value of genotypic co-efficient of variation GCV (11.09 %) and phenotypic co-efficient of variation PCV (11.21 %) were observed with certain presence of environmental variation ECV (1.96 %). The high estimates of heritability (97.35 %), genetic advance (177.89) and per cent mean of genetic advance (22.36 %) were observed. In F₆ generation it showed a wide range of variation

611.63 to 847.31 g with mean of 780.12 g. The closer value of GCV (13.26 %) and PCV (13.27 %) were recorded with certain influence of ECV (0.66 %). The high estimates were recorded for heritability and genetic advance as per cent of mean (99.92 % and 27.34 %, respectively).

4.1.2.4.2 Average length of fruit (cm)

In F₅ generation the wide range of variability was observed for average length of fruit (8.75 cm to 12.31 cm) with an average 11.48 cm. The close association of GCV (11.04 %) and PCV (11.14 %) was observed with certain presence of environmental factor ECV (0.28 %). The high estimates were obtained for heritability (99.12 %) and genetic advance as per cent of mean (22.71 %). In F₆ generation it was ranged in between 8.11 cm to 11.94 cm with an average 11.24 cm. The close association of GCV (12.72 %) and PCV (12.76 %) was observed with certain presence of environmental factor (ECV 1.09 %). The high estimates were obtained for heritability (99.21 %) and genetic advance as per cent of mean (26.28 %) with low value for genetic advance (2.94).

4.1.2.4.3 Average diameter of fruit (cm)

In case of F₅ generation the average diameter of fruit was ranged in between 10.84 cm to 13.36 cm with an average 12.87 cm. The close association of GCV (6.81 %) and PCV (6.87 %) was observed with low influence of environmental factor ECV (1.21 %). The high estimates of heritability (99.35 %), low genetic advance (1.87) and moderate genetic advance as per cent of mean (14.51 %) were recorded. While in case of F₆ generation it

was ranged from 10.81 cm to 12.94 cm with an average 12.34 cm. The close association of GCV (5.72 %) and PCV (5.75 %) was observed with certain influence of environmental factor ECV (0.61 %). The high value of heritability (98.97 %) was observed with low and moderate values of genetic advance (1.41) and genetic advance as per cent of mean (11.82 %), respectively.

4.1.2.4.4 Average rind thickness (cm)

In F₅ generation the character average rind thickness was ranged in between 0.17 cm to 0.21 cm with mean value 0.19 cm. The genetical variability contributed as GCV (10.13 %) and PCV (10.68 %) with noticeable environmental variability ECV (5.21 %). The high estimate of heritability (75.81%) was recorded with low estimates of genetic advance (1.16) and moderate estimates of genetic advance as per cent of mean (16.66 %). While in F₆ generation it was ranged in between 0.16 cm to 0.23 cm with mean value of 0.21 cm. The substantial genetical variability contributed as GCV (10.42 %) and PCV (12.26 %) along with noticeable environmental variability ECV (6.47 %). The high value of heritability (75.29 %) was recorded with low and moderate estimates of genetic advance (0.04) and genetic advance as per cent of mean (19.24 %) respectively.

4.1.2.4.5 Average pulp thickness (cm)

In F₅ generation the average pulp thickness was ranged in between 1.98 cm to 2.61 cm with an average 2.42 cm. The close association of GCV (10.22 %) and PCV (10.34 %) was observed with certain presence of environmental factor ECV (1.42 %). Furthermore high estimates were obtained for

heritability (98.11 %) and genetic advance as per cent of mean (21.82 %). In F₆ generation it showed wide range (1.87 cm to 2.48 cm) with an average 2.31 cm. The close association of GCV (11.38 %) and PCV (11.40 %) was observed with certain presence of environmental factor ECV (0.67 %). The high values were obtained for heritability (99.69 %) and genetic advance as per cent of mean (24.26 %).

4.1.2.4.6 Average fruit cavity (cm²)

In case of F₅ generation the wide range of variability was observed for average fruit cavity (36.48 to 51.75 cm) with mean value of 45.64 cm. The close values of GCV (16.12 %) and PCV (16.21 %) were observed along with certain presence of environmental factor ECV (1.09%). The high estimates of heritability (99.58 %) were observed along with high value of genetic advance (18.43) and genetic advance as per cent of mean (40.41 %). Whereas in case of F₆ generation it was ranged from 39.42 cm to 61.72 cm with an average 43.84 cm. The close values of GCV (14.66 %) and PCV (14.67 %) was observed with ECV (0.36 %). The high value for heritability (99.95%), moderate value for genetic advance (13.21) and high value for genetic advance as per cent of mean (30.15 %).

4.1.2.4.7 Average weight of pulp per fruit (g)

In F₅ generation the average weight of pulp per fruit was observed in wide range of 358.71 to 587.84 g with mean value of 521.12 g. The close association of GCV (17.37 %) and PCV (17.82 %) was recorded along with noticeable environmental variability ECV (3.11 %). The high value of heritability (96.83 %)

was recorded along with high value of genetic advance (183.72 %) and genetic advance as per cent of mean (35.30 %). While in F₆ generation it showed the wide range of variation (347.52 to 567.12 g) with mean value of 492.16 g. The significant genetical variability contributed as GCV (11.77 %) and PCV (13.24 %) with noticeable environmental variability ECV (6.09 %). The high value of heritability (78.93 %) was recorded with high estimates of genetic advance (98.63) and genetic advance as per cent of mean (20.32 %).

4.1.2.4.8 Average weight of seed per fruit (g)

In case of F₅ generation the wide range of variability was observed for average weight of seed per fruit (8.48 to 10.72 g) with an average 8.94 g. The close association of GCV (13.62 %) and PCV (13.71 %) was observed with certain presence of environmental factor ECV (0.45 %). Furthermore high values were obtained for heritability (99.81 %), genetic advance (2.53) and genetic advance as per cent of mean (28.32 %). In case of F₆ generation it showed wide range in between 6.38 to 9.13 g with an average 7.01 g. The close associations of GCV (18.96 %) with PCV (18.97 %) were observed with certain presence of ECV (0.38 %). The high values were obtained for heritability (99.97 %) and genetic advance as per cent of mean (38.51 %) while low value was recorded for genetic advance (2.70).

4.1.2.5 Fruit characters (qualitative)

4.1.2.5.1 Total soluble solids (T.S.S.°Brix)

T.S.S. content of fruit is an important qualitative character in muskmelon. In case of F₅ generation it was

observed in the range of 11.12 to 11.85° Brix with mean value 11.64° Brix. The significant contribution of genetic variability of GCV (13.35 %) and PCV (14.43 %) were observed with presence of environmental factor ECV (5.73 %). The high estimates were recorded for heritability (84.52 %) and genetic advance per cent of mean (24.42 %). While in case of F₆ generation it was ranged in between 11.04 to 11.94° Brix with mean value of 11.61° Brix. The genetical variability GCV (13.44%) and PCV (15.57%) were observed with ECV (7.83 %). The high estimates were recorded for heritability and genetic advance as per cent of mean (75.12 % and 21.25 % respectively).

4.1.2.5.2 Acidity (%)

In F₅ generation the acidity percentage was ranged in between 1.14 to 1.34 % with an average 1.18 %. The contribution of genetic variability of GCV (5.73 %) and PCV (6.09 %) was observed with certain presence of environmental factor ECV (1.97 %). The high and moderate estimates were obtained for heritability (89.17 %) and genetic advance as per cent of mean (10.24 %) respectively. In F₆ generation it was ranged in between 1.31 to 1.37 % with an average 1.34 %. The close association of GCV (11.80%) and PCV (12.17 %) was observed with ECV (2.31 %). The high value was obtained for heritability (55.53 %) along with low values of genetic advance as per cent of mean (15.71 %) and genetic advance (0.21).

4.1.2.5.3 Ascorbic acid (mg/100g)

In case of F₅ generation the ascorbic acid content was ranged from 25.89 to 26.94 mg/100g along with mean value

26.19 mg/100g. The close association of GCV (10.37 %) and PCV (11.54 %) was observed with influence of environmental factor ECV (1.61 %). The high estimates of heritability (78.21 %) along with low value of genetic advance (4.28) and moderate genetic advance as per cent of mean (16.32) were observed. In case of F₆ generation it was ranged from 25.11 to 26.39 mg/100g with an average 24.48 mg/100g. The close association of GCV (10.38 %) and PCV (11.81 %) was observed with certain influence of environmental factor ECV (1.37 %). The high estimate of heritability (77.38 %) was observed with low genetic advance (4.51) and moderate genetic advance as per cent of mean (17.72 %).

4.1.2.5.4 Total sugar (%)

In F₅ generation the total sugar content was ranged in between 9.27 to 10.32 % with mean value 10.11 %. The genetical variability contributed as GCV (3.69 %) and PCV (3.71 %) with presence of environmental variability ECV (0.32 %). The high value of heritability (99.37 %) was recorded with low estimate of genetic advance as per cent of mean (7.56 %). In F₆ generation it was ranged in between 9.21 to 10.43 % with mean value 9.95 %. The closer value of GCV (4.63 %) and PCV (4.68 %) were recorded with environmental variability ECV (0.78 %). The high and low values were obtained for heritability (98.42 %) and genetic advance (0.89 %) respectively.

4.1.2.5.5 Reducing sugar (%)

In case of F₅ generation the reducing sugar content was ranged in between 7.24 to 8.28 % with an average 8.04 %.

The close association of GCV (5.51 %) with PCV (5.56 %) was observed with certain presence of environmental factor ECV (0.36 %). The high and moderate values were obtained for heritability (99.56 %) and genetic advance as per cent of mean (11.42 %) respectively. In case of F₆ generation it was ranged in between 7.24 to 7.83 % with an average 7.64 %. The genetic variability was contributed as GCV (5.32%) and PCV (6.15%) was observed with certain presence of environmental factor ECV (0.82 %). The moderate and low values were obtained for heritability (81.92 %) and genetic advance as per cent of mean (6.31 %) respectively.

4.1.2.5.6 Non reducing sugar (%)

In F₅ generation the non reducing sugar content was ranged from 1.82 to 2.43 % with an average 1.92 %. The genetic variability was contributed as GCV (10.21 %) and PCV (10.49 %) with noticeable influence of environmental factor ECV (2.44 %). The high estimates were recorded for heritability (94.51 %) and genetic advance as per cent of mean (20.81 %)). In F₆ generation it was ranged from 2.01 to 2.58 % with an average 2.31 %. The GCV (5.87 %) and PCV (6.05 %) was observed with influence of environmental factor ECV (2.15 %). The high heritability (88.27 %) was observed with low values of genetic advance (0.26) and moderate values for genetic advance as per cent of mean (11.34 %).

4.1.3 Variability, heritability and genetic advance of cross Hara Madhu x Punjab Sunheri (C₃ : 3 x 7) for F₅ and F₆ generations.

Four progenies of F₅ and F₆ along with their parents were studied for growth, flowering, yield and fruit quantitative and qualitative traits and presented in Table 8 and 9 respectively.

4.1.3.1 Vine growth characters

4.1.3.1.1 Vine length (cm)

In case of F₅ generation the vine length showed wide range (215.35 to 239.47 cm) with an average of 221.38 cm. The genotypic co-efficient of variation (GCV) and phenotypic coefficient of variation (PCV) were observed as 13.56 % and 15.74 % respectively. While environmental co-efficient of variation ECV was 7.98 %. The high estimates were observed for heritability (74.66 %), genetic advance (55.29) and genetic advance as per cent of mean (25.00 %). In case of F₆ generation it was ranged in between 193.20 to 224.66 cm with an average of 211.43 cm. The genotypic co-efficient of variance (GCV 12.55 %) and phenotypic coefficient of variance (PCV 12.68 %) were observed with environmental co-efficient of variance ECV (3.94 %). The high estimates were observed for heritability (90.47 %), genetic advance (48.32) and genetic advance as per cent of mean (GAM 22.94 %), indicating better scope for improvement through selection.

4.1.3.1.2 Number of primary branches per vine

In F₅ generation the number of primary branches per vine was observed in the range of 2.24-2.51 with mean value 2.32. The genetical variability was contributed GCV (12.08 %) and PCV (12.84 %) with environmental factors ECV (4.48 %). The high estimate of heritability (84.78 %) was recorded with high value of genetic advance as per cent of mean (24.61 %) and low value of genetic advance. While in F₆ generation it was ranged in between 2.14 to 2.36 with mean value of 2.20. The GCV (13.31 %) and PCV (15.68 %) were observed with noticeable influence of environmental factor (ECV 7.10 %). The high estimate of heritability (78.12 %) was associated with high value of genetic advance as per cent of mean (23.61 %). The low value was recorded for genetic advance (0.52).

4.1.3.2 Flowering characters

4.1.3.2.1 Days to first female flower appearance

In case of F₅ generation this character was ranged in between 35.12 to 43.56 days with mean value of 38.69 days. The genetic variability was contributed as GCV (6.51 %) and PCV (8.66 %) along with noticeable influence of environmental factor ECV (5.29 %). The moderate estimate of heritability (60.32%) was obtained low (4.54) and moderate genetic advance as per cent of mean (11.17 %). In case of F₆ generation it showed wide range of variability (29.11 to 41.38 days) with mean value 31.82 days. The close association of GCV (7.10%) and PCV (7.25%) were observed with certain presence of environmental factor ECV (2.15%). The high estimate of heritability (94.38 %) was obtained

with moderate genetic advance (6.22) and moderate value of genetic advance as per cent of mean (19.52 %).

4.1.3.2.2 Number of male flowers per vine

In F₅ generation the wide range of variability (68.35 to 85.64) was observed for number of male flowers per vine with mean value of 79.15. The very close values were recorded for GCV (10.01 %) and PCV (10.09%) along with very low influence of environmental variability (ECV 0.52%). High values were recorded for heritability (98.71 %), genetic advance (16.41 %) and genetic advance as per cent of mean (20.71 %). In F₆ generation it was ranged in between 54.93 to 70.23 with mean value 61.72. The GCV (11.80%) and PCV (12.30%) were recorded with ECV (1.88%). The high value of heritability (98.23 %) was recorded with high estimates of genetic advance as per cent of mean (22.06 %) and genetic advance (16.22) respectively.

4.1.3.2.3 Number of female flowers per vine

In case of F₅ generation the wide range of variability was observed for number of female flowers per vine was (10.58 to 13.31) with an average value 11.14. The close association of GCV (12.32 %) and PCV (12.77 %) was observed with noticeable environmental variability (ECV 3.24 %). The high values were obtained for heritability (92.64 %) along with genetic advance as per cent of mean (23.21 %). Whereas in case of F₆ generation it was ranged in between 9.15 to 12.19 with an average 10.74. The close association of GCV (14.20%) and PCV (15.18%) was observed with certain presence of environmental factor ECV (4.30%). The high values were obtained for heritability (80.14 %)

and genetic advance as per cent of mean (20.51 %) whereas low value was obtained for genetic advance (2.20).

4.1.3.2.4 Sex ratio (female:male)

In F₅ generation the wide range of variability was observed for sex ratio (6.38 to 8.24) with mean value of 7.10. The substantial genetical variability was contributed as GCV (11.47 %) and PCV (11.64 %) with noticeable environmental variability ECV (1.95 %). High estimates were recorded for heritability (96.38 %) and genetic advance as per cent of mean (24.10 %). In F₆ generation it was ranged in between 5.14 to 6.76 with mean value 6.05. The genetical variability GCV (13.16%) and PCV (14.87%) were observed with ECV (6.98%). The high value of heritability (78.21 %) was recorded with high estimates of genetic advance as per cent of mean (24.15 %).

4.1.3.2.5 Node at which first female flower appeared

In case of F₅ generation the node at which first female flower appeared was ranged in between 4.86 to 6.40 with an average value 5.01. The close association of GCV and PCV (9.51 % and 9.53 % respectively) was observed with certain presence of environmental factor (ECV 0.62 %). The high values were obtained for heritability (99.61 %) and moderate value for genetic advance as per cent of mean (19.57 %). In case of F₆ generation it was ranged in between 4.08 to 5.52 with an average 4.37 days. The close association of GCV (7.67%) and PCV (7.70%) were observed with certain presence of environmental factor ECV (0.54 %). The high, moderate and low values were obtained for

heritability (99.56 %), genetic advance as per cent of mean (15.79 %) and genetic advance (0.78) respectively.

4.1.3.2.6 Days required for first harvest of fruit

In F₅ generation the wide range of variability was observed for days required for first harvest of fruit (71.64 to 88.24 days) with an average 73.24 days. The GCV (5.72 %) and PCV (5.97 %) was observed with influence of environmental factor ECV (1.64 %). The high heritability was observed (92.24 %) along with high genetic advance (10.21) and moderate genetic advance as per cent of mean (13.92 %). While in F₆ generation it was ranged from 67.31 to 74.52 days with an average 71.68 days. The close association of GCV (7.85 %) and PCV (8.89 %) were observed with noticeable influence of environmental factor ECV (4.06 %). The high value of heritability was observed (78.91 %) with high and moderate genetic advance (10.81) and genetic advance as per cent of mean (15.21 %).

4.1.3.3 Yield and it's contributing character

4.1.3.3.1 Number of fruits per vine

In case of F₅ generation number of fruits per vine showed wide range (2.61-3.42) with an average 3.02 per vine. The close association of genetic variability GCV (12.51 %) and PCV (12.61 %) were recorded along with certain presence of environmental variability ECV (1.38 %). The high estimates were observed for heritability (96.79 %) and genetic advance as per cent of mean (26.29 %). Whereas in case of F₆ generation it was observed with the range of 2.11 to 2.82 per vine with an average 2.74 per vine. The GCV (12.32 %) and PCV (12.43 %) were

observed with certain presence of environmental variability ECV (1.67 %). The high estimates were observed for heritability (98.24 %) and genetic advance as per cent of mean (24.10 %) with low value for genetic advance.

4.1.3.3.2 Fruit yield per vine (kg)

In F₅ generation the wide range was observed for fruit yield per vine 1.65-1.84 kg with an average 1.74 kg per vine. The significant contribution of genetic variability GCV (16.91 %) and PCV (19.13 %) were observed with environmental variability ECV (8.87 %). The high estimates were observed for heritability (79.45 %) along with genetic advance as per cent of mean (29.35 %). Whereas in case of F₆ generation it was ranged in between 1.37-1.68 kg per vine with an average 1.65 kg per vine. The contribution of genetic variability GCV (12.18 %) and PCV (13.98 %) were observed with environmental variability ECV (6.39 %). The high estimates of heritability (98.24 %) along with higher value of genetic advance as per cent of mean (22.42 %) was observed. However lower values of genetic advance (0.37) was observed.

4.1.3.4 Fruit characters (quantitative)

4.1.3.4.1 Average weight of fruit (g)

In case of F₅ generation the average weight of fruit showed a wide range of variability (488.62-687.34 g) with mean value 556.42 g. The genotypic co-efficient of variation GCV (11.57 %) and PCV (12.42 %) were recorded with presence of environmental variability ECV (4.45 %). The high estimates of heritability, genetic advance and genetic advance as per cent of

mean (87.94 %, 123.61 and 22.20 % respectively) were recorded. While in case of F₆ generation it showed a wide range of variation (542.92-761.98 g) with mean value of 656.97 g. The GCV (12.09 %) and PCV (12.79 %) was recorded with noticeable environmental factor ECV (4.12 %). The high estimates of heritability (90.11 %) and genetic advance as per cent of mean (20.14 %) and genetic advance (131.97) were recorded which proves that the average weight of fruit can be improved during further selection cycle.

4.1.3.4.2 Average length of fruit (cm)

In F₅ generation the average length of fruit was showed wide range in between 8.37 cm to 11.27 cm with an average 9.12 cm. The close association of GCV (11.54 %) and PCV (11.58 %) was observed with certain presence of environmental factor ECV (0.56 %). The high values were obtained for heritability (99.61 %) and genetic advance as per cent of mean (24.12 %). Whereas in F₆ generation it showed wide range (8.20 to 11.26 cm) with an average 9.21 cm. The close association of GCV (11.39 %) and PCV (11.47 %) was observed with certain presence of environmental factor ECV (1.24 %). The high values were obtained for heritability (98.87 %) and genetic advance as per cent of mean (23.71 %) while low genetic advance (2.18) was observed.

4.1.3.4.3 Average diameter of fruit (cm)

In case of F₅ generation the wide range of variability was observed for average diameter of fruit (10.42 cm to 13.21 cm) with mean value of 12.24 cm. The contribution of genetic

variability of GCV (6.42 %) and PCV (6.56 %) was observed with certain influence of environmental factor (ECV 1.24 %). The high estimate of heritability (96.32 %), lower and moderate value for genetic advance (1.47) and moderate value of genetic advance as per cent of mean (12.01 %) were observed. Whereas in case of F₆ generation it was ranged from 9.42 cm to 12.10 cm with an average 11.10 cm. The close association of GCV (6.81 %) and PCV (6.84 %) was observed with certain influence of environmental factor ECV (0.52 %). The high heritability (99.31 %), low genetic advance (1.47) and moderate genetic advance as per cent of mean (13.21 %) were observed respectively.

4.1.3.4.4 Average rind thickness (cm)

In F₅ generation this character was ranged in between 0.18 cm to 0.33 cm. with mean of 0.31 cm. The genetical variability contributed as GCV (15.04 %) and PCV (15.94 %) were observed with noticeable environmental variability ECV (5.21 %). High value of heritability (89.27%) was recorded with low value of genetic advance (0.09) and high estimates of genetic advance as per cent of mean (22.61 %). In F₆ generation it was ranged in between 0.18 cm to 0.27 cm. with mean value 0.26 cm. The substantial genetical variability was observed for GCV (16.76 %) and PCV (19.34 %) with noticeable environmental variability ECV (9.62 %). The high value of heritability (76.35 %) was recorded with high estimates of genetic advance as per cent of mean (30.8 %) and low genetic advance (0.08).

4.1.3.4.5 Average pulp thickness (cm)

In case of F₅ generation the average pulp thickness was ranged in between 1.64 cm to 2.03 cm with an average 1.72 cm. The genetic variability contributed as GCV (8.48 %) and PCV (8.57 %) were observed with certain presence of environmental factor ECV (1.17 %). The high estimate were obtained for heritability (98.12 %) and genetic advance as per cent of mean (15.72 %) with low genetic advance (0.27). In case of F₆ generation it was ranged in between 1.54 cm to 1.97 cm with an average 1.67 cm. The close association of GCV (10.16 %) and PCV (10.22 %) was observed with certain presence of environmental factor (ECV 1.21 %). The high values were obtained for heritability (98.63 %) along with genetic advance as per cent of mean (20.4 %) and low value of genetic advance (0.34).

4.1.3.4.6 Average fruit cavity (cm²)

In case of F₅ generation the average fruit cavity was ranged from 38.31 cm to 56.32 cm with mean value of 41.32 cm. The close association of GCV (14.66 %) and PCV (14.68 %) were observed with meager influence of environmental factor (ECV 0.36 %). The high estimates were obtained for Heritability (99.95 %), genetic advance (13.27) and genetic advance as per cent of mean (32.13 %). While in case of F₆ generation it was ranged from 40.58 cm to 59.32 cm with an average 44.12 cm. The close association of GCV (14.15 %) and PCV (14.36 %) was observed with noticeable influence of environmental factor ECV (2.47 %). The high value of heritability (97.17 %), genetic advance (12.65

%) and genetic advance as per cent of mean (28.71 %) were observed respectively.

4.1.3.4.7 Average weight of pulp per fruit (g)

In F₅ generation this character was ranged in between 309.31 to 410.28 g with mean of 364.35 g. The significant genetical variability GCV (11.77 %) and PCV (13.27 %) were observed with noticeable environmental variability ECV (6.08 %). High value of heritability (78.93 %) was recorded with high estimates of genetic advance as per cent of mean (20.52 %). Whereas in F₆ generation it was observed in wide range (281.65 to 494.35 g) with mean value of 435.38 g. The close value of GCV (10.32 %) and PCV (10.63 %) were recorded with noticeable environmental variability ECV (2.53%). The high value of heritability (94.39 %), genetic advance (62.04) and genetic advance as per cent of mean (14.12 %) were observed respectively.

4.1.3.4.8 Average weight of seed per fruit (g)

In case of F₅ generation the average weight of seed per fruit showed wide range of variability in between 6.35 to 9.81 g with an average 7.09 g. The GCV (18.95 %) and PCV (18.95 %) were observed with low value of environmental variation ECV (0.38 %). The high values for heritability (99.97 %), and genetic advance as per cent of mean (38.62 %) were recorded with low value for genetic advance (2.75). While in case of F₆ generation it was ranged in between 6.78 to 7.81 g with an average 7.06 g. The close association of GCV (14.03 %) and PCV (14.25 %) was observed with certain presence of environmental factor ECV

(2.19 %). The high values were obtained for heritability (97.64 %) and genetic advance as per cent of mean (28.61 %) with low genetic advance (2.01).

4.1.3.5 Fruit characters (qualitative)

4.1.3.5.1 Total soluble solids (°Brix)

T.S.S. content of fruit is an important qualitative character in muskmelon. In case of F₅ generation it showed a wide range of variation in between 11.00-11.30° Brix with mean value of 11.12° Brix. The genotypic variability GCV (13.42 %), PCV (15.59 %) and ECV (7.81 %) were observed. The high estimates for heritability (75.11 %) and genetic advance as per cent of mean (22.81 %) were observed with low value of genetic advance (2.53). In case of F₆ generation it was observed in range of 10.98 to 11.47° Brix with mean value 11.14° Brix. The GCV (17.16 %) and PCV (17.39 %) were recorded with ECV (3.57%). The higher values were recorded for heritability (75.78 %) and genetic advance as per cent of mean (23.92 %).

4.1.3.5.2 Acidity (%)

In case of F₅ generation the acidity percentage was observed in the range of 1.31 to 1.37 % with an average 1.34 %. The GCV (11.80 %) and PCV (12.17 %) were observed with certain presence of environmental factor ECV (2.31 %). The moderate values were obtained for heritability (55.53 %), and genetic advance as per cent of mean (16.41 %) with low value for genetic advance (0.22). While in case of F₆ generation it was ranged in between 1.21 to 1.37 % with an average 1.26 %. The contribution of genetic variability of GCV (10.15 %) and PCV

10.65 %) was observed with ECV (1.05 %). The high and moderate values were obtained for heritability (77.38 %) and genetic advance as per cent of mean (16.14 %) respectively.

4.1.3.5.3 Ascorbic acid (mg/100g)

In F₅ generation the ascorbic acid content was ranged from 26.16 to 27.12 mg/100g with an average 26.40 mg/100g. The close association of GCV (10.38 %) and PCV (11.81 %) was observed with low influence of ECV (1.37 %). Heritability was high (76.32 %) along with low genetic advance (4.47) and moderate genetic advance as per cent of mean (16.91 %). Whereas in case of F₆ generation it was ranged from 25.08 to 25.46 mg/100g with an average 25.27 mg/100g. The genetic variability of GCV (10.71 %) and PCV (11.32 %) were observed with certain influence of ECV (1.28 %). The moderate heritability (72.21 %) and genetic advance as per cent of mean (16.56 %) were recorded.

4.1.3.5.4 Total sugar (%)

Total sugar was ranged in between 8.20 to 9.24 % with mean value 8.45 % in F₅ generation. The genetical variability contributed as GCV (4.63 %) and PCV (4.69%) with environmental variability ECV (0.78 %). High value of heritability (97.34 %) was recorded along with low value of genetic advance (0.89) and genetic advance as per cent of mean (10.51 %). In F₆ generation it was observed in wider range of 8.24 to 9.35 % with mean value 8.50%. The genetical variability contributed as GCV (5.89 %) and PCV (5.93 %) with environmental variability ECV (0.43 %). The high value of heritability (99.51 %) was recorded

with moderate estimates of genetic advance as per cent of mean (12.18 %) and lower value of genetic advance (1.03).

4.1.3.5.5 Reducing sugar (%)

In case of F₅ generation the reducing sugar content was ranged in between 7.21 to 7.34 % with an average 7.25 %. The close association of GCV and PCV (5.33 % and 6.15 %) was observed with certain presence of environmental factor ECV (0.82 %). The high and low values were obtained for heritability (88.12 %) and genetic advance (0.48) respectively. Whereas in case of F₆ generation it was ranged in between 6.04 to 7.19 % with an average 6.32 %. The close association of GCV (7.17 %) and PCV (7.29 %) was observed with certain presence of environmental factor ECV (0.89 %). The high and moderate values were obtained for heritability (98.62 %) and genetic advance as per cent of mean (14.96 %) respectively.

4.1.3.5.6 Non reducing sugar (%)

In F₅ generation the non reducing sugar content was ranged from 1.02 % to 2.12 % with an average 1.21 %. The close association of GCV (5.85 %) and PCV (6.05 %) was observed with noticeable influence of (ECV 2.15 %). The high heritability (88.35 %) was observed with low value of genetic advance (0.23) and genetic advance as per cent of mean (19.62 %). While in F₆ generation it was ranged from 2.01 % to 2.33 % with mean value 2.18 %. The close association of GCV (5.94 %) and PCV (6.99 %) was observed with ECV (0.67 %). The moderate heritability (72.76 %) and genetic advance as per cent of mean (10.90 %) were observed.

4.1.4 Variability, heritability and genetic advance of cross IVMM-3 x Pusa Madhuras (C₄: 4 x 5) for F₅ and F₆ generations.

Three F₅ and F₆ progenies along with their parents were studied for growth, flowering, yield and fruit quantitative and qualitative traits and are presented in Table 10 and 11.

4.1.4.1 Vine growth characters

4.1.4.1.1 Vine length (cm)

In case of F₅ generation data presented in Table 10 showed wide range of vine length (167.17 to 227.12 cm) with an average of 209.24 cm. The significant genetic variability GCV (11.37 %) and PCV (11.53 %) were observed with the influence of environmental factor (ECV 1.92 %). Very high estimates were observed for heritability (97.26 %), genetic advance (45.98) and genetic advance as per cent of mean was (22.00 %) indicating better scope for improvement through selection. Whereas in case of F₆ generation wide range (157.51 to 262.32 cm) with an average of 216.34 cm. The close association of GCV (11.17 %) and PCV (11.39 %) were observed with noticeable influence of ECV (2.30 %). The high estimates of heritability (95.94 %), genetic advance (44.56) and genetic advance as per cent of mean (20.06 %) were observed.

4.1.4.1.2 Number of primary branches per vine

In F₅ generation the number of primary branches per vine was ranged in between 2.24 and 2.76 with mean value of 2.61. The very close values were recorded for GCV and PCV (11.69% and 11.76% respectively) with certain low influence of

environmental factors (ECV 1.30 %). The high estimate of heritability (98.81 %) was observed with low value of genetic advance (0.61) which is accompanied with high value of genetic advance as per cent of mean (23.41%). While in F₆ generation it was observed in the range of 2.08-2.45 with mean value 2.31. The close values were recorded for GCV (11.81 %) and PCV (11.92 %) with certain presence of environmental factor ECV (1.52 %). The high estimate of heritability (98.38%) was associated with high value of genetic advance as per cent of mean (26.43 %) and low genetic advance (0.61).

4.1.4.2 Flowering characters

4.1.4.2.1 Days to first female flower appearance

In case of F₅ generation the wide range of variability was observed for days to first female flower appearance (36.60-44.29 days) with mean value of 38.64 days. The GCV and PCV were recorded (7.71 and 7.89 % respectively) with noticeable influence of environmental factors (ECV 1.74 %). The high estimate for heritability (95.27 %) was observed which was associated with moderate genetic advance (5.98) and genetic advance as per cent of mean (15.5 %). In case of F₆ generation it showed wide range of variability (29.35-36.61 days) with mean value 30.75 days. The genetic variability was contributed as GCV (6.54 %) and PCV (6.78 %) with noticeable influence of environmental factor ECV (1.82 %). The high estimate of heritability (92.85 %) was observed with low genetic advance (4.09) and moderate genetic advance as per cent of mean (13.39 %).

4.1.4.2.2 Number of male flowers per vine

In F₅ generation this character was ranged in between 65.81 to 81.92 with mean value of 76.12. The close association of GCV (10.56 %) and PCV (10.65 %) were recorded with noticeable environmental variability (ECV 1.42 %). The high value of heritability (98.26 %) was recorded with high estimates of genetic advance (16.82) and genetic advance as per cent of mean (22.14 %). Whereas in case of F₆ generation it was ranged in between 45.12 to 58.34 with mean value 48.02. The genetical variability contributed as GCV (11.65 %) and PCV (11.84 %) with noticeable environmental variability ECV (1.86 %). The high value of heritability (97.65%) was recorded with high estimates of genetic advance as per cent of mean (23.73 %) and moderate value of genetic advance (11.41).

4.1.4.2.3 Number of female flowers per vine

In case of F₅ generation the number of female flowers per vine was ranged in between 9.94 to 13.52 with an average 12.74. The close association of GCV (10.82 %) and PCV (10.89 %) were observed with certain presence of environmental factor ECV (1.76 %). The high values were obtained for heritability (97.46 %) and genetic advance as per cent of mean (22.16 %) with low value of genetic advance (2.81). While in case of F₆ generation it showed wide range between 10.12 to 12.94 with an average 12.14. The close association of GCV (12.28 %) with PCV (12.70 %) was observed with certain presence of environmental factor ECV (3.18 %). The high values were obtained for heritability (93.71 %) and genetic advance as per cent of mean (22.9 %).

4.1.4.2.4 Sex ratio (female:male)

In F₅ generation the wide range of variability was observed for sex ratio (5.62 to 8.33) with mean value of 5.97. The genetical variability was contributed as GCV (13.59 %) and PCV (13.78 %) with noticeable environmental variability ECV (2.18 %). The high value of heritability (97.56 %) was recorded with high estimate of genetic advance as per cent of mean (27.62 %) with low value of genetic advance (1.74). In F₆ generation it was ranged in between 3.84 to 6.78 with mean of 4.32. The close association of GCV (21.55 %) and PCV (21.82 %) was observed with noticeable environmental variability ECV (3.40 %). The high value of heritability (97.59 %) was recorded with high estimate of genetic advance as per cent of mean (43.83 %).

4.1.4.2.5 Node at which first female flower appeared

In case of F₅ generation, this character was observed in wide range 3.97 to 6.24 with an average 4.12. The close association of GCV (21.69 %) and PCV (21.82 %) were observed with certain presence of environmental factor (ECV 0.52 %). The high values were obtained for heritability (99.97 %) and genetic advance as per cent of mean (44.72 %) with low value for genetic advance (2.01). In case of F₆ generation it was ranged in between 3.91 to 5.71 with an average 4.11. The close association of GCV (15.82 %) and PCV (15.96 %) was observed with certain presence of environmental factor ECV (0.74 %). The high values were obtained for heritability (99.76 %) and genetic advance as per cent of mean (32.79 %) whereas low genetic advance (1.47) was recorded.

4.1.4.2.6 Days required for first harvest of fruit

In F₅ generation the days required for first harvest of fruits was ranged from 71.34 to 84.35 days with an average 73.12 days. The genetic variability as of GCV (7.73 %) and PCV (8.09%) were observed with influence of environmental factor ECV (2.43 %). The high values were observed for heritability (92.08 %), genetic advance (13.57) and moderate genetic advance as per cent of mean (18.61 %). In F₆ generation it was ranged from 71.42 to 78.47 days with an average 72.38 days. The close values of GCV (6.90 %) and PCV (6.98 %) was observed with certain influence of environmental factor ECV (1.10 %). The high heritability (97.64 %) and high genetic advance (10.39) and moderate genetic advance as per cent of mean (14.41 %) were observed respectively.

4.1.4.3 Yield and its contributing character

4.1.4.3.1 Number of fruits per vine

In case of F₅ generation the number of fruits per vine was observed in the range of 2.42 to 3.38 along with an average 3.15 per vine. Close values of GCV (12.30 %) and PCV (12.38 %) were observed with ECV (1.27 %). The high estimates were observed for heritability (99.94 %) and genetic advance as per cent of mean (24.15 %) with low value for genetic advance (0.76). While in case of F₆ generation it was ranged in between 2.35 to 2.78 with an average 2.68 per vine. The genetic variability GCV (12.69 %) and PCV (12.94 %) were observed with ECV (2.24 %). The high estimate of heritability (96.98 %) was associated with

high estimate of genetic advance as per cent of mean (24.36 %) and low genetic advance (0.65).

4.1.4.3.2 Fruit yield per vine (kg)

In case of F₅ generation the fruit yield per vine was observed in wide range of 1.62 to 2.13 kg per vine with an average 1.99 kg per vine. The close value of GCV (13.73 %) and PCV (14.51 %) were observed with noticeable value of environmental variability ECV (4.52%). The high estimates of heritability (91.23 %) with high genetic advance as per cent of mean (27.18 %) and low value of genetic advance (0.54) was observed. Whereas in case of F₆ generation it showed wide range (1.32 to 1.92 kg) per vine with an average 1.84 kg per vine. The close association of genetic variability GCV (12.59 %) and PCV (12.67 %) were observed with noticeable environmental variability ECV (1.53 %). The high estimates of heritability (98.58 %) along with high estimates of genetic advance as per cent of mean (24.58 %) and low value of genetic advance (0.45) were recorded.

4.1.4.4 Fruit characters (quantitative)

4.1.4.4.1 Average weight of fruit (g)

In case of F₅ generation the average weight of fruit was varied in wide range of 512.32-709.13 g with mean value of 683.24 g. The genotypic co-efficient of variation GCV (14.66 %) and phenotypic co-efficient of variation PCV (18.81 %) were observed with the influence of environmental factor ECV (11.76%). The moderate value for heritability (61.72 %) and high values for genetic advance (154.12) and genetic advance per cent

of mean (22.63 %) were recorded. In case of F₆ generation it showed a wide range of variation 551.82-689.87 g with mean value 664.35 g. The genetical variability GCV (11.91 %) and PCV (11.96 %) were recorded with environmental variability ECV (1.09 %). The high estimates of heritability (99.18 %), genetic advance (161.81) and genetic advance as per cent of mean (24.40 %) were recorded respectively.

4.1.4.4.2 Average length of fruit (cm)

In F₅ generation the average length of fruit was ranged in between 8.17 cm to 10.12 cm with an average 9.94 cm. The close association of GCV (5.59 %) and PCV (5.69 %) was observed with certain presence of environmental factor ECV (1.01 %). The high estimate was obtained for heritability (97.12 %) whereas low and moderate values were observed for genetic advance (1.09) and genetic advance as per cent of mean (11.00 %) respectively. In F₆ generation it was ranged in between 8.75 cm to 9.01 cm with an average 8.92 cm. The genetic variability was contributed as GCV (7.45 %) and PCV (8.71 %) and ECV (0.41 %). The moderate value was obtained for heritability (68.79 %) and genetic advance as per cent of mean (10.96 %) with low value for genetic advance (0.97).

4.1.4.4.3 Average diameter of fruit (cm)

In case of F₅ generation the average fruit diameter was ranged from 10.90 cm to 11.98 cm with an average 11.84 cm. The genetic variability of GCV (3.27 %) and PCV (3.43 %) were observed with certain presence of environmental factor ECV (1.04 %). The high value of heritability (91.34 %) whereas low

values of genetic advance (0.76) and moderate genetic advance as per cent of mean (11.10 %) were observed. In case of F₆ generation it was ranged from 10.45 cm to 11.91 cm with an average 11.59 cm. The close association of GCV (4.10 %) and PCV (4.12 %) was observed with low influence of environmental factor ECV (0.34 %). The high heritability (99.41 %) was found along with low value for genetic advance (0.98) and moderate genetic advance as per cent of mean (10.39 %).

4.1.4.4.4 Average rind thickness (cm)

In F₅ generation this character was ranged in between 0.18 cm to 0.27 cm. with mean value 0.24 cm. The genetical variability GCV (14.25 %) and PCV (16.35 %) were observed with the influence of environmental variability ECV (8.01 %). The high values of heritability (76.98%) along with high estimates of genetic advance as per cent of mean (29.28 %) and low value for genetic advance (0.07) were observed. Whereas in F₆ generation it was ranged in between 0.18 cm to 0.27 cm. with mean value 0.23 cm. The close value of genetical variability was contributed as GCV (12.83 %) and PCV (13.11 %) with noticeable environmental variability ECV (2.14 %). The high value of heritability (79.98%) was recorded along with high estimates of genetic advance as per cent of mean (26.12 %).

4.1.4.4.5 Average pulp thickness (cm)

In case of F₅ generation the average pulp thickness was ranged in between 1.92 cm to 2.34 cm with an average 2.21 cm. The contribution of genetic variability of GCV (10.12 %) and PCV (11.12 %) were observed with certain presence of

environmental factor ECV (1.25 %). The high values were obtained for heritability (99.32 %) and genetic advance as per cent of mean (20.41 %) while low value was observed for genetic advance (0.45). While in case of F₆ generation it was observed in wider range of 1.67 cm to 2.18 cm with an average 2.11 cm. The close association of GCV (10.78 %) and PCV (10.84 %) was observed with certain presence of environmental factor ECV (0.94 %). The high values were obtained for heritability (99.28 %) associated with high genetic advance as per cent of mean (22.34 %) and low genetic advance (0.47).

4.1.4.4.6 Average fruit cavity (cm²)

In F₅ generation the average fruit cavity was ranged from 32.94 cm to 49.35 cm with an average 39.14 cm. The close association of GCV (12.17 %) and PCV (12.19 %) were observed with certain influence of environmental factor ECV (0.52 %). The high estimates were observed for heritability (99.84 %) and genetic advance as per cent of mean (24.53 %) while moderate value was observed for genetic advance (9.57). In F₆ generation it showed the wide range of variability (32.38 cm to 52.45 cm) with an average 35.32 cm. The close values of GCV (21.98 %) and PCV (22.09 %) was observed with noticeable influence of environmental factor ECV (2.04 %). The high estimates were observed for heritability (99.17 %) and genetic advance as per cent of mean (43.00 %) with genetic advance (15.17).

4.1.4.4.7 Average weight of pulp per fruit (g)

In case of F₅ generation the wide range of variation was observed (475.32 to 530.15 g) with mean value 503.62 g for

average weight of pulp per fruit. The significant genetical variability was contributed as GCV (17.67 %) and PCV (23.96 %) with noticeable environmental variability ECV (16.21 %). The high estimates were observed for heritability (77.16 %), genetic advance (100.52) and genetic advance as per cent of mean (20.12 %). In case of F₆ generation it was observed in wide range (358.39 to 510.31 g) with mean value 441.58 g. The genetical variability GCV (12.39 %) and PCV (14.30 %) were obtained with ECV (4.98 %). The high value of heritability (75.99 %) was recorded with high genetic advance (88.52) and high estimates of genetic advance as per cent of mean (20.21 %).

4.1.4.4.8 Average weight of seed per fruit (g)

In F₅ generation the wide range of variability was observed for average weight of seed per (8.12 to 12.24 g) with an average 8.91 g. The close association of GCV (16.86 %) and PCV (16.89 %) were observed with certain presence of environmental factor ECV (0.36 %). The high values were obtained for heritability (99.98 %) and genetic advance as per cent of mean (34.71 %) while low value was observed for genetic advance (3.09). Whereas in F₆ generation it showed the wide range of variability (7.18 to 12.09 g) with an average 8.12 g. The close association of GCV (20.94 %) and PCV (20.95 %) was observed with certain presence of environmental factor ECV (0.47 %). The high values were obtained for heritability (99.98 %) along with high values for genetic advance as per cent of mean (40.61 %) and low genetic advance (3.30).

4.1.4.5 Fruit characters (qualitative)

4.1.4.5.1 Total soluble solids (°Brix)

T.S.S. content of fruit is an important qualitative character in muskmelon. In case of F₅ generation it showed a variation with range of 10.81 to 11.19°Brix with mean value 11.21° Brix. The genetical variability i.e. GCV (15.15 %) and PCV (15.84 %) were observed with presence of environmental variability ECV (3.02 %). The high values were recorded for heritability (89.10%) and genetic advance as per cent of mean (22.00 %) with low value for genetic advance (2.47). Whereas in case of F₆ generation it showed a wide range of variation 11.12-11.49° Brix with mean value 11.38° Brix. The genetical variability GCV (15.76 %) and PCV (16.34 %) were recorded with certain presence of environmental factor ECV (2.71 %). The high values were recorded for heritability (78.24 %) and genetic advance as per cent of mean (21.4 %) while low genetic advance (2.43) was observed.

4.1.4.5.2 Acidity (%)

In F₅ generation the acidity percentage was ranged in between 1.16 to 1.48 % with an average 1.19 %. The genetical variability is GCV (8.36 %) and PCV (8.64 %) were observed with presence of environmental factor ECV (2.10%). The high and moderate values were obtained for heritability (93.98 %) and genetic advance as per cent of mean (17.66 %). In F₆ generation it was ranged in between 1.20 to 1.51 % with an average 1.28 %. The close association of GCV (8.71 %) with PCV (8.89 %) was observed with presence of environmental factor ECV (1.87 %).

The high value was obtained for heritability (95.63 %), moderate value for genetic advance as per cent of mean (18.82 %) and low value for genetic advance (0.24) respectively.

4.1.4.5.3 Ascorbic acid (mg/100g)

In case of F₅ generation the ascorbic acid content was observed in wide range of 24.42 to 26.48 mg/100g with an average 26.15 mg/100g. The GCV (8.32 %) and PCV (8.65 %) were recorded with noticeable influence of environmental factor ECV (2.36 %). The high estimates of heritability (93.40%) were observed with low genetic advance (4.32) and moderate genetic advance as per cent of mean (16.51 %). While in case of F₆ generation it was ranged from 24.27 to 26.87 mg/100g with an average 26.47 mg/100g. The close association of GCV (8.23 %) and PCV (8.27 %) was observed with influence of environmental factor ECV (0.65 %). The high heritability (99.37 %) was recorded with low genetic advance (4.34) and moderate genetic advance as per cent of mean (16.43 %).

4.1.4.5.4 Total sugar (%)

In F₅ generation the total sugar content was ranged in between 9.13 to 10.48 % with mean value of 10.11%. The genetical variability was contributed as GCV (5.28 %) and PCV (5.29 %) with presence of environmental variability ECV (0.68 %). The high value of heritability (98.48 %) was recorded with moderate estimates of genetic advance as per cent of mean (10.87 %) and low value of genetic advance (1.09) respectively. In F₆ generation it was ranged in between 8.50 to 9.82 % with mean value 9.58 %. The genetical variability contributed as GCV (7.26

%) and PCV (7.30 %) with environmental variability ECV (0.64 %). High value of heritability (99.31 %) was recorded with low and moderate estimates of genetic advance (1.42) and genetic advance as per cent of mean (14.83 %) respectively.

4.1.4.5.5 Reducing sugar (%)

In case of F₅ generation the reducing sugar content was ranged in between 7.28 to 8.47 % with an average 8.17%. The close association of GCV (6.51 %) and PCV (6.57 %) were observed with certain presence of environmental factor ECV (0.31 %). The high and moderate values were obtained for heritability (99.84 %) and genetic advance as per cent of mean (13.51%) respectively. In case of F₆ generation it was ranged in between 6.35 to 7.12 % with an average 6.91 %. The close association of GCV (7.62 %) and PCV (7.84 %) were observed with certain presence of environmental factor ECV (1.82 %). The high and moderate values were obtained for heritability (94.72 %) and genetic advance as per cent of mean (15.82 %) respectively.

4.1.4.5.6 Non reducing sugar (%)

In F₅ generation the non reducing sugar content was ranged from 1.79 to 1.96 % with an average 1.83 %. The close association of GCV (6.04 %) and PCV (6.98 %) were recorded with influence of environmental factor ECV (1.55 %). The moderate heritability (64.61 %) was observed with low estimates of genetic advance as per cent of mean (9.35 %). While in F₆ generation it was ranged from 2.42 to 2.78 % with an average 2.67 %. The close association of GCV (6.32 %) and PCV (6.91 %)

was observed with noticeable influence of environmental factor ECV (2.72 %). The high heritability (84.51 %) was observed with moderate estimates of genetic advance as per cent of mean (11.28 %).

4.1.5 Variability, heritability and genetic advance of cross IVMM-3 x Punjab Sunheri (C₅: 4 x 7) for F₅ and F₆ generations.

Three F₅ and F₆ progenies along with their parents were studied for growth, flowering, yield and fruit quantitative and qualitative traits (Table 12 and 13).

4.1.5.1 Vine growth characters

4.1.5.1.1 Vine length (cm)

In case of F₅ generation the vine length showed wide range (189.32 to 239.15 cm) with an average 219.35 cm. The genotypic co-efficient of variation (GCV) and phenotypic coefficient of variation (PCV) were observed as 12.67 % and 12.99 % respectively while environmental co-efficient of variation ECV was 2.92 %. The high estimates were observed for heritability (94.96 %), genetic advance (55.23) and genetic advance as per cent of mean (25.24 %) indicating better scope for improvement through selection. Whereas in case of F₆ generation it was ranged in between 188.32 to 213.68 cm with an average 227.34 cm. The GCV (12.48 %) and PCV (12.96 %) were recorded with ECV (3.43 %). The high estimates were observed for heritability (93.03 %), genetic advance (48.52) and genetic advance as per cent of mean (21.35 %).

4.1.5.1.2 Number of primary branches per vine

In F₅ generation this character was observed in the range (2.24-2.63) with mean value 2.52. Very close values were recorded for GCV (12.43 %) and PCV (12.62 %) with certain influence of environmental factors ECV (1.75 %). The high estimate of heritability (98.06 %) was observed with high genetic advance as per cent of mean (27.42 %) and low value of genetic advance (0.69). In F₆ generation it was ranged in between 2.06-2.53 with mean value 2.46. The close values were recorded for GCV (11.25 %) and PCV (11.30 %) with ECV (1.04%). The high estimate of heritability (99.15 %) was observed with high genetic advance as per cent of mean (25.00 %) and low genetic advance (0.59).

4.1.5.2 Flowering characters

4.1.5.2.1 Days to first female flower appearance

In case of F₅ generation the wide range of variability was observed for days to first female flower appearance (34.00-42.38 days) with mean value 35.75 days. Very close values were recorded for GCV (8.12 %) and PCV (8.18%) with noticeable influence of environmental factor ECV (1.58 %). The high estimate was observed for heritability (96.32 %) while low and moderate estimates were recorded for genetic advance (5.98) and genetic advance as per cent of mean (16.71 %) respectively (Table 12). While in case of F₆ generation it was observed in the range 29.35-33.62 days with mean value 30.12 days. Very close values were recorded for GCV (14.09 %) and PCV (14.15 %) with noticeable influence of environmental factor ECV (3.79 %). The

high estimate were observed for heritability (93.10 %) and genetic advance as per cent of mean (22.15%) while low value for genetic advance (6.71) was observed.

4.1.5.2.2 Number of male flowers per vine

In F₅ generation this character was ranged in between 73.01 to 85.22 with mean value 74.38. The close association of as GCV (10.93 %) and PCV (10.95 %) was observed with noticeable environmental variability ECV (0.85 %). The high value of heritability (99.51 %) was recorded with high estimates of genetic advance as per cent of mean (23.15 %) and genetic advance (17.19). Whereas in F₆ generation it was ranged in between 52.48 to 64.69 with mean value 61.18. The substantial genetical variability contributed as GCV (12.10 %) and PCV (12.58 %) with noticeable environmental variability ECV (3.98 %). The high values were obtained for heritability (92.65 %), genetic advance as per cent of mean (24.91 %) and genetic advance (15.24).

4.1.5.2.3 Number of female flowers per vine

In case of F₅ generation the flowering character number of female flowers per vine was ranged in between 11.32 to 13.84 with an average 13.04. The genetic variability was contributed as GCV (5.84 %) and PCV (6.12%) with certain presence of environmental factor ECV (1.81 %). The high values were obtained for heritability (93.36 %) and genetic advance as per cent of mean (20.91 %) while low genetic advance (2.73) was recorded. In case of F₆ generation it was ranged in between 11.74 to 12.49 with an average 12.09. The close association of

GCV (10.70 %) and PCV (10.97 %) was observed with certain presence of environmental factor ECV (2.32 %). The high values were obtained for heritability (95.56 %) associated with genetic advance as per cent of mean (21.35 %) and low genetic advance (2.57).

4.1.5.2.4 Sex ratio (female:male)

In F₅ generation the sex ratio was ranged in between 6.08 to 7.12 with mean of 5.70. The genetical variability contributed as GCV (12.34 %) and PCV (13.04 %) with noticeable environmental variability ECV (4.21 %). The high value of heritability (89.63 %) was recorded with high estimate of genetic advance as per cent of mean (23.81 %). Whereas in F₆ generation it was ranged in between 4.87 to 5.95 with mean value 5.06. The genetical variability contributed as GCV (13.47 %) and PCV (14.82 %) with noticeable influence of environmental variability ECV (6.15%). The high value of heritability (82.68 %) was recorded with high estimates of genetic advance as per cent of mean (25.41 %).

4.1.5.2.5 Node at which first female flower appeared

In case of F₅ generation this character showed wide range of variability (3.98 to 5.84) with an average 4.32. The close association of GCV (16.21 %) and PCV (16.24 %) were observed with certain presence of environmental factor ECV (0.68 %). The high values were obtained for heritability (99.84 %) along with genetic advance as per cent of mean (33.37 %) while low genetic advance (1.47) was obtained. Whereas in case of F₆ generation it was ranged in between 4.01 to 5.41 with an average 4.12. The

close association of GCV (11.26 %) and PCV (11.30 %) was observed with certain presence of environmental factor ECV (0.94 %). The high values were obtained for heritability (99.30 %) and genetic advance as per cent of mean (23.12 %) with low genetic advance (0.98).

4.1.5.2.6 Days required for first harvest of fruit

In case of F₅ generation the days required for first harvest of fruits was observed in wide range of 69.32 to 84.38 days with an average 76.35 days. The close association of GCV (5.97 %) and PCV (6.02 %) were observed with influence of environmental factor ECV (0.80 %). The high estimate was observed for heritability (98.27 %) while moderate estimates were recorded for genetic advance (9.60) and genetic advance as per cent of mean (12.61 %). In case of F₆ generation it was ranged from 64.25 to 76.18 days with an average 69.35 days. The close association of GCV (6.54 %) and PCV (6.55 %) was observed with influence of environmental factor ECV (1.13 %). The high value of heritability was observed (97.11 %) along with moderate genetic advance (9.33) and genetic advance as per cent of mean (13.51 %).

4.1.5.3 Yield and its contributing character

4.1.5.3.1 Number of fruits per vine

In case of F₅ generation the number of fruits per vine was ranged in between 2.86 to 3.28 per vine with an average 3.12 per vine. The significant contribution of genetic variability i.e. GCV (12.14 %) and PCV (12.27 %) were observed with environmental variability ECV (1.69 %). The high estimates were

observed for heritability (98.17 %) and genetic advance as per cent of mean (25.00 %) which proves that yield potential can be improved during further selection cycle. Whereas in case of F₆ generation it was ranged from 2.45-2.91 per vine with an average 2.84 per vine. The contribution of genetic variability i.e. GCV (11.99 %) and PCV (12.14 %) were observed with environmental variability ECV (1.88 %). The high estimates were observed for heritability (97.66 %) and genetic advance as per cent of mean (23.64 %).

4.1.5.3.2 Fruit yield per vine (kg)

In F₅ generation the data presented in for the character fruit yield per vine showed wide range of 1.57-2.92 kg per vine with an average 2.74 kg per vine. The significant contribution of genetic variability GCV (21.58 %) and PCV (21.75 %) were observed along with environmental variability ECV (2.87 %). The high estimates of heritability (98.29 %) along with high genetic advance as per cent of mean (42.02 %) and low value for genetic advance (1.15) were observed respectively. While in F₆ generation it showed wide range of 1.48-2.87 kg per vine with an average 2.56 kg per vine. The genetic variability GCV (21.06 %) and PCV (21.16 %) were observed with influence of environmental variability ECV (1.98 %). The high estimates of heritability (99.14 %) along with high genetic advance as per cent of mean (37.42 %) and low genetic advance (0.95) were observed respectively.

4.1.5.4 Fruit characters (quantitative)

4.1.5.4.1 Average weight of fruit (g)

In case of F₅ generation average weight of fruit showed a wide range of variation 584.12-915.17 g with mean of 847.12 g. The close values of GCV (16.09 %) and PCV (16.27 %) were observed with certain presence of environmental factor ECV (2.42%). The high estimates of heritability (97.80 %), genetic advance (274.26) and genetic advance as per cent of mean (32.41 %) were recorded respectively. In case of F₆ generation it showed wide range of variation (642.35-892.12 g) with mean value 858.09 g. The significant contribution of genetic variability GCV (25.37 %) and PCV (25.38 %) were recorded with low influence of environmental factor ECV (0.67 %). The high estimates were recorded for heritability (99.95 %), genetic advance (281.92) and genetic advance as per cent of mean (48.21 %).

4.1.5.4.2 Average length of fruit (cm)

In F₅ generation the average length of fruit was observed in wide range of 9.12 cm to 12.09 cm with an average 11.48 cm. The close association of GCV (12.61 %) and PCV (12.63 %) were observed with certain presence of environmental factor ECV (0.35 %). The high values were obtained for heritability (99.92 %) and genetic advance as per cent of mean (23.85 %) along with low value for genetic advance (2.73). While in F₆ generation it was observed in wide range of 8.35 cm to 11.82 cm with an average 11.21 cm. The close association of GCV (12.09 %) with PCV (12.10 %) was observed with low influence of environmental factor ECV (0.45 %). The high values

were obtained for heritability (99.89 %) and genetic advance as per cent of mean (24.91 %) with low value of genetic advance (2.79).

4.1.5.4.3 Average diameter of fruit (cm)

In case of F₅ generation the average diameter of fruit was ranged from 10.35 cm to 13.23 cm with an average 12.18 cm. The close association of GCV (7.25 %) and PCV (7.29 %) were observed with ECV (0.21 %). The heritability was high (99.93 %) with low value for genetic advance (1.71) and moderate genetic advance as per cent of mean (14.07 %). In case of F₆ generation it was ranged from 10.58 cm to 12.39 cm with an average 12.02 cm. The close association of GCV (7.16 %) and PCV (7.19 %) was observed with low ECV (0.28 %). The high heritability (99.89 %) was observed with low and moderate values of genetic advance (1.67) and genetic advance as per cent of mean (13.91 %) respectively.

4.1.5.4.4 Average rind thickness (cm)

In F₅ generation this character was ranged in between 0.19 cm to 0.28 cm. with mean of 0.25 cm. The genetical variability contributed as GCV (14.97 %) and PCV (15.18 %) with noticeable environmental variability ECV (2.32 %). The high value of heritability (97.63%) was recorded with high estimates of genetic advance as per cent of mean (36.25 %). In F₆ generation it was ranged in between 0.17 cm to 0.28 cm. with mean value 0.25 cm. The genetical variability GCV (12.84 %) and PCV (13.87 %) were observed with ECV (3.29 %). The high value of heritability (85.53 %) was recorded with high estimates of genetic

advance as per cent of mean (24.00 %) and low genetic advance (0.06).

4.1.5.4.5 Average pulp thickness (cm)

In case of F₅ generation the average pulp thickness was observed in wide range of 1.87 cm to 2.95 cm with an average 2.63 cm. The close association of GCV (12.98 %) and PCV (13.01 %) was observed with certain presence of environmental factor ECV (0.95 %). The high values were obtained for heritability (99.47 %) and genetic advance as per cent of mean (25.01 %). Whereas in case of F₆ generation it was ranged in between 1.84 cm to 2.51 cm with an average 2.35 cm. The close association of GCV (12.54 %) and PCV (12.58 %) was observed with certain presence of environmental factor ECV (0.90 %). The high values were obtained for heritability (99.52 %) and genetic advance as per cent of mean (25.10 %).

4.1.5.4.6 Average fruit cavity (cm²)

In F₅ generation the average fruit cavity was observed in wide range of 32.82 cm to 43.55 cm with their average 41.32 cm. The close association of GCV (9.01 %) and PCV (9.02 %) were observed with low influence of environmental factor ECV (0.32 %). The high heritability was observed (99.91 %) with moderate genetic advance as per cent of mean (18.41 %) and genetic advance (7.59) respectively. While in F₆ generation it was ranged from 31.12 cm to 47.31 cm with an average 42.12 cm. The close value of GCV (12.59 %) and PCV (12.65 %) was observed with ECV (1.14 %). The high heritability was observed (99.20 %) along

with high genetic advance (11.37) and high estimates of genetic advance as per cent of mean (27.00 %).

4.1.5.4.7 Average weight of pulp per fruit (g)

In case of F₅ generation the average weight of pulp per fruit was observed in wider range of 424.34 to 672.31 g with mean value of 612.32 g. The significant genetical variability GCV (23.14 %) and PCV (23.35 %) were observed with noticeable environmental variability ECV (3.24 %). The high estimates were recorded for heritability (98.10 %), genetic advance (269.58) and genetic advance as per cent of mean (44.10 %). Whereas in case of F₆ generation it was ranged from 509.45 to 687.12 g with mean value 631.35 g. The significant genetical variability contributed as GCV (25.75 %) and PCV (26.19 %) with noticeable environmental variability ECV (4.78 %). The high estimates were recorded for heritability (96.69 %), genetic advance (281.62) and genetic advance as per cent of mean (44.31 %).

4.1.5.4.8 Average weight of seed per fruit (g)

In F₅ generation the average weight of seed per fruit was ranged in between 10.12 to 12.21 g with an average 11.18 g. The close association of GCV (10.25 %) and PCV (10.27 %) were observed with certain presence of environmental factor ECV (0.81 %). The high values were obtained for heritability (99.41 %), genetic advance as per cent of mean (21.72 %) and low value for genetic advance (2.31) respectively. In F₆ generation it was ranged in between 8.95 to 11.86 g with an average 11.31 g. The close association of GCV (11.36 %) and PCV (11.38 %) were observed with certain presence of environmental factor ECV

(0.96 %). The high values were obtained for heritability (99.32 %) and genetic advance as per cent of mean (20.81 %) with low value of genetic advance (2.35).

4.1.5.5 Fruit characters (qualitative)

4.1.5.5.1 Total soluble solids (°Brix)

T.S.S. content of fruit is an important qualitative character in muskmelon. In case of F₅ generation it shows a wide range of variation 11.31 to 12.54°Brix with mean of 12.14°Brix. The close association of GCV (10.76 %) and PCV (11.23 %) were observed with ECV (3.37 %). The high values were recorded for heritability and genetic advance as per cent of mean (91.18 % and 23.82 %) respectively. Whereas in case of F₆ generation it was ranged from 11.32-12.97° Brix with mean value 12.35° Brix. The GCV (10.38 %) and PCV (10.42 %) were recorded with ECV (1.13 %). The high values were recorded for heritability (98.83 %) associated with and high genetic advance as per cent of mean (20.23 %) with low genetic advance (2.50).

4.1.5.5.2 Acidity (%)

In F₅ generation the acidity percentage was ranged in between 1.17 to 1.32 % with an average 1.21 %. The close association of GCV (10.21 %) and PCV (11.72 %) were observed with certain presence of environmental factor ECV (5.78 %). The high and moderate values were obtained for heritability (75.86 %) and genetic advance as per cent of mean (17.41 %) respectively. In F₆ generation it was ranged in between 1.21 to 1.40 % with an average 1.26 %. The close association of GCV (6.36 %) and PCV (6.48 %) was observed with certain presence

of environmental factor (ECV 1.27 %). The high and moderate values were obtained for heritability (97.26 %) and genetic advance as per cent of mean (13.52 %) respectively.

4.1.5.5.3 Ascorbic acid (mg/100g)

In case of F₅ generation the ascorbic acid content was ranged from 24.31 to 25.59 mg/100g with an average 25.09 mg/100g. The GCV (9.17 %) and PCV (9.20 %) were observed with noticeable influence of environmental factor ECV (3.11 %). The high estimates were observed for heritability (75.06 %) and moderate genetic advance as per cent of mean (18.01 %). While in case of F₆ generation it was ranged in between 25.82 to 26.61 mg/100g with an average 26.48 mg/100g. The close association of GCV (9.27 %) and PCV (10.52 %) were observed with certain influence of environmental factor ECV (2.86 %). The high heritability (79.53 %) was associated with moderate values of genetic advance (4.35) and genetic advance as per cent of mean (16.44 %).

4.1.5.5.4 Total sugar (%)

In F₅ generation the total sugar content was ranged in between 9.23 to 9.81 % with mean value of 9.52 %. The genetical variability contributed as GCV (4.02 %) and PCV (4.07 %) with environmental variability ECV (0.62 %) were recorded. The high value of heritability (97.67 %) was recorded with low estimates of genetic advance as per cent of mean (8.31 %) and genetic advance (0.79). In F₆ generation it was ranged in between 9.14 to 9.72 % with mean value 9.61 %. The close association of

genetical variability is GCV (3.90 %) and PCV (3.91 %) with environmental variability ECV (0.71 %). The high value of heritability (96.89 %) was recorded with low estimates of genetic advance (0.76) and genetic advance as per cent of mean (7.92 %).

4.1.5.5.5 Reducing sugar (%)

In case of F₅ generation the reducing sugar content was ranged in between 6.95 to 7.31 % with an average 7.05 %. The close association of GCV (7.71 %) and PCV (7.93 %) were observed with certain presence of environmental factor (ECV 0.33 %). The moderate value was obtained for heritability (67.98%) whereas low values were obtained for genetic advance as per cent of mean (8.01 %) and genetic advance (0.57). In case of F₆ generation it was ranged in between 6.71 to 7.59 % with an average 7.28 %. The close association of GCV (5.02 %) and PCV (6.19 %) was observed with certain presence of environmental factor ECV (1.71 %). The moderate value was obtained for heritability (66.91 %) whereas low values were obtained for genetic advance (0.61) and genetic advance as per cent of mean (8.40 %).

4.1.5.5.6 Non reducing sugar (%)

In F₅ generation the non reducing sugar content was ranged from 1.97 % to 2.48 % with an average 2.45 %. The close association of GCV (6.84 %) and PCV (6.94 %) were observed with influence of environmental factor ECV (1.18 %). The high heritability (97.14 %) was observed with moderate per cent mean of genetic advance (13.42 %) and low value for genetic advance

(0.33) (Table 12). While in F₆ generation it was ranged from 2.21 % to 2.45 % with an average 2.33 %. The close association of GCV (5.67 %) and PCV (6.17 %) was observed with influence of environmental factor ECV (1.82 %). The high heritability (77.15 %) was observed with low genetic advance (0.26) and moderate estimates of genetic advance as per cent of mean (10.56 %).

4.2 Correlation coefficient between yield and yield contributing characters

The genotypic and phenotypic co-efficient of correlation for the important yield and yield contributing characters is presented in Table 14-23 for each five crosses in F₅ and F₆ generations respectively. The magnitude of genotypic correlation coefficient was higher than the phenotypic correlation coefficients. However only the significant correlations of important yield contributing characters are described in foregoing paragraphs.

4.2.1 Correlation coefficient of five crosses in F₅ and F₆ generations

Fifteen muskmelon progenies from five crosses were studied for association of relationship between yield and yield contributing characters in F₅ and F₆ generations respectively and are presented in Table 14-23.

4.2.1.1 Vine length

The vine length showed positive and significant correlation with number of primary branches per vine, days required for first female flower appearance, number of female flowers per vine, number of fruits per vine, average weight of

fruit, average length of fruit, average diameter of fruit, average weight of pulp per fruit and fruit yield per vine at both genotypic and phenotypic levels in most of progenies. While, it had significant negative correlation with node at which first female flower appeared and days required for first harvest of fruit, at both genotypic and phenotypic levels.

4.2.1.2 Number of primary branches per vine

The number of primary branches per vine exhibited positive significant correlation with number of female flowers per vine, number of fruits per vine, average weight of fruit, average length of fruit, average diameter of fruit, average weight of pulp per fruit and fruit yield per vine at both genotypic and phenotypic levels. Whereas it showed negative significant correlation with days required for first female flower appearance, node at which first female flower appeared and days required for first harvest of fruit at both genotypic and phenotypic levels.

4.2.1.3 Days to first female flower appearance

The days required for first female flower appearance were significantly and positively correlated with number of female flowers per vine, node at which first female flower appeared and days required for first harvest of fruit at both genotypic and phenotypic levels. Whereas significant and negative correlation was observed at genotypic and phenotypic levels with number of fruits per vine, average weight of fruit, average length of fruit, average diameter of fruit, average weight of pulp per fruit and average yield per vine in both the F₅ and F₆ generation.

4.2.1.4 Number of female flowers per vine

Number of female flowers per vine positively and significantly correlated with number of fruits per vine, average weight of fruit, average length of fruit, average diameter of fruit, average weight of pulp per fruit and average yield per vine whereas it was negatively and significantly correlated with node at which first female flower appeared and days required for first harvest of fruit at both genotypic and phenotypic levels.

4.2.1.5 Node at which first female flower appeared

Nodal position of first female flower appearance exhibited significant and positive correlation with days required for first harvest of fruit at both genotypic and phenotypic levels. It showed significant and negative association with number of fruits per vine, average weight of fruit, average length of fruit, average diameter of fruit, average weight of pulp per fruit and average yield per vine at both genotypic and phenotypic levels.

4.2.1.6 Days required for first harvest of fruit

Days to first harvest negatively and significantly correlated with number of fruits per vine, average weight of fruit, average length of fruit, average diameter of fruit, average weight of pulp per fruit and average yield per vine at both genotypic and phenotypic levels.

4.2.1.7 Number of fruits per vine

Number of fruits per vine showed significant and positive association with average weight of fruit, average length of fruit, average diameter of fruit, average weight of pulp per fruit

and average yield per vine at both genotypic and phenotypic levels.

4.2.1.8 Average weight of fruit (g)

Average fruit weight showed significant and positive correlation with average length of fruit, average diameter of fruit, average weight of pulp per fruit and average yield per vine at both genotypic and phenotypic levels.

4.2.1.9 Average length of fruit (cm)

The average length of fruit had significant and positive correlation with average diameter of fruit, average weight of pulp per fruit and average yield per vine at both genotypic and phenotypic levels.

4.2.1.10 Average diameter of fruit (cm)

The average diameter of fruit was positively and significantly correlated with average weight of pulp per fruit and average yield per vine at both genotypic and phenotypic levels.

4.2.1.11 Average weight of pulp per fruit (g)

The average weight of pulp per fruit exhibited significant and positive association at both genotypic and phenotypic levels with average fruit yield per vine.

4.3 Per cent incidence of diseases and pests.

The genotype presented in Table 24, the parents Pusa Madhuras (P₅) and Punjab Sunehari (P₇) were moderately resistant to fusarium wilt whereas parent Punjab Sunehari (P₇) was tolerant to downey mildew. The parent Hara Madhu (P₃) was susceptible to downey mildew. The incidence of diseases and

pests *viz.*, downey mildew, fusarium wilt and leaf miner of F₅ and F₆ segregating progenies was described in table 24.

4.3.1 Per cent incidence of diseases

4.3.1.1 Per cent incidence of downey mildew

Out of five parents, the incidence of downey mildew was found in almost all the parents. The highest incidence of downey mildew was recorded in Pusa Madhuras (34.38 & 30.38 %) whereas the least incidence of downey mildew was recorded in Punjab Sunehari (14.67 and 16.16 %) in both F₅ and F₆ generations respectively

In case of segregating progenies, the highest incidence of downey mildew (32.11 and 30.34%) was recorded in most of the progenies of the cross IVMM-3 x Pusa Madhuras (C₄: 4 x 5) and least incidence of downey mildew (25.75 & 22.37%) was recorded in IVMM-3 x Punjab Sunheri (C₅: 4 x 7) in F₅ and F₆ generation respectively.

4.3.1.2 Per cent incidence of fusarium wilt

Among the parents low incidence of fusarium wilt at field condition was recorded in the parents Pusa Madhuras (P₅) and Punjab Sunehari (P₇) (each 1.00 and 1.00) while highest incidence was observed in parent Durgapura selection (8.00 & 10.00 %) in both F₅ and F₆ generations, respectively.

From the Table 24, it was observed that incase of crosses most of the progenies was recorded lowest incidence of fusarium wilt (each 5.00 & 5.00 %) at field condition in cross Hara Madhu x IVMM-3 (C₂: 3 x 4), IVMM-3 x Pusa Madhuras (C₄: 4 x 5) and IVMM-3 x Punjab Sunheri (C₅: 4 x 7) whereas highest

incidence of fusarium wilt (15.00 & 16.00 %) was observed in the cross Durgapura selection x Punjab Sunheri (C₁: 2 x 7) in the F₅ and F₆ generations respectively.

4.3.2 Per cent incidence of pest

4.3.2.2 Per cent incidence of leaf miner

From the Table 24 it was observed that out of five parents, the infestation of leaf miner at field condition was found in almost all the parents. The highest infestation was found in parent (P₅) Pusa Madhuras (23.21 and 20.37 %) while least infestation was observed in Durgapura selection (P₂) (16.82 and 12.24 %) in both F₅ and F₆ generations, respectively.

Among the crosses, the progenies of cross IVMM-3 x Punjab Sunehari (C₅: 4 x 7) recorded least infestation of leaf miner (17.38 and 14.37 %) while the progenies of cross IVMM-3 x Pusa Madhuras (C₄: 4 x 5) recorded highest infestation of leaf miner (21.39 and 18.14 %) in both F₅ and F₆ generations respectively.

4.4 Fruit characters (Qualitative)

F₅ and F₆ progenies of crosses Durgapura Selection x Punjab Sunheri (C₁:2 x 7), Hara Madhu x IVMM-3 (C₂:3 x 4), Hara Madhu x Punjab Sunheri (C₃:3 x 7), IVMM-3 x Pusa Madhuras (C₄:4 x 5) and IVMM-3 x Punjab Sunheri (C₅:4 x 7) along with their parents were studied for the different fruit characters (qualitative) such as fruit shape, fruit colour, rind surface of fruit, flavor and pulp colour (Table 25).

4.4.1 Fruit shape

As per features of genotypes presented in Table 3.1.2 the parents Durgapura selection (2), Hara Madhu (3), Pusa Madhuras (5) and Punjab Sunheri (7) had round fruit shape while parent IVMM-3 (4) had round flat fruit shape.

In F_5 and F_6 generations, the segregating progenies of two crosses *viz.*, Durgapura Selection x Punjab Sunheri ($C_1:2 \times 7$) Hara Madhu x IVMM-3 ($C_2:3 \times 4$), Hara Madhu x Punjab Sunheri ($C_3:3 \times 7$), IVMM-3 x Punjab Sunheri ($C_5:4 \times 7$) were observed round fruit shape, whereas cross IVMM-3 x Pusa Madhuras ($C_4:4 \times 5$) produced round flat shape fruits in most of the progenies.

4.4.2 Fruit colour

From the Table 25, it was observed that the parents Durgapura selection (2) and Hara Madhu (3) had yellowish colour with green ridges. The parent IVMM-3 (4) had greenish colour with brownish ridges, parent Pusa Madhuras (5) had pale yellow colour with dark green ridges and parent Punjab Sunheri (7) had greenish yellow colour with green ridges.

In F_5 and F_6 generations segregating progenies, among the five crosses two crosses *viz.*, Durgapura Selection x Punjab Sunheri ($C_1:2 \times 7$) and Hara Madhu x IVMM-3 ($C_2: 3 \times 4$) showed yellowish colour with green ridges. Whereas the cross Hara Madhu x Punjab Sunheri ($C_3: 3 \times 7$) showed pale yellowish colour with green ridges. The remaining two crosses *viz.*, IVMM-3 x Pusa Madhuras ($C_5: 4 \times 5$) and IVMM-3 x Punjab Sunheri ($C_4: 4 \times 7$) showed greenish yellow colour with ridges.

4.4.3 Rind surface of fruits (netted or smooth)

As per features of the parents presented in table 3.1.2 the parent Durgapura Selection (2) and Hara Madhu (3) had smooth fruit surface (rind), the parent IVMM-3 (4) had partial netted fruit surface (rind), parent Pusa Madhuras (5) had sparsely netted fruit surface (rind) and parent Punjab Sunheri (7) had netted fruit rind surface.

In F₅ and F₆ generations, most of the progenies of four crosses *viz.*, Durgapura Selection x Punjab Sunheri (C₁: 2 x 7), Hara Madhu x IVMM-3 (C₂: 3 x 4), Hara Madhu x Punjab Sunheri (C₃: 3 x 7) and IVMM-3 x Punjab Sunheri (C₅: 4 x 7) showed netted fruit surface (rind) while some progenies showed partial netted fruit surface (rind). In case of cross IVMM-3 x Pusa Madhuras (C₄: 4 x 5) most of the progenies showed partial netted fruit surface (rind) while some progenies showed netted fruit surface (rind).

4.4.4 Flavor

The pulp flavor of all the parents Durgapura Selection (2), Hara Madhu (3), IVMM-3 (4), Pusa Madhuras (5) and Punjab Sunheri (7) were observed as pleasant.

The pulp flavor of fruits of F₅ and F₆ progenies of all the five crosses *viz.*, Durgapura Selection x Punjab Sunheri (C₁: 2 x 7), Hara Madhu x IVMM-3 (C₂: 3 x 4), Hara Madhu x Punjab Sunheri (C₃: 3 x 7), IVMM-3 x Pusa Madhuras (C₄: 4 x 5) and IVMM-3 x Punjab Sunheri (C₅: 4 x 7) were also observed as pleasant.

4.4.5 Colour of pulp

From the table 3.1.2 it was observed that the parents Durgapura selection (2) had greenish yellow pulp colour, parent Hara Madhu (3) had pale green; while remaining parents IVMM-3

(4), Pusa Madhuras (5) and Punjab Sunheri (7) had orange pulp colour.

The progenies of all five crosses *viz.*, Durgapura Selection x Punjab Sunheri (C₁: 2 x 7), Hara Madhu x IVMM-3 (C₂: 3 x 4) and Hara Madhu x Punjab Sunheri (C₃: 3 x 7), IVMM-3 x Pusa Madhuras (C₄: 4 x 5) and IVMM-3 x Punjab Sunheri (C₅: 4 x 7) showed orange pulp colour of fruits in F₅ and F₆ generations.

5. DISCUSSION

Muskmelon (*Cucumis melo* L.) is one of the important cucurbitaceous vegetable and grown for its highly relished fruits because of pleasant flavor, sweet taste and refreshing effect. However, very little efforts have been made with respect to its genetic improvement. Interpretations on genetics of various quantitative traits especially yield and yield attributing traits is very essential in choosing the appropriate breeding method and formulating the efficient breeding procedure for genetic improvement of crop plants. Improvement of yield and its components in a highly cross-pollinated crop like muskmelon is rather slow because of quantitative nature of these traits which are subjected to fluctuation due to interactions between genotype and environment.

The yield components being quantitative in nature are polygenic and are complex in their mode of inheritance. The total variance available in the population is sum of additive, dominance and epistasis variances and their interactions. An understanding of the genetic nature of such complex quantitative characters is essential in formulating a breeding scheme to develop high yielding superior cultivars. Ever since Fisher (1918) partitioned heritable variances into additive, dominance and epistatic components, there have been constant efforts to devise several biometrical methods to estimate and use them in breeding programme. Success of a breeding programme is largely dependent on the extent of genetic variability present in

the population. Greater the diversity in the material better are the chances for evolving promising and desired types. A detailed study of the extent of variability in different characters associated with yield and knowledge of their heritability in relation to their contribution towards yield are prime requisite for an efficient plant breeding programme.

In muskmelon, yield is a cumulative effect of many component characters individually contributing towards yield. Diversity in muskmelon is expected to be immense as the fruits vary greatly in shape and size. Studies on genetic parameters of various traits provide information for selection and help in crop improvement.

Keeping all above points in mind, present investigation was undertaken where the segregating progenies of five crosses along with their parents were evaluated for their growth, flowering, yield and qualitative characters in F₅ and F₆ generations during *Kharif* 2014 and summer 2015

The results in respect of range of mean values, variability parameters like genotypic and phenotypic coefficient of variation, environmental coefficient of variation, heritability, genetic advance and correlation in F₅ and F₆ progenies, were discussed under with suitable subheadings.

5.1 Range of the mean values

5.2 Variability parameters i.e. genotypic and phenotypic co-efficient of variation

5.3 Heritability and genetic advance

5.4 Correlation coefficient

5.5 Per cent incidence of diseases and pests

5.6 Fruit characters (qualitative)

5.1 Range of the mean values

In the present study, among the progenies of all five crosses *viz.*, Durgapura Selection x Punjab Sunheri (C₁: 2 x 7), Hara Madhu x IVMM-3 (C₂: 3 x 4), Hara Madhu x Punjab Sunheri (C₃: 3 x 7), IVMM-3 x Pusa Madhuras (C₄: 4 x 5) and IVMM-3 x Punjab Sunheri (C₅: 4 x 7) for F₅ and F₆ generations respectively showed wide range of variability for most of the characters.

The wide range of variability was observed in cross Durgapura Selection x Punjab Sunheri (C₁: 2 x 7) in F₅ generation for all the most of characters of muskmelon (Table 4). The vine length was ranged from 171.34 cm to 236.14 cm, number of primary branches per vine from 2.31 to 2.84, days required for first female flower appearance from 35.14 days to 41.95 days, number of male flowers per vine 69.21 to 85.74, number of female flowers per vine from 11.82 to 12.74, sex ratio from 5.59 to 7.19, node at which first female flower appeared from 4.15 to 4.67, days required for first harvest of fruit from 70.69 days to 84.68 days, number of fruits per vine from 2.41 to 2.84, average yield per vine from 1.64 kg to 2.56 kg, average weight of fruit from 611.36 g to 842.12 g, average length of fruit from 10.11 cm to 10.87 cm, average diameter of fruit from 9.42 cm to 11.36 cm, average rind thickness from 0.17 cm to 0.26 cm, average pulp thickness from 2.17 cm to 2.75 cm, average fruit cavity from 39.41 cm to 43.68 cm, average weight of pulp per fruit from 370.31 g to 632.17 g, average weight of seed per fruit from 8.23 g

to 10.79 g, T.S.S. from 10.64° Brix to 11.72° Brix, acidity from 1.15 per cent to 1.31 per cent, ascorbic acid 25.36 mg/100 g to 26.42 mg/100g, total sugar 9.27 per cent to 9.59 per cent, reducing sugar from 7.21 per cent to 7.34 per cent and non reducing sugar from 2.05 per cent to 2.29 per cent.

In F₅ generation wide range of variability was also observed for most of the characters in cross Hara Madhu x IVMM-3 (C₂: 3 x 4) (Table 5). The vine length was ranged from 194.32 cm to 235.12 cm, number of primary branches per vine from 2.61 to 2.87, days required for first female flower appearance from 36.68 days to 41.34 days, number of male flowers per vine 61.81 to 72.34, number of female flowers per vine from 11.88 to 13.68, sex ratio from 4.98 to 6.24, node at which first female flower appeared from 3.86 to 6.44, days required for first harvest of fruit from 61.83 days to 80.31 days, number of fruits per vine from 2.48 to 2.94, average yield per vine from 1.94 kg to 2.46 kg, average weight of fruit from 617.92 g to 644.35 g, average length of fruit from 8.75 cm to 12.31 cm, average diameter of fruit from 10.84 cm to 13.36 cm, average rind thickness from 0.17 cm to 0.21 cm, average pulp thickness from 1.98 cm to 2.61 cm, average fruit cavity from 36.48 cm to 51.75 cm, average weight of pulp per fruit from 358.71 g to 587.84 g, average weight of seed per fruit from 8.48 g to 10.72 g, T.S.S. from 11.12° Brix to 11.85° Brix, acidity from 1.14 per cent to 1.34 per cent, ascorbic acid 25.89 mg/100 g to 26.94 mg/100g, total sugar 9.27 per cent to 10.32 per cent, reducing

sugar from 7.24 per cent to 8.28 per cent and non reducing sugar from 1.82 per cent to 2.43 per cent.

In the cross Hara Madhu x Punjab Sunheri (C₃: 3 x 7) wide range of variability was observed in F₅ generation for all the characters of muskmelon (Table 6). The vine length was ranged from 215.35 cm to 239.47 cm, number of primary branches per vine from 2.24 to 2.51, days required for first female flower appearance from 35.12 days to 43.56 days, number of male flowers per vine 68.35 to 88.64, number of female flowers per vine from 10.58 to 13.31, sex ratio from 6.38 to 8.24, node at which first female flower appeared from 4.86 to 6.40, days required for first harvest of fruit from 82.64 days to 90.00 days, number of fruits per vine from 2.61 to 3.42, average yield per vine from 1.65 kg to 1.84 kg, average weight of fruit from 488.62 g to 687.34 g, average length of fruit from 8.37 cm to 11.27 cm, average diameter of fruit from 10.42 cm to 13.21 cm, average rind thickness from 0.18 cm to 0.33 cm, average pulp thickness from 1.64 cm to 2.03 cm, average fruit cavity from 38.31 cm to 56.32 cm, average weight of pulp per fruit from 309.31 g to 410.28 g, average weight of seed per fruit from 6.35 g to 9.81 g, T.S.S. from 11.00° Brix to 11.30° Brix, acidity from 1.31 per cent to 1.37 per cent, ascorbic acid 26.16 mg/100 g to 27.12 mg/100g, total sugar 8.20 per cent to 9.24 per cent, reducing sugar from 7.21 per cent to 7.34 per cent and non reducing sugar from 1.02 per cent to 2.12 per cent.

In the cross IVMM-3 x Pusa Madhuras (C₄: 4 x 5), wide range of variability was recorded in F₅ generation for most of the

characters. The vine length was ranged from 167.17 cm to 227.12 cm, number of primary branches per vine from 2.24 to 2.76, days required for first female flower appearance from 36.60 days to 44.29 days, number of male flowers per vine 65.81 to 81.92, number of female flowers per vine from 9.94 to 13.52, sex ratio from 5.62 to 8.33, node at which first female flower appeared from 3.97 to 6.24, days required for first harvest of fruit from 78.34 days to 84.35 days, number of fruits per vine from 2.64 to 3.38, average yield per vine from 1.62 kg to 2.13 kg, average weight of fruit from 512.32 g to 709.13 g, average length of fruit from 8.17 cm to 10.12 cm, average diameter of fruit from 10.90 cm to 11.98 cm, average rind thickness from 0.18 cm to 0.27 cm, average pulp thickness from 1.92 cm to 2.34 cm, average fruit cavity from 32.94 cm to 49.35 cm, average weight of pulp per fruit from 475.32 g to 530.15 g, average weight of seed per fruit from 8.12 g to 12.24 g, T.S.S. from 10.81° Brix to 11.19° Brix, acidity from 1.16 per cent to 1.48 per cent, ascorbic acid 24.42 mg/100 g to 26.48 mg/100g, total sugar 9.13 per cent to 10.48 per cent, reducing sugar from 7.28 per cent to 8.47 per cent and non reducing sugar from 1.79 per cent to 1.96 per cent (Table 7).

The wide range of variability was also observed for most of the characters in cross IVMM-3 x Punjab Sunheri (C₅: 4 x 7) in F₅ generation (Table 8). The vine length was ranged from 189.32 cm to 239.15 cm, number of primary branches per vine from 2.24 to 2.63, days required for first female flower appearance from 34.00 days to 42.38 days, number of male

flowers per vine 73.01 to 85.22, number of female flowers per vine from 11.32 to 13.84, sex ratio from 6.08 to 7.12, node at which first female flower appeared from 3.98 to 5.84, days required for first harvest of fruit from 75.32 days to 84.38 days, number of fruits per vine from 2.86 to 3.28, average yield per vine from 1.57 kg to 2.92 kg, average weight of fruit from 584.12 g to 915.17 g, average length of fruit from 9.12 cm to 12.09 cm, average diameter of fruit from 10.35 cm to 13.23 cm, average rind thickness from 0.19 cm to 0.28 cm, average pulp thickness from 1.87 cm to 2.95 cm, average fruit cavity from 32.82 cm to 43.55 cm, average weight of pulp per fruit from 424.34 g to 672.31 g, average weight of seed per fruit from 10.12 g to 12.21 g, T.S.S. from 11.31° Brix to 12.54° Brix, acidity from 1.17 per cent to 1.32 per cent, ascorbic acid 24.31 mg/100 g to 25.59 mg/100g, total sugar 9.23 per cent to 9.81 per cent, reducing sugar from 6.95 per cent to 7.31 per cent and non reducing sugar from 1.97 per cent to 2.48 per cent.

In F₆ generation of cross Durgapura Selection x Punjab Sunheri (C₁: 2 x 7) also observed wide range of variability (Table 9). The vine length was ranged from 163.83 cm to 212.64 cm, number of primary branches per vine from 2.18 to 2.41, days required for first female flower appearance from 29.09 days to 36.28 days, number of male flowers per vine 50.68 to 67.51, number of female flowers per vine from 11.05 to 12.36, sex ratio from 5.17 to 6.05, node at which first female flower appeared from 3.86 to 5.13, days required for first harvest of fruit from 65.13 days to 73.23 days, number of fruits per vine from 2.72 to

3.01, average yield per vine from 2.15 kg to 2.58 kg, average weight of fruit from 632.48 g to 872.35 g, average length of fruit from 10.75 cm to 11.02 cm, average diameter of fruit from 10.42 cm to 11.28 cm, average rind thickness from 0.21 cm to 0.30 cm, average pulp thickness from 2.15 cm to 2.67 cm, average fruit cavity from 40.45 cm to 43.61 cm, average weight of pulp per fruit from 560.35 g to 610.24 g, average weight of seed per fruit from 7.86 g to 9.15 g, T.S.S. from 11.86° Brix to 12.48° Brix, acidity from 1.20 per cent to 1.39 per cent, ascorbic acid 24.57 mg/100 g to 26.12 mg/100g, total sugar 8.86 per cent to 9.74 per cent, reducing sugar from 7.23 per cent to 7.84 per cent and non reducing sugar from 1.36 per cent to 2.12 per cent.

In the cross Hara Madhu x IVMM-3 (C₂: 3 x 4), wide range of variability was recorded in F₆ generation for most of the characters. The vine length was ranged from 182.87 cm to 220.38 cm, number of primary branches per vine from 2.19 to 2.51, days required for first female flower appearance from 30.00 days to 36.33 days, number of male flowers per vine 48.94 to 62.38, number of female flowers per vine from 9.35 to 11.63, sex ratio from 5.20 to 5.61, node at which first female flower appeared from 4.07 to 5.34, days required for first harvest of fruit from 71.25 days to 77.32 days, number of fruits per vine from 2.07 to 2.74, average yield per vine from 1.41 kg to 2.32 kg, average weight of fruit from 611.63 g to 847.31 g, average length of fruit from 8.11 cm to 11.94 cm, average diameter of fruit from 10.81 cm to 12.94 cm, average rind thickness from 0.16 cm to 0.20 cm, average pulp thickness from 1.87 cm to 2.48 cm,

average fruit cavity from 39.42 cm to 61.72 cm, average weight of pulp per fruit from 347.52 g to 556.12 g, average weight of seed per fruit from 6.38 g to 9.13 g, T.S.S. from 11.04° Brix to 11.94° Brix, acidity from 1.31 per cent to 1.37 per cent, ascorbic acid 25.11 mg/100 g to 26.39 mg/100g, total sugar 9.21 per cent to 10.43 per cent, reducing sugar from 7.24 per cent to 7.83 per cent and non reducing sugar from 2.01 per cent to 2.58 per cent (Table 10).

The wide range of variability was also observed for most of the characters in the cross Hara Madhu x Punjab Sunheri (C₃: 3 x 7) in F₆ generation (Table 11). The vine length was ranged from 193.20 cm to 224.66 cm, number of primary branches per vine from 2.14 to 2.36, days required for first female flower appearance from 29.11 days to 41.38 days, number of male flowers per vine 54.93 to 70.24, number of female flowers per vine from 9.15 to 12.19, sex ratio from 5.14 to 6.76, node at which first female flower appeared from 4.08 to 5.52, days required for first harvest of fruit from 67.31 days to 74.52 days, number of fruits per vine from 2.11 to 2.82, average yield per vine from 1.37 kg to 1.68 kg, average weight of fruit from 542.92 g to 761.98 g, average length of fruit from 8.20 cm to 11.26 cm, average diameter of fruit from 9.42 cm to 12.10 cm, average rind thickness from 0.18 cm to 0.27 cm, average pulp thickness from 1.54 cm to 1.97 cm, average fruit cavity from 40.58 cm to 59.32 cm, average weight of pulp per fruit from 281.65 g to 494.35 g, average weight of seed per fruit from 6.78 g to 7.81 g, T.S.S. from 10.98° Brix to 11.47° Brix, acidity from 1.21

per cent to 1.37 per cent, ascorbic acid 25.08 mg/100 g to 25.46 mg/100g, total sugar 8.24 per cent to 9.35 per cent, reducing sugar from 6.04 per cent to 7.19 per cent and non reducing sugar from 2.01 per cent to 2.33 per cent.

In the cross IVMM-3 $\times$ Pusa Madhuras (C_4 : 4 $\times$ 5), wide range of variability was recorded in F_6 generation for most of the characters. The vine length was ranged from 157.51 cm to 262.32 cm, number of primary branches per vine from 2.08 to 2.45, days required for first female flower appearance from 29.35 days to 36.61 days, number of male flowers per vine 45.12 to 58.34, number of female flowers per vine from 10.12 to 12.94, sex ratio from 3.84 to 6.78, node at which first female flower appeared from 3.91 to 5.71, days required for first harvest of fruit from 71.42 days to 78.47 days, number of fruits per vine from 2.35 to 2.78, average yield per vine from 1.32 kg to 1.92 kg, average weight of fruit from 551.82 g to 689.87 g, average length of fruit from 8.75 cm to 9.01 cm, average diameter of fruit from 10.45 cm to 11.91 cm, average rind thickness from 0.18 cm to 0.27 cm, average pulp thickness from 1.67 cm to 2.18 cm, average fruit cavity from 32.38 cm to 52.45 cm, average weight of pulp per fruit from 358.39 g to 510.31 g, average weight of seed per fruit from 7.18 g to 12.09 g, T.S.S. from 11.12° Brix to 11.49° Brix, acidity from 1.20 per cent to 1.51 per cent, ascorbic acid 24.27 mg/100 g to 26.87 mg/100g, total sugar 8.50 per cent to 9.82 per cent, reducing sugar from 6.35 per cent to 7.12 per cent and non reducing sugar from 2.42 per cent to 2.78 per cent (Table 12).

The wide range of variability was also observed for most of the characters in the cross IVMM-3 x Punjab Sunheri (C₅: 4 x 7) in F₆ generation (Table 13). The vine length was ranged from 188.32 cm to 213.68 cm, number of primary branches per vine from 2.06 to 2.53, days required for first female flower appearance from 29.35 days to 33.62 days, number of male flowers per vine 52.48 to 64.69, number of female flowers per vine from 11.74 to 12.49, sex ratio from 4.87 to 5.95, node at which first female flower appeared from 4.01 to 5.41, days required for first harvest of fruit from 64.25 days to 76.18 days, number of fruits per vine from 2.45 to 2.91, average yield per vine from 1.48 kg to 2.87 kg, average weight of fruit from 642.35 g to 892.12 g, average length of fruit from 8.35 cm to 11.82 cm, average diameter of fruit from 10.58 cm to 12.39 cm, average rind thickness from 0.17 cm to 0.28 cm, average pulp thickness from 1.84 cm to 2.51 cm, average fruit cavity from 31.12 cm to 47.31 cm, average weight of pulp per fruit from 509.45 g to 687.12 g, average weight of seed per fruit from 8.95 g to 11.86 g, T.S.S. from 11.32° Brix to 12.97° Brix, acidity from 1.21 per cent to 1.40 per cent, ascorbic acid 25.82 mg/100 g to 26.61 mg/100g, total sugar 9.14 per cent to 9.72 per cent, reducing sugar from 6.71 per cent to 7.59 per cent and non reducing sugar from 2.21 per cent to 2.45 per cent.

In present investigation high mean estimates were observed for vine length, fruit yield per vine, average fruit weight, average fruit length, average fruit diameter, average weight of pulp per fruit and average pulp thickness. Similar results were

also in conformity with the findings of Tarsem and Sanjay (1997), Torkadi and Musmade (2007) and Mehta *et al.* (2010), Choudhary *et al.* (2011), Ibrahim (2012), Reddy *et al.* (2013) and Mali *et al.* (2015) in muskmelon. Rajput (2012) observed high mean estimates for fruit yield per vine, average fruit weight and average fruit length in bitter gourd. Frinker *et al.* (1973) revealed that high mean was relatively effective in identifying the superior segregants.

5.2 Variability estimates i.e. genotypic and phenotypic coefficient of variation

The assessment of genotype for its nature and magnitude of genetic variability is an important prerequisite for developing variety with high yield potential and the desired morphological characters. This helps the breeder to assess and identify superior genotypes.

In the present study among the genotypes in F_5 and F_6 generations wide range of variability was observed for most of the characters. In general the phenotypic coefficient of variation was slightly higher than the corresponding genotypic coefficient of variation for all the characters in all the five crosses of F_5 and F_6 generation. This indicates the presence of minor role of environment in the expression of characters (Table 4 to 13). Similar results were in agreement with the findings of Tarsem and Sanjay (1997), Rakhi and Rajamony (2005), Torkadi and Musmade (2007), Mehta *et al.* (2010), Choudhary *et al.* (2011), Ibrahim (2012), Reddy *et al.* (2013), Mali *et al.* (2015) in muskmelon, Kadam (1997), Gusmini and Wehner (2007),

Rolania *et al.* (2004) in watermelon. Joshi *et al.* (2005), Gaikwad (2007), Arunkumar *et al.* (2011) and Azcon (2012) in cucumber, Choudhary *et al.* (1991), Rajput (2012) in bitter gourd, Pandit *et al.* (2009), Patil (2010), Arvindkumar *et al.* (2011), Husna *et al.* (2011), Yadav and Kumar (2012) in bottle gourd, Chaudhary and Kumar (2011) and Rabbani *et al.* (2012) in ridge gourd.

In F₅ and F₆ progenies of cross Durgapura Selection x Punjab Sunheri (C₁: 2 x 7) fruit yield per vine, average weight of pulp per fruit, average rind thickness, average weight of fruit, T.S.S., average fruit cavity, number of primary branches per vine, number of male flowers per vine, vine length, number of fruits per vine, sex ratio, number of female flowers per vine, average weight of seed per fruit, acidity except in F₆ generation, recorded high values of genotypic and phenotypic coefficients of variations, while node at which first female flower appeared, days required for first harvest of fruit, days to first female flower appearance, average diameter of fruit only in F₅ generation, average pulp thickness, acidity only in F₆ generation, ascorbic acid and reducing sugar only in F₅ generation exhibited moderate values of genotypic and phenotypic coefficients of variation. Rest of traits such as average diameter of fruit only in F₆ generation, reducing sugar only in F₆ generation, average length of fruit, total sugar and non reducing sugar recorded low values of genotypic and phenotypic coefficients of variations in F₅ and F₆ generation.

In F₅ and F₆ progenies of the cross Hara Madhu x IVMM-3 (C₂: 3 x 4) node at which first female flower appeared,

average weight of pulp per fruit, average fruit cavity, fruit yield per vine, average weight of seed per fruit, T.S.S., number of primary branches per vine, vine length, average weight of fruit, sex ratio, average length of fruit, number of male flowers number of female flowers per vine, average rind thickness, ascorbic acid, acidity recorded high values of genotypic and phenotypic coefficients of variations. While days to first female flower appearance, average diameter of fruit, days required for first harvest of fruit, acidity, ascorbic acid except F_5 and reducing sugar, non reducing sugar in F_5 generation exhibited moderate values of genotypic and phenotypic coefficients of variation. The traits total sugar recorded low value of genotypic and phenotypic coefficients of variation in both F_5 and F_6 generation.

In F_5 and F_6 progenies of the cross Hara Madhu x Punjab Sunheri (C_3 : 3 x 7) average weight of seed per fruit, fruit yield per vine, average rind thickness, average fruit cavity, vine length, T.S.S., number of fruits per vine, number of primary branches per vine, acidity, average weight of pulp per fruit, average weight of fruit, average length of fruit, sex ratio, ascorbic acid, number of male flowers per vine, number of female flowers per vine, , average diameter of fruit only in F_6 generation, average pulp thickness only in F_6 generation, and recorded high values of genotypic and phenotypic coefficients of variations. While node at which first female flower appeared, average pulp thickness only in F_5 generation, days required for first female flower appearance, days required for first harvest of fruit, average diameter of fruit, total sugar only in F_6 generation, reducing

sugar and non reducing sugar exhibited moderate values of genotypic and phenotypic coefficients of variation. The trait total sugar only in F₅ generation exhibited low values of genotypic and phenotypic coefficients of variations.

In F₅ and F₆ progenies of the cross IVMM-3 x Pusa Madhuras (C₄: 4 x 5) node at which first female flower appeared, average weight of pulp per fruit, average weight of seed per fruit, T.S.S., average weight of fruit, average rind thickness, yield per vine, sex ratio, average fruit cavity, number of fruits per vine, number of primary branches per vine, number of male flowers per vine, number of female flowers per vine, vine length, and average pulp thickness recorded high values of genotypic and phenotypic coefficients of variations. Whereas acidity, reducing sugar, non reducing sugar, ascorbic acid, days required for first female flower appearance, days required for first harvest of fruit, average length of fruit, total sugar exhibited moderate values of genotypic and phenotypic coefficients of variation. The character average diameter of fruit recorded low value of genotypic and phenotypic coefficients of variations.

In F₅ and F₆ progenies of the cross IVMM-3 x Punjab Sunheri (C₅: 4 x 7) average weight of pulp per fruit, fruit yield per vine, average weight of fruit, node at which first female flower appeared, vine length, average rind thickness, number of primary branches per vine, days required for first female flower appearance only in F₆ generation, number of male flowers per vine, number of female flowers per vine only in F₆ generation, sex ratio, number of fruits per vine, average length of fruit, average

pulp thickness, average fruit cavity only in F_6 generation, average weight of seed per fruit, T.S.S., ascorbic acid only in F_6 generation and acidity only in F_5 generation recorded high values of genotypic and phenotypic coefficients of variations. While acidity only in F_6 generation, ascorbic acid only in F_5 generation average fruit cavity only in F_5 generation, days required for first harvest of fruit, days to first female flower appearance only in F_5 generation, number of female flowers per vine only in F_5 generation, average diameter of fruit, reducing sugar and non reducing sugar exhibited moderate values of genotypic and phenotypic coefficients of variation. The character total sugar recorded low values of genotypic and phenotypic coefficients of variations in both F_5 and F_6 generation.

In the present studies high genotypic and phenotypic coefficients of variation were observed for vine length, number of primary branches per vine, number of male and female flowers per vine, sex ratio, node at which first female flower appeared, number of fruits per vine, fruit yield per vine, average weight of fruit, average length of fruit, average rind thickness, average pulp thickness, average fruit cavity, average weight of pulp per fruit, average weight of seed per fruit, T.S.S. and non reducing sugar in both F_5 and F_6 generation.

Characters which showed high estimates of GCV and PCV should be exploited in further selection programme due to presence of high amount of variability within segregating populations i.e. scope for improvement through selection.

While characters which showed low estimates of GCV and PCV should be least exploited in further selection programme due to small amount of variations observed within segregating populations i.e. lack of scope for improvement through selection.

These findings were conformity with Somkumar *et al.* (1997) revealed high PCV and GCV for average fruit weight, number of fruits per vine and fruit yield per vine whereas days to first harvest of fruit recorded low GCV and PCV in muskmelon. Torkadi and Musmade (2007) recorded high genotypic and phenotypic coefficient of variations for economically important characters such as average weight of fruit, fruit cavity and number of fruits per vine in muskmelon. Mehta *et al.* (2010) obtained high genotypic and phenotypic coefficient of variations for fruit yield per vine followed by acidity percentage, number of fruits per vine and total soluble solids while moderate estimates were obtained for number of node at which first female flower appeared and fruit weight in muskmelon. Choudhary *et al.* (2011) indicated presence of considerable amount of genetic variability for all the characters yield per plant, flesh weight per fruit and average weight of fruit establish higher values of genotypic and phenotypic co-efficient of variation, high estimate of genotypic coefficient of variation were observed for most of the yield contributing characters, these characters can be effectively improved through selection. Reddy *et al.* (2013) observed high estimates of PCV and GCV for fruit yield (28.30% and 26.08%) followed by fruit cavity length (28.20% and 26.66%), rind

thickness (26.39% and 22.14%) and average fruit weight (24.01% and 22.82%) in muskmelon. Mali *et al.* (2015) also reported high estimate of genotypic and phenotypic coefficient of variation in most of the yield contributing characters. Similar results i.e. high estimates of PCV and GCV in muskmelon were also reported by Dahiya *et al.* (1989), Tarsem and Sanjay (1997), Rakhi and Rajamony (2005) and Ibrahim (2012).

In other cucurbitaceous crops similar results were reported by Kadam (1997) and Gusmini and Wehner (2007) in water melon. Joshi *et al.* (2005), Gaikwad (2007), Arunkumar *et al.* (2011) and Azcon (2012) in cucumber. Choudhary and Mandal (1991) and Rajput (2012) in bitter gourd. Patil (2010), Arvindkumar *et al.* (2011) and Yadav and Kumar (2012) in bottle gourd. Choudhary and Kumar (2011) and Rabbani *et al.* (2012) in ridge gourd.

However in F₅ generation in case of cross Durgapura Selection x Punjab Sunheri (C₁: 2 x 7) fruit yield per vine, average weight of fruit, average rind thickness, average weight of pulp per fruit and T.S.S., in case of cross Hara Madhu x IVMM-3 (C₂: 3 x 4) number of fruits per vine, average rind thickness, T.S.S. and acidity in cross Hara Madhu x Punjab Sunheri (C₃: 3 x 7) vine length, days to first female flower appearance, fruit yield per vine, average weight of fruit, average rind thickness, average weight of pulp per fruit, T.S.S. and ascorbic acid in cross IVMM-3 x Pusa Madhuras (C₄: 4 x 5) average weight of fruit, fruit yield per vine, average rind thickness, average weight of pulp per fruit, in case of cross IVMM-3 x Punjab Sunheri (C₅: 4 x 7) sex ratio

and acidity showed more magnitudinal differences between genotypic coefficient of variation and phenotypic coefficient of variations. Whereas in case of F_5 generation in case of cross Durgapura Selection x Punjab Sunheri (C_1 : 2 x 7) the characters sex ratio, average rind thickness and non reducing sugar, in cross Hara Madhu x IVMM-3 (C_2 : 3 x 4) number of female flowers per vine, average rind thickness, average weight of pulp per fruit and T.S.S., in cross Hara Madhu x Punjab Sunheri (C_3 : 3 x 7) number of primary branches per vine, sex ratio, days required for first harvest of fruit, fruit yield per vine, average weight of fruit, average rind thickness, in cross IVMM-3 x Pusa Madhuras (C_4 : 4 x 5) average weight of pulp per fruit and in case of cross IVMM-3 x Punjab Sunheri (C_5 : 4 x 7) sex ratio, average rind thickness and reducing sugar showed more magnitudinal differences between genotypic coefficient of variation and phenotypic coefficient of variations. Since in such traits genotype x environmental interaction ($G \times E$) is effective, which suggests definite role of environmental effect in the expression of these characters. These results are in agreement with the findings of Dhayia *et al.* (1989), Rakhi and Rajamony (2005), Torkadi and Musmade (2007), Choudhary *et al.* (2011), Ibrahim (2012) and Mali *et al.* (2015) in muskmelon.

The magnitude of genetic variability is an important prerequisite for developing variety with high yield potential and the desired morphological characters. This helps the breeder to assess and identify superior genotypes.

5.3 Heritability and genetic advance

Heritability (broad sense) was found high for most of the traits in all five crosses of F_5 and F_6 generations. In case of F_5 and F_6 generation in cross Durgapura Selection x Punjab Sunheri (C_1 : 2 x 7) heritability was ranged from 49.39 to 99.94 per cent and 55.27 to 99.70 per cent. In cross Hara Madhu x IVMM-3 (C_2 : 3 x 4) it ranged from 75.81 to 99.94 per cent and 53 to 99.97 per cent. In cross Hara Madhu x Punjab Sunheri (C_3 : 3 x 7) from 55.53 to 99.97 per cent and 72.21 to 99.56 per cent. In cross IVMM-3 x Pusa Madhuras (C_4 : 4 x 5) from 61.72 to 99.97 per cent and 68.79 to 99.98 per cent. In cross IVMM-3 x Punjab Sunheri (C_5 : 4 x 7) from 67.98 to 99.93 per cent and 66.91 to 99.95 per cent.

In F_5 and F_6 generation in cross Durgapura Selection x Punjab Sunheri (C_1 : 2 x 7) high estimate of heritability were recorded for all the character, except character acidity in F_5 generation and non reducing sugar in F_6 generation, whereas the cross Hara Madhu x IVMM-3 (C_2 : 3 x 4) was exhibited highest heritability estimate for all character, except character acidity in F_6 generation. The highest estimate were observed for all the character in the cross Hara Madhu x Punjab Sunheri (C_3 : 3 x 7) in both F_5 and F_6 generation except character acidity in F_5 generation. The cross IVMM-3 x Pusa Madhuras (C_4 : 4 x 5) exhibited high heritability estimate for all character except character average length of fruit in F_6 generation and non reducing sugar in F_5 generation. In cross IVMM-3 x Punjab Sunheri (C_5 : 4 x 7) observed the high heritability estimate for all

character in both F_5 and F_6 generation except character reducing sugar in both F_5 and F_6 generation. Above information suggests that selection based on phenotypic expression could be relied upon as major role of genetic constitution in the expression of these characters. Similar results were reported by Vishwanatha (2003), Torkadi and Musmade (2007), Mehta *et al.* (2010), Mishra *et al.* (2012) and Mali *et al.* (2015) in muskmelon. Azcon (2012) in cucumber. Rajput (2012) in bitter gourd. Yadav and Kumar (2012) in bottle gourd.

In case of F_5 and F_6 generation, in cross Durgapura Selection x Punjab Sunheri (C_1 : 2 x 7) the values of genetic advance observed were low to very high and ranged from 0.07 to 176.12 and 0.06 to 182.45, in cross Hara Madhu x IVMM-3 (C_2 : 3 x 4) ranged from 0.12 to 183.72 and 0.04 to 212.76, in cross Hara Madhu x Punjab Sunheri (C_3 : 3 x 7) genetic advance ranged from 0.09 to 123.61 and 0.08 to 131.97, in cross IVMM-3 x Pusa Madhuras (C_4 : 4 x 5) it ranged from 0.07 to 154.12 and 0.06 to 161.81 in F_5 and F_6 generations respectively. Likewise genetic advance also ranged from 0.09 to 274.26 and 0.06 to 281.62 in cross IVMM-3 x Punjab Sunheri (C_5 : 4 x 7) in F_5 and F_6 generations respectively. These findings are in conformity with the findings of Torkadi and Musmade (2007), Choudhary *et al.* (2011) and Mali *et al.* (2015) in muskmelon. Azcon (2012) in cucumber. Rajput (2012) in bitter gourd.

Genetic advance as per cent of mean coupled with heritability provide great scope of improvement in present set of materials for the trait studied.

In case of F_5 generation in cross Durgapura Selection x Punjab Sunheri (C_1 : 2 x 7) the association of high estimates of heritability with high estimates of genetic advance as per cent of mean were recorded in characters like vine length (96.94 and 21.16 %), number of primary branches per vine (98.12 and 22.01%), number of male flowers per vine (99.87 and 22.04 %), number of female flowers per vine (97.64 and 21.37 %), sex ratio (96.99 and 21.04 %), number of fruits per vine (96.98 and 22.34 %), fruit yield per vine (86.26 and 23.92 %), average weight of fruit (86.26 and 23.25 %), average rind thickness (76.45 and 28.00 %), average fruit cavity (90.95 and 22.12 %), average weight of pulp per fruit (91.45 and 23.18 %), average weight of seed per fruit (99.94 and 22.13%) and T.S.S.(87.72 and 23.00 %). Whereas the high estimates of heritability with moderate estimates of genetic advance as per cent of mean was observed for days to first female flower appearance (90.91 and 10.98 %), node at which first female flower appeared (97.68 and 14.51 %), days required for first harvest of fruit (97.95 and 12.91 %), average pulp thickness (98.51 and 11.31 %), average diameter of fruit (88.86 and 10.29 %), and ascorbic acid (98.31 and 17.87 %). The high estimates of heritability with lower estimates of genetic advance as per cent of mean was recorded in average length of fruit (98.54 and 5.42%), total sugar (89.41 and 9.62 %),

reducing sugar (82.36 and 7.02 %) and non reducing sugar (86.63 and 7.61 %).

In the cross Hara Madhu x IVMM-3 (C₂: 3 x 4) the traits like vine length (94.36 and 22.12 %), number of primary branches per vine (97.68 and 25.21 %), number of male flowers per vine (93.34 and 23.32 %), number of female flowers per vine (98.70 and 22.15 %), sex ratio (98.20 and 22.71 %), node at which first female flower appeared (99.94 and 45.4 %), number of fruits per vine (96.17 and 31.34 %), fruit yield per vine (97.64 and 27.21 %), average weight of fruit (97.35 and 22.36 %), average length of fruit (99.12 and 22.71%), average pulp thickness (98.11 and 21.82 %), average fruit cavity (99.58 and 40.41 %), average weight of pulp per fruit (96.83 and 35.30 %), average weight of seed per fruit (99.81 and 28.32%) and T.S.S.(84.52 and 24.42 %) recorded high estimates of heritability along with high estimates of genetic advance as per cent of mean in F₃ generation. Whereas the characters days to first female flower appearance (98.23 and 15.41 %), days required for first harvest of fruit (96.11 and 13.01 %), average diameter of fruit (99.35 and 14.51 %), average rind thickness (75.81 and 16.66 %), acidity (89.17 and 10.24 %), ascorbic acid (78.21 and 16.32 %) and reducing sugar (99.56 and 11.42 %) recorded high estimates of heritability with moderate estimates of genetic advance as per cent of mean. While the character total sugar (99.37 and 7.56 %) showed high estimates of heritability with low estimates of genetic advance as per cent of mean in F₅ generation.

In F₅ generation the cross Hara Madhu x Punjab Sunheri (C₃: 3 x 7) characters like number of primary branches per vine (84.78 and 24.61 %), number of male flowers per vine (98.71 and 20.71 %), number of female flowers per vine (92.64 and 23.21 %), sex ratio (96.38 and 24.01 %), number of fruits per vine (96.79 and 26.29 %), fruit yield per vine (79.45 and 29.35 %), average weight of fruit (87.94 and 22.20 %), average length of fruit (99.61 and 24.12%), average rind thickness (89.27 and 22.61 %), average fruit cavity (99.95 and 32.13 %), average weight of pulp per fruit (78.93 and 20.52 %), average weight of seed per fruit (99.97 and 38.62%) and T.S.S.(75.11 and 22.81 %) recorded high estimates of heritability along with high estimates of genetic advance as per cent of mean. Whereas the characters node at which first female flower appeared (99.61 and 19.57 %), days required for first harvest of fruit (92.24 and 11.46 %), average diameter of fruit (96.32 and 12.01 %), average pulp thickness (98.12 and 15.72 %), ascorbic acid (76.32 and 16.91 %), total sugar (97.34 and 10.51 %) and non reducing sugar (88.35 and 19.62 %) recorded high estimate of heritability with moderate estimate of genetic advance as per cent of mean. The rest of characters reducing sugar (88.12 and 6.62 %) showed the high estimates of heritability with lower estimate of genetic advance as per cent of mean. final vine length (74.66 and 25.00 %) showed moderate estimates of heritability with high estimate of genetic advance as per cent of mean. Whereas the characters days to first female flower appearance (92.24 and 11.46 %), Acidity (55.53 and 16.41%) showed moderate estimates of

heritability with moderate estimate of genetic advance as per cent of mean.

In F₅ generation cross IVMM-3 x Pusa Madhuras (C₄: 4 x 5) the characters like vine length (97.26 and 22.00 %), number of primary branches per vine (98.81 and 23.41 %), number of male flowers per vine (98.26 and 22.14 %), number of female flowers per vine (97.46 and 22.16 %), sex ratio (97.56 and 27.62 %), node at which first female flower appeared (99.97 and 44.72 %) number of fruits per vine (99.94 and 24.15 %), fruit yield per vine (91.23 and 27.18 %), average weight of fruit (61.72 and 22.63 %), average rind thickness (76.98 and 29.28 %), average pulp thickness (99.32 and 20.41 %), average fruit cavity (99.84 and 24.53 %), average weight of pulp per fruit (77.16 and 20.12 %), average weight of seed per fruit (99.98 and 34.71 %) and T.S.S. (89.10 and 22.00 %) recorded high estimates of heritability along with high estimates of genetic advance as per cent of mean. Whereas the characters days to first female flower appearance (97.46 and 22.16 %), days required for first harvest of fruit (92.08 and 16.92 %), average length of fruit (97.12 and 11.00 %), average diameter of fruit (91.34 and 11.10 %), acidity (93.98 and 17.66 %), ascorbic acid (93.40 and 16.51 %), total sugar (98.48 and 10.87 %) and reducing sugar (99.84 and 13.51 %) recorded high estimates of heritability with moderate estimates of genetic advance as per cent of mean. While the characters non reducing sugar (64.61 and 9.35 %) showed the moderate estimates of heritability with low estimates of genetic advance as per cent of mean.

In F₅ generation of cross IVMM-3 x Punjab Sunheri (C₅: 4 x 7) the characters like vine length (94.96 and 25.24 %), number of primary branches per vine (98.06 and 27.42 %), number of male flowers per vine (99.51 and 23.15 %), number of female flowers per vine (93.36 and 20.91 %), sex ratio (89.63 and 23.81 %), node at which first female flower appeared (99.84 and 33.37 %), number of fruits per vine (98.17 and 25.00 %), fruit yield per vine (98.29 and 42.02 %), average weight of fruit (97.80 and 32.41 %), average length of fruit (99.92 and 23.85 %), average rind thickness (97.63 and 36.25 %), average pulp thickness (99.47 and 25.01 %), average weight of pulp per fruit (98.10 and 44.10 %), average weight of seed per fruit (99.41 and 21.72 %) and T.S.S.(91.18 and 23.82 %) recorded high estimates of heritability along with high estimates of genetic advance as per cent of mean. Whereas the characters days to first female flower appearance (96.32 and 16.71 %), days required for first harvest of fruit (98.27 and 12.61 %), average diameter of fruit (99.93 and 14.07 %), average fruit cavity (99.91 and 18.41 %), acidity (75.86 and 17.41 %), ascorbic acid (75.06 and 18.01 %) recorded high estimate of heritability with moderate estimate of genetic advance as per cent of mean. The characters non reducing sugar (97.14 and 13.42 %), total sugar (97.67 and 8.31 %) and reducing sugar (67.95 and 8.01 %) showed the high estimates of heritability with low estimates of genetic advance as per cent of mean.

In case of F₆ generation, in cross Durgapura Selection x Punjab Sunheri (C₁: 2 x 7) the association of high estimate of

heritability with high estimate of genetic advance as per cent of mean were recorded in characters like vine length (98.27 and 22.85 %), number of primary branches per vine (98.09 and 23.17 %), number of male flowers per vine (98.42 and 20.89 %), number of female flowers per vine (98.12 and 21.42 %), sex ratio (82.59 and 22.06 %), number of fruits per vine (97.21 and 22.10 %), fruit yield per vine (98.38 and 24.10 %), average weight of fruit (98.34 and 22.54 %), average rind thickness (82.67 and 22.24 %), average fruit cavity (87.38 and 21.81 %), average weight of pulp per fruit (99.64 and 30.54 %), average weight of seed per fruit (99.12 and 21.35 %) and T.S.S.(93.68 and 21.05 %). Whereas the high estimate of heritability with moderate estimate of genetic advance as per cent of mean was observed in the characters days to first female flower appearance (93.64 and 12.84 %), node at which first female flower appeared (97.26 and 14.18 %), days required for first harvest of fruit (98.12 and 11.94 %), average diameter of fruit (99.48 and 10.18 %), average pulp thickness (97.35 and 11.01 %), acidity (82.37 and 10.48 %), total sugar (99.70 and 10.01 %), reducing sugar (94.41 and 10.21 %) and ascorbic acid (97.68 and 16.74 %). While the high estimate of heritability with low estimate of genetic advance as per cent of mean was recorded in average length of fruit (99.15 and 6.45%) and moderate estimate of heritability with low estimate of genetic advance as per cent of mean was recorded in non reducing sugar (55.27 and 7.26%).

In cross Hara Madhu x IVMM-3 (C₂: 3 x 4) the characters like final vine length (92.89 and 25.36 %), number of

primary branches per vine (96.71 and 24.5 %), number of male flowers per vine (98.71 and 21.92 %), number of female flowers per vine (76.52 and 23.51 %), sex ratio (97.65 and 23.01 %), node at which first female flower appeared (99.89 and 32.51 %), number of fruits per vine (99.78 and 22.81 %), fruit yield per vine (99.84 and 45.54 %), average weight of fruit (99.92 and 27.34 %), average length of fruit (99.21 and 26.28 %), average pulp thickness (99.69 and 24.26 %), average fruit cavity (99.95 and 30.15 %), average weight of pulp per fruit (78.93 and 20.32 %), average weight of seed per fruit (99.97 and 38.51 %) and T.S.S. (75.12 and 21.35 %) recorded high estimates of heritability along with high estimates of genetic advance as per cent of mean in F₆ generation. Whereas the characters days to first female flower appearance (90.88 and 15.35 %), days required for first harvest of fruit (91.32 and 12.81 %), average diameter of fruit (98.97 and 11.12 %), average rind thickness (75.29 and 19.24 %) and ascorbic acid (77.38 and 17.72 %) recorded high estimate of heritability with moderate estimate of genetic advance as per cent of mean., total sugar (98.42 and 11.18 %), reducing sugar (81.92 and 6.31 %) and non reducing sugar (88.27 and 11.34 %) showed the high estimate of heritability with low estimate of genetic advance as per cent of mean. While the characters acidity (55.53 and 15.71 %) showed the moderate estimate of heritability with moderate estimate of genetic advance as per cent of mean in the F₆ generation.

In F₆ generation the cross Hara Madhu x Punjab Sunheri (C₃: 3 x 7) traits like vine length (90.47 and 22.94 %),

number of primary branches per vine (78.12 and 23.61 %), number of male flowers per vine (98.23 and 26.38 %), number of female flowers per vine (80.14 and 20.51 %), sex ratio (78.21 and 24.15 %), number of fruits per vine (98.22 and 24.10 %), fruit yield per vine (98.24 and 22.42 %), average weight of fruit (90.11 and 20.14 %), average length of fruit (98.87 and 23.71%), average rind thickness (76.35 and 30.8 %), average pulp thickness (98.63 and 20.41 %), average fruit cavity (97.17 and 28.71 %), average weight of pulp per fruit (94.39 and 14.12 %), average weight of seed per fruit (97.64 and 28.61 %) and T.S.S.(75.78 and 23.92 %) recorded high estimates of heritability along with high estimates of genetic advance as per cent of mean. Whereas the characters days to first female flower appearance (94.38 and 19.52 %), node at which first female flower appeared (99.56 and 15.79 %), days required for first harvest of fruit (78.91 and 15.21 %), average diameter of fruit (99.31 and 13.21 %), acidity (77.38 and 16.14 %), total sugar (99.51 and 12.18 %), reducing sugar (98.62 and 14.96 %) recorded high estimate of heritability with moderate estimate of genetic advance per cent of mean. The character ascorbic acid (71.21 and 16.56 %) and non reducing sugar (72.76 and 10.90 %) recorded moderate estimate of heritability with moderate estimate of genetic advance per cent of mean F_6 generation.

In cross IVMM-3 x Pusa Madhuras (C_4 : 4 x 5) the characters like vine length (95.94 and 20.06 %), number of primary branches per vine (98.38 and 26.43 %), number of male flowers per vine (97.65 and 23.73 %), number of female flowers

per vine (93.71 and 22.9 %), sex ratio (97.59 and 43.83 %), node at which first female flower appeared (99.76 and 32.79 %) number of fruits per vine (96.98 and 24.36 %), fruit yield per vine (98.58 and 24.58 %), average weight of fruit (99.18 and 24.40 %), average pulp thickness (99.28 and 22.34 %), average fruit cavity (99.17 and 43.00 %), average weight of pulp per fruit (75.99 and 20.21 %), average weight of seed per fruit (99.98 and 40.61 %) and T.S.S.(78.24 and 21.40 %) recorded high estimates of heritability along with high estimates of genetic advance as per cent of mean. Whereas the characters days to first female flower appearance (92.85 and 13.39 %), days required for first harvest of fruit (97.64 and 14.41 %), average diameter of fruit (99.41 and 10.39 %), acidity (95.63 and 18.82 %), ascorbic acid (99.37 and 16.43 %), total sugar (99.31 and 14.83 %), reducing sugar (94.72 and 15.82 %) and non reducing sugar (84.51 and 11.28 %) recorded high estimate of heritability with moderate estimate of genetic advance as per cent of mean. While the character average length of fruit (68.79 and 10.90 %) showed the moderate estimate of heritability with moderate estimate of genetic advance as per cent of mean in F_6 generation.

In F_6 generation in case of cross IVMM-3 x Punjab Sunheri (C_5 : 4 x 7) the characters like vine length (93.03 and 21.35 %), number of primary branches per vine (99.15 and 25.00 %), days to first female flower appearance (93.10 and 22.15 %), number of male flowers per vine (92.65 and 24.91 %), number of female flowers per vine (95.56 and 21.35 %), sex ratio (82.68 and 25.41 %), node at which first female flower appeared (99.30 and

23.12 %), number of fruits per vine (97.66 and 23.64 %), fruit yield per vine (99.14 and 37.42 %), average weight of fruit (99.95 and 48.21 %), average length of fruit (99.89 and 24.91 %), average rind thickness (85.53 and 24.00 %), average pulp thickness (99.52 and 25.10 %), average fruit cavity (99.20 and 27.00 %), average weight of pulp per fruit (96.69 and 44.31 %), average weight of seed per fruit (99.32 and 20.81 %) and T.S.S.(98.83 and 20.23 %) recorded high estimates of heritability along with high estimates of genetic advance as per cent of mean. Whereas the characters days to first harvest of fruit (97.11 and 13.51 %), average diameter of fruit (99.89 and 13.91 %), acidity (97.26 and 13.52 %), ascorbic acid (79.53 and 16.44 %), total sugar (96.89 and 7.92 %) non reducing sugar (77.15 and 10.56 %) recorded high estimate of heritability with moderate estimate of genetic advance as per cent of mean. While the characters and reducing sugar (66.91 and 8.40 %) showed the moderate estimate of heritability with moderate estimate of genetic advance as per cent of mean.

In the present investigation characters which exhibited high estimates of heritability along with high estimates of genetic advance as per cent of mean might be due to predominance of additive gene effects. Therefore it appears that selection for characters mentioned in above crosses and their respective generation would be effective.

Rakhi and Rajamony (2005) observed high heritability along with high genetic advance as per cent of mean for average fruit length, 100-seeds weight, average fruit weight and keeping

quality of fruits in muskmelon. Torkadi and Musmade (2007) found high heritability with high genetic advance as per cent of mean for node number of first female flower, number of fruits per vine, average weight of fruit, average fruit yield per vine, average length of fruit, average diameter of fruit, average pulp thickness, average fruit cavity, F:C ratio, average weight of seed per fruit, T.S.S. in muskmelon. Mehta *et al.* (2010) found high heritability with high genetic advance as per cent of mean for node number at which first female flower appeared, number of fruits per vine, fruit yield per vine, average fruit weight and total soluble solid. Patil (2014) observed high heritability and high genetic advance in the cross 5 (IVMM-3 x Punjab Sunehari) for most of the characters like vine length, days required for initiation of male and female flowering, number of female flowers per vine, node at which first female flower appeared, days required for first harvest of fruits, yield per vine, weight of fruit, length of fruit, diameter of fruit, rind thickness, pulp thickness, fruit cavity, weight of pulp per fruit, weight of seed per fruit, total soluble solids, acidity, downey mildew, powdery mildew and leaf miner in muskmelon. It indicated that the heritability is due to additive gene effects and selection may be effective. Mali *et al.* (2015) observed that High heritability estimates associated with high values of genetic advance as percent of mean were observed for final vine length, number of primary branches per vine, number of male and female flowers per vine, sex ratio, node at which first female flower appeared, number of fruits per vine, fruit yield per vine, average weight of fruit, average length of fruit, average rind

thickness, average pulp thickness, average fruit cavity, average weight of pulp per fruit, average weight of seed per fruit, T.S.S. and non reducing sugar in the F₄ generation. Similar results in muskmelon were also reported by Vishwanatha (2003), Prasad *et al.* (2004), Arvindkumar (2005), Pandey *et al.* (2005), Singh and Lal (2005), Ibrahim (2012), Mishra *et al.* (2012) and Reddy *et al.* (2013).

The similar results *i.e.* the high heritability along with high genetic advance as percent of mean in other cucurbitaceous crops were also reported by Krishna *et al.* (2002) and Gusmini and Wehner (2007) in water melon. Joshi *et al.* (2005), Kumar *et al.* (2010), Arunkumar *et al.* (2011) and Azcon (2012) in cucumber. Chaudhary *et al.* (1991) and Rajput (2012) in bitter gourd. Yadav and Kumar (2012) in bottle gourd. The high estimate of heritability with low genetic advance as per cent mean indicates the presence of non-additive gene effect. Therefore selection may not be effective for these traits. The high heritability and low genetic advance may be attributed due to low phenotypic variation in these traits. Torkadi and Musmade (2007) observed high heritability and low genetic advance for appearance of first female flower and days to first fruit harvest in muskmelon. Similar results are in accordance with the findings of Moon *et al.* (2004), Pandey *et al.* (2005), Singh and Lal (2005), Mishra *et al.* (2012) and Reddy *et al.* (2013) observed high heritability and low genetic advance as percent mean for days to first fruit harvest indicate that the character is highly influenced

by environmental effects and selection could be effective. Kumar *et al.* (2007) in cucumber. Rajput (2012) in bitter gourd.

5.4 Correlation coefficient

In present study the phenotypic and the genotypic correlation co-efficient were worked out in respect of the twelve characters for each five crosses of both F₅ and F₆ generations (Table 14 to 23) and the same are discussed here below.

In case of F₅ and F₆ generation in cross Durgapura Selection x Punjab Sunheri (C₁: 2 x 7) the significant and high positive correlation both at phenotypic and the genotypic level was observed between fruit yield per vine and the yield contributing characters such as final vine length, number of primary branches per vine, number of female flowers per vine, number of fruits per vine, average weight of fruit, average length of fruit, average diameter of fruit and average weight of pulp per fruit. While, the characters like days required for first female flower appearance, node at which first female flower appeared and days required for first harvest of fruit were significantly and negatively correlated with average yield per vine, which were helpful relationships. Most of these characters were also found to be positively associated among them. Similar correlation coefficient both at phenotypic and genotypic level between fruit yield per vine and the yield contributing characters were observed in crosses Hara Madhu x IVMM-3 (C₂: 3 x 4), Hara Madhu x Punjab Sunheri (C₃: 3 x 7), IVMM-3 x Pusa Madhuras (C₄: 4 x 5) and IVMM-3 x Punjab Sunheri (C₅: 4 x 7) in F₅ and F₆ generations. These findings in both F₅ and F₆ generations

indicate that the ideal vine should have more vine length, more number of primary branches per vine, more number of female flowers per vine, more number of fruits per vine, more weight of fruit, more length of fruit, more diameter of fruit and more weight of pulp per fruit and less days required for first female flower appearance, lower node position at which first female flower appeared and less days required for first harvest of fruit. The selection of a better yielder should also emphasis for improvement in these components. Similar finding was reported by Monila *et al.* (1989) observed the significant and positive correlation between total fruit yield with average weight of fruit, fruit length, fruit width, flesh thickness and rind thickness in muskmelon. Choudhary *et al.* (2003) observed that yield per plant had significant positive correlation with average fruit weight, number of fruits per plant, harvest duration, rind thickness, shelf life and vine length in muskmelon. Chamnan and Kasem (2006) observed in two inbred lines (RM1 and LM2) of slicing melon (*C. melo* L. var. *conomon* markino) and their related progenies were determined for. The results indicated that fruit number per plant had highly positive correlation to yield per plant.

Mali *et al.* (2015) fruit yield per vine showed highly significant positive correlation with final vine length, number of primary branches per vine, number of female flowers per vine, number of fruits per vine, average weight of fruit, average length of fruit, average diameter of fruit and average weight of pulp per fruit in muskmelon. Similar results were also reported by Kadam

(1997) and Rolania *et al.* (2003) in watermelon, Rao *et al.* (2003), Joshi *et al.* (2005) and Bhande *et al.* (2012) in cucumber, Dey *et al.* (2005) and Botau *et al.* (2010) in bitter gourd. Pandit (2009), Yadav *et al.* (2010), Kumar *et al.* (2012), Sharma and Sengupta (2012), Yadav and Kumar (2012) and Deepthi (2014) in bottle gourd. Choudhary and Kumar (2011), Hanumegowda *et al.* (2012) and Rabbani *et al.* (2012) in ridge gourd found that most of these characters were favorably associated with fruit yield per vine.

5.5 Per cent incidence of diseases and pests

5.5.1 Per cent incidence of diseases

5.5.1.1 Per cent incidence of downy mildew

As regards per cent incidence of downy mildew, the parent Punjab Sunehari recorded least incidence of downey mildew (14.67 & 16.16 %), while the parent Pusa Madhuras showed maximum downey mildew incidence (34.38 & 30.38 %) in both F₅ and F₆ generation respectively.

The progenies of cross IVMM-3 x Pusa Madhuras (C₄: 4 x 5) recorded highest incidence of downey mildew (32.11 & 30.34 %) whereas least incidence (22.75 & 22.37 %) was observed in the cross IVMM-3 x Punjab Sunheri (C₅: 4 x 7) in both F₅ and F₆ generation respectively. These results are in conformity with the findings of Jagtap (2010), Patil (2014), Mali *et al.* (2015) in muskmelon (Table 24).

5.5.1.2 Per cent incidence of fusarium wilt

As regards the per cent incidence of fusarium wilt at field condition the low incidence was observed in the parents

Pusa Madhuras (1.00 & 1.00) and Punjab Sunehari (each 1.00 & 1.00) whereas highest incidence was observed in parent Durgapur selection (8.00 & 10.00 %) in both F₅ and F₆ generation, respectively (Table 24).

The most of the progenies of crosses Hara Madhu x IVMM-3 (C₂: 3 x 4), and IVMM-3 x Punjab Sunheri (C₅: 4 x 7) recorded low incidence (each 5.00 and 5.00) of fusarium wilt whereas highest incidence of fusarium wilt (15.00 & 16.00 %) was observed in the cross Durgapur selection x Punjab Sunheri (C₁: 2 x 7) in the F₅ and F₆ generation respectively (Table 24). The low incidence might be due to the presence of moderate resistant against fusarium wilt in parents Pusa Madhuras and Punjab Sunehari. Jagtap (2010), Patil (2014), Mali *et al.* (2015) in their studied in muskmelon reported similar type of results.

5.5.2 Per cent incidence of pest

5.5.2.1 Per cent incidence of leaf miner

As regards the per cent incidence of leaf miner at field condition almost all the parents had shown the infestation (Table 24). The highest infestation was found in Pusa Madhuras (23.21 and 20.37 %) while least infestation was observed in Durgapur selection (16.82 and 12.24 %) followed by Punjab Sunehari (18.22 and 14.28 %) in both F₅ and F₆ generation, respectively.

Among the crosses, the cross IVMM-3 x Punjab Sunehari (C₅: 4 x 7) recorded least infestation of leaf miner (17.38 and 14.37 %) while the cross IVMM-3 x Pusa Madhuras (C₄: 4 x 5) recorded highest infestation of leaf miner (21.39 & 18.14 %) in both F₅ and F₆ generation respectively (Table 24).

Similar results were also reported by Jagtap (2010), Patil (2014), Mali *et al.* (2015) in muskmelon.

5.4 Fruit characters (qualitative)

F₅ and F₆ progenies of crosses Durgapura Selection x Punjab Sunheri (C₁: 2 x 7), Hara Madhu x IVMM-3 (C₂: 3 x 4), Hara Madhu x Punjab Sunheri (C₃: 3 x 7), IVMM-3 x Pusa Madhuras (C₄: 4 x 5) and IVMM-3 x Punjab Sunheri (C₅: 4 x 7) along with their parents were studied for the different qualitative traits such as shape of fruit, colour of fruit, rind surface of fruit, flavor and colour of pulp was presented in Table 25.

5.4.1 Shape of fruits

Among the F₅ and F₆ segregating progenies of the five crosses, four crosses *viz.*, Durgapura Selection x Punjab Sunheri (C₁:2 x 7), cross Hara Madhu x IVMM-3 (C₂:3 x 4), and Hara Madhu x Punjab Sunheri (C₃:3 x 7) and IVMM-3 x Punjab Sunheri (C₅:4 x 7) produced round shape of fruits in most of the progenies. Whereas some progenies of cross IVMM-3 x Pusa Madhuras (C₄:4 x 5) were produced round flat fruit shape. Thus shape of fruit was governed by additive variance (Ramaswamy *et al.* 1977) Similar results were reported by Jagtap (2010), Patil (2014) and Mali *et al.* (2015) in muskmelon.

5.4.2 Colour of fruits

In F₅ and F₆ segregating progenies, among the five crosses the three crosses *viz.*, Durgapura Selection x Punjab Sunheri (C₁: 2 x 7), Hara Madhu x IVMM-3 (C₂: 3 x 4) and Hara Madhu x Punjab Sunheri (C₃: 3 x 7) showed yellowish with green ridges as a colour of fruits, while the remaining two crosses *viz.*,

IVMM-3 x Pusa Madhuras (C₅: 4 x 5) and IVMM-3 x Punjab Sunheri (C₄: 4 x 7) showed greenish yellow with ridges as colour of fruits (Chadha *et al.* 1972). These findings were in conformity with the findings of Jagtap (2010), Patil (2014) and Mali *et al.* (2015) in muskmelon.

5.4.3 Rind surface of fruits

In F₅ and F₆ segregating progenies of all five crosses *viz.*, Durgapura Selection x Punjab Sunheri (C₁: 2 x 7), Hara Madhu x IVMM-3 (C₂: 3 x 4), Hara Madhu x Punjab Sunheri (C₃: 3 x 7), IVMM-3 x Pusa Madhuras (C₄: 4 x 5) and IVMM-3 x Punjab Sunheri (C₅: 4 x 7) showed netted and partial netted rind surface of fruits. Thus from the results it may be concluded that the netted rind surface character was monogenic and have partial dominant over partial netted rind surface (Ramaswamy *et al.*, 1977). Similar results were also reported by Jagtap (2010), Patil (2014) and Mali *et al.* (2015) in muskmelon.

5.4.4 Flavor

The flavor of fruits of all the parents of five crosses had pleasant flavor. Hence, all progenies of all studied crosses were recorded pleasant flavor and indicating monogenic dominant gene action. Jagtap (2010), Patil (2014) and Mali *et al.* (2015) in muskmelon in their studies also reported similar results.

5.4.5 Colour of pulp

The most of progenies of all five crosses *viz.*, Durgapura Selection x Punjab Sunheri (C₁: 2 x 7), Hara Madhu x IVMM-3 (C₂: 3 x 4) and Hara Madhu x Punjab Sunheri (C₃: 3 x

7), IVMM-3 x Pusa Madhuras (C₄: 4 x 5) and IVMM-3 x Punjab Sunheri (C₅: 4 x 7) observed orange colour of fruit pulp in F₅ and F₆ generation. Thus from the results it may be concluded that the orange colour of pulp was monogenically dominant over yellow and pale green colour of pulp (Ramaswamy *et al.* 1977). These results were also reported by Jagtap (2010), Patil (2014) and Mali *et al.* (2015) in muskmelon.

6. SUMMARY AND CONCLUSIONS

The present investigation , “Genetic studies in F₅ and F₆ generations of muskmelon (*Cucumis melo* L.)” was undertaken during *Kharif* 2014 and summer 2015 at Instructional cum Research Farm, Department of Horticulture, M.P.K.V., Rahuri.

In the present investigation, the seed of fifteen F₄ progenies from the crosses *i.e.* three progenies from each cross; Durgapur Selection x Punjab Sunheri (C₁: 2x7), IVMM-3 x Pusa Madhuras (C₄: 4x5) and IVMM-3 x Punjab Sunheri (C₅: 4x7), four progenies from each cross Hara Madhu x Punjab Sunheri (C₃: 3x7) and two progeny from cross Hara Madhu x IVMM-3 (C₂: 3x4), were evaluated along with their parents in randomized block design with two replications. Data on twenty four quantitative and qualitative characters were recorded on total plant population in both F₅ and F₆ generations and data were used for variability *i.e.* genotypic coefficient of variation, phenotypic coefficient of variation, heritability (broad sense), genetic advance, genetic advance as per cent mean and correlation coefficients in the both F₅ and F₆ generations.

6.1 Variability, heritability and genetic advance

A good range of variability was observed for all twenty four traits of muskmelon in five crosses for F₅ and F₆ generations. Genotypic coefficient of variation was lower than the phenotypic coefficient of variations in all quantitative traits role of environment in the phenotypic expression of traits. All the fifteen progenies of five crosses (Durgapura Selection x Punjab

Sunheri (C₁: 2 x 7), Hara Madhu x IVMM-3 (C₂: 3 x 4), Hara Madhu x Punjab Sunheri (C₃: 3 x 7), IVMM-3 x Pusa Madhuras (C₄: 4 x 5) and IVMM-3 x Punjab Sunheri (C₅: 4 x 7) were recorded high values of Genotypic coefficient of variation and phenotypic coefficient of variations in both the F₅ and F₆ generations for most of the character *viz.*, final vine length, number of primary branches per vine, number of male flowers per vine, number of female flowers per vine, sex ratio, number of fruits per vine, fruit yield per vine, average weight of fruit, average rind thickness, average fruit cavity, average weight of pulp per fruit, average weight of seed per fruit, T.S.S. in F₅ and F₆ generations and acidity indicating presence of substantial amount of genetic variation for these characters which can be effectively exploited in future crop improvement.

High heritability values were found in F₅ and F₆ generations of five crosses. In cross Durgapura Selection x Punjab Sunheri (C₁: 2 x 7) it was ranged between 49.39 to 99.94 per cent and 55.27 to 99.70 per cent to F₅ and F₆ generation respectively. In cross Hara Madhu x IVMM-3 (C₂: 3 x 4) it was ranged between 75.81 to 99.94 per cent and 55.53 to 99.97 per cent. In the cross Hara Madhu x Punjab Sunheri (C₃: 3 x 7) it was ranged between 55.53 to 99.97 per cent and 72.21 to 99.56 per cent in F₅ and F₆ generation respectively. In cross IVMM-3 x Pusa Madhuras (C₄: 4 x 5) it was ranged between 61.72 to 99.97 per cent and 68.79 to 99.98 per cent in F₅ and F₆ generation respectively. In cross IVMM-3 x Punjab Sunheri (C₅: 4 x 7) it was ranged between 67.98 to 99.93 per cent and 66.91 to 99.95 per

cent in F_5 and F_6 generation respectively. It indicate major role of genetic constitution in expression of characters. Also, range of genetic advance was found high for most of the characters.

Association of high heritability with high and moderate genetic advance as per cent of mean was recorded in F_5 and F_6 generations progeny of all the five crosses for most of the important characters for the characters like final vine length, number of primary branches per vine, days to first female flower, node at which first female flower appeared, days required for first harvest of fruit, number of male flowers per vine), number of female flowers per vine, sex ratio, number of fruits per vine, fruit yield per vine, average weight of fruit, average rind thickness, average fruit cavity, average weight of pulp per fruit, average pulp thickness, average weight of seed per fruit, T.S.S. and ascorbic acid. Hence high heritability along with high genetic advance as per cent of mean might be attributed due to the dominance of additive gene effect. Therefore phenotypic selection will be effective in further breeding programme.

High heritability with low genetic advance as per cent of mean indicates non-additive gene effect. Thus selection for such characters will not be effective in further breeding programme.

6.2 Correlation coefficient

In case of F_5 and F_6 generations of all five crosses significant and positive correlation both at phenotypic and genotypic level was observed between fruit yield per vine and the yield contributing characters such as vine length, number of

primary branches per vine, number of female flowers per vine, number of fruits per vine, average weight of fruit, average length of fruit, average diameter of fruit and average weight of pulp per fruit. While the characters like days required for first female flower appearance, node at which first female flower appeared and days required for first harvest of fruit were significantly and negatively correlated with average yield per vine, which were helpful relationships. Most of these characters were also found to be positively associated among themselves.

6.3 Per cent incidence of diseases and pests

The least incidence of downey mildew was recorded in Punjab Sunehari (14.67 & 16.16 %) in both F₅ and F₆ generations respectively. In case of segregating progenies, minimum incidence of downey mildew (25.75 & 22.37 %) was recorded in IVMM-3 x Punjab Sunheri (C₅: 4 x 7) in F₅ and F₆ generations respectively.

The low incidence of fusarium wilt at field condition was recorded in the parents Pusa Madhuras and Punjab Sunehari (each 1.00 & 1.00). In case of crosses, most of the progenies was recorded lowest incidence of fusarium wilt, in cross Hara Madhu x IVMM-3 (C₂: 3 x 4), IVMM-3 x Pusa Madhuras (C₄: 4 x 5) and IVMM-3 x Punjab Sunheri (C₅: 4 x 7) recorded low incidence (each 5.00 and 5.00) of fusarium wilt in the F₅ and F₆ generations respectively.

As regards the per cent incidence of leaf minor, the highest infestation of leaf miner was found in Pusa Madhuras (23.21 and 20.37 %) while least infestation was observed in

Durgapur selection (16.82 and 12.24 %) followed by Punjab Sunehari (18.22 and 14.28 %) in both F_5 and F_6 generation respectively. Among the crosses, the progenies of cross IVMM-3 x Punjab Sunehari (C_5 : 4 x 7) recorded least infestation of leaf miner (17.38 and 14.37 %).

6.4 Qualitative traits

Among the five crosses, segregating progenies of crosses Durgapura Selection x Punjab Sunheri (C_1 : 2 x 7), Hara Madhu x IVMM-3 (C_2 : 3 x 4), Hara Madhu x Punjab Sunheri (C_3 : 3 x 7), and IVMM-3 x Punjab Sunheri (C_4 : 4 x 7) showed round shape of fruits whereas round flat shape of fruit was observed in the progenies cross IVMM-3 x Pusa Madhuras (C_5 : 4 x 5) in both generations. In case of colour of fruits, yellowish with green ridges was observed in the crosses Durgapura Selection x Punjab Sunheri (C_1 : 2 x 7), Hara Madhu x IVMM-3 (C_2 : 3 x 4) and Hara Madhu x Punjab Sunheri (C_3 : 3 x 7) whereas the greenish with ridges as colour of fruits was observed in crosses IVMM-3 x Pusa Madhuras (C_5 : 4 x 5) and IVMM-3 x Punjab Sunheri (C_4 : 4 x 7) in the F_5 and F_6 generations. In The maximum number of progenies of all five crosses showed netted rind surface of fruits indicating monogenic and have partial dominant gene action over smoothness and partial netted rind surface in both the F_5 and F_6 generations.

In case of pulp flavor, the F_5 and F_6 progenies of all five crosses were recorded pleasant flavor and indicating monogenic dominant gene action. Incase of colour of pulp, the maximum number of progenies of all the five crosses *viz.*,

Durgapura Selection x Punjab Sunheri (C₁: 2 x 7), Hara Madhu x IVMM-3 (C₂: 3 x 4) and Hara Madhu x Punjab Sunheri (C₃: 3 x 7), IVMM-3 x Pusa Madhuras (C₄: 4 x 5) and IVMM-3 x Punjab Sunheri (C₅: 4 x 7) in both F₅ and F₆ generations showed orange colour of pulp. Thus, from the results it may be concluded that the orange colour of pulp was monogenically dominant over yellow and pale green colour of pulp.

6.5 Conclusion

On the basis of result obtained in present investigation following conclusions were made

1. A wide range of variability observed for most of the characters in F₅ and F₆ generations.
2. In all the crosses of F₅ and F₆ generations, the high estimates of phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV) were observed for most of the yield contributing characters, which suggested greater phenotypic and genotypic variability among the accessions and sensitiveness of the attributes for making further improvement by selection.
3. High estimates of genetic gain were observed for most of the yield contributing characters in five crosses of F₅ and F₆ generation indicating the importance of additive gene action, and can be improved to a large extent through selection.
4. High heritability with high genetic advance as per cent of mean was observed for most of the characters in five

crosses of F_5 and F_6 progenies and phenotypic selection for their improvement could be achieved by selection pressure.

5. High heritability with low genetic advance as per cent of mean also observed in some characters for which simple selection would not be rewarding.
6. In all five crosses of F_5 and F_6 generations, the significant and positive correlation both at phenotypic and the genotypic level were observed between fruit yield per vine and the yield contributing characters. Thus, association of characters should be considered while selection for increasing the yield.
7. Seven Superior progenies were identified for future crop improvement i.e. raising of F_7 generation based on 2.80 to 3.00 kg fruit yield per vine with good T.S.S., round shape of fruit, greenish yellow fruit colour with ridges, netted rind surface, pleasant flavor with orange pulp.

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*** Originals are not seen.**

8. VITA

MISS.GAIKWAD SHILPA DEORAM

A candidate for the degree
of

DOCTOR OF PHILOSOPHY (HORTICULTURE)

in

VEGETABLE SCIENCE

Title of thesis : Genetic studies in F₅ and F₆ generations of muskmelon (*Cucumis melo* L.)

Major field : Horticulture

Biographical information

Personal : Born at Rahuri, Dist. Ahmednagar on 15 Dec.1987. Doughter of Mrs. Sanjana and Mr. Deoram P. Gaikwad, having one sister Mrs. Smita and brother Mr. Sunil.

Educational : Attended Primary, Secondary and Higher Secondary School at Savitribai Phule Madhamik Vidyalaya, MPKV,Rahuri.

Received Bachelor of Science (Horti.) degree from College of Agriculture, Pune (MPKV, Rahuri) in 2009.

Received Master of Science (Horti.) degree from Dr.PDKV,Akola.

PERMANENT ADDRESS : G-47,Dnyaneshwar colony,MPKV,Rahuri

Email address : Shil151287@gmail.com

Table 14. Genotypic (G) and Phenotypic (P) correlation co-efficient for yield and yield contributing characters in F₅ generation of cross Durgapur Selection x Punjab Sunheri (C₁:2x7)

Sr. No.	Name of Character	S	1	2	3	4	5	6	7	8	9	10	11	12
1	Vine length	G P	1.000 1.000	0.638** 0.532**	0.537** 0.476*	0.712** 0.645**	-0.712** -0.673**	-0.778** -0.732**	0.723** 0.654**	0.967** 0.894**	0.988** 0.896**	0.975** 0.894**	0.783** 0.682**	0.564** 0.523**
2	No. of primary branches per vine	G P	- -	1.000 1.000	-0.894** -0.855**	0.802** 0.769**	-0.866** -0.836**	-0.898** -0.823**	0.756** 0.632**	0.783** 0.766**	0.978** 0.912**	0.548** 0.509**	0.923** 0.866**	0.986** 0.983**
3	Days to first female flower appear.	G P	- -	- -	1.000 1.000	0.822** 0.774**	0.935** 0.845**	0.943** 0.915**	-0.545** -0.508**	-0.854** -0.834**	-0.866** -0.789**	-0.647** -0.583**	-0.966** -0.884**	-0.854** -0.812**
4	Number of female flower per vine	G P	- -	- -	- -	1.000 1.000	-0.502** -0.478*	-0.572** -0.523**	0.756** 0.723**	0.894** 0.798**	0.993** 0.968**	0.733** 0.684**	0.622** 0.589**	0.786** 0.689**
5	Node at which first female flower appeared	G P	- -	- -	- -	- -	1.000 1.000	0.845** 0.802**	-0.834** -0.733**	-0.988** -0.965**	-0.673** -0.598**	-0.890** -0.867**	-0.923** -0.804**	-0.933** -0.867**
6	Days required for first harvest of fruit	G P	- -	- -	- -	- -	- -	1.000 1.000	-0.563** -0.510**	-0.943** -0.865**	-0.625** -0.596**	-0.893** -0.872**	-0.835** -0.804**	-0.948** -0.834**
7	No. of fruits per vine	G P	- -	- -	- -	- -	- -	- -	1.000 1.000	0.874** 0.804**	0.866** 0.795**	0.589** 0.503**	0.933** 0.875**	0.946** 0.894**
8	Average weight of fruit	G P	- -	- -	- -	- -	- -	- -	- -	1.000 1.000	0.463* 0.408*	0.856** 0.840**	0.956** 0.878**	0.923** 0.903**
9	Average length of fruit	G P	- -	- -	- -	- -	- -	- -	- -	- -	1.000 1.000	0.911** 0.823**	0.735** 0.684**	0.945** 0.812**
10	Average diameter of fruit	G P	- -	- -	- -	- -	- -	- -	- -	- -	- -	1.000 1.000	0.834** 0.709**	0.924** 0.845**
11	Average weight of pulp per fruit	G P	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	1.000 1.000	0.834** 0.734**
12	Fruit yield per vine	G P	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	1.000 1.000

*, ** : Significance at 5% and 1%, respectively.

Table 15. Genotypic (G) and Phenotypic (P) correlation co-efficient for yield and yield contributing characters in F₅ generation of cross Hara Madhu x IVMM-3 (C₂:3x4).

Sr. No.	Name of Character	S	1	2	3	4	5	6	7	8	9	10	11	12
1	Vine length	G P	1.000 1.000	0.834** 0.803**	0.744** 0.708**	0.673** 0.604**	0.673** 0.689**	0.763** 0.662**	0.612** 0.578**	0.856** 0.802**	0.975** 0.909**	0.978** 0.856**	0.878** 0.745**	0.563** 0.498**
2	No. of primary branches per vine	G P		1.000 1.000	-0.893** -0.806**	0.863** 0.802**	-0.834** -0.819**	-0.912** -0.963**	0.853** 0.833**	0.911** 0.843**	0.845** 0.802**	0.856** 0.824**	0.866** 0.892**	0.503** 0.488**
3	Days to first female flower app.	G P		-	1.000 1.000	0.845** 0.809**	0.834** 0.823**	0.945** 0.905**	-0.886** -0.823**	-0.902** -0.885**	-0.925** -0.804**	-0.875** -0.806**	-0.678** -0.605**	-0.587** -0.509**
4	Number of female flower per vine	G P		-	-	1.000 1.000	-0.895** -0.822**	-0.954** -0.911**	0.874** 0.802**	0.845** 0.823**	0.783** 0.673**	0.976** 0.811**	0.875** 0.833**	0.845** 0.834**
5	Node at which first female flower app.	G P		-	-	-	1.000 1.000	0.995** 0.904**	-0.877** -0.964**	-0.892** -0.811**	-0.672** -0.603**	-0.883** -0.894**	-0.905** -0.867**	-0.822** -0.803**
6	Days required for first harvest of fruit	G P		-	-	-	-	1.000 1.000	-0.925** -0.911**	-0.910** -0.893**	-0.678** -0.534**	-0.877** -0.808**	-0.923** -0.845**	-0.673** -0.564**
7	No. of fruits per vine	G P		-	-	-	-	-	1.000 1.000	0.977** 0.945**	0.867** 0.805**	0.875** 0.829**	0.678** 0.634**	0.683** 0.604**
8	Average weight of fruit	G P		-	-	-	-	-	-	1.000 1.000	0.956** 0.867**	0.845** 0.805**	0.608** 0.557**	0.835** 0.806**
9	Average length of fruit	G P		-	-	-	-	-	-	-	1.000 1.000	0.823** 0.785**	0.683** 0.604**	0.745** 0.798**
10	Average diameter of fruit	G P		-	-	-	-	-	-	-	-	1.000 1.000	0.845** 0.834**	0.689** 0.604**
11	Average weight of pulp per fruit	G P		-	-	-	-	-	-	-	-	-	1.000 1.000	0.599** 0.512**
12	Fruit yield per vine	G P		-	-	-	-	-	-	-	-	-	-	1.000 1.000

*, ** : Significance at 5% and 1%, respectively.

Table 16. Genotypic (G) and Phenotypic (P) correlation co-efficient for yield and yield contributing characters in F₅ generation of Hara Madhu x Punjab Sunheri (C₃:3x7).

Sr. No.	Name of Character	S	1	2	3	4	5	6	7	8	9	10	11	12
1	Vine length	G P	1.000 1.000	0.678** 0.509**	0.765** 0.702**	0.456* 0.406*	0.765** 0.609**	0.834** 0.624**	0.865** 0.784**	0.589** 0.545**	0.576** 0.687**	0.845** 0.685**	0.365* 0.307*	0.682** 0.576**
2	No. of primary branches per vine	G P		1.000 1.000	-0.845 -0.660	0.634** 0.589**	-0.756** -0.722**	-0.476* -0.382*	0.893** 0.765**	0.875** 0.768**	0.576** 0.634**	0.324* 0.305*	0.956** 0.644**	0.854** 0.844**
3	Days to first female flower app.	G P			1.000 1.000	0.598** 0.486**	0.834** 0.802**	0.574** 0.502**	-0.895** -0.654**	-0.684** -0.604**	-0.734** -0.695**	-0.489** -0.365**	-0.645** -0.366*	-0.733** -0.624**
4	Number of female flower per vine	G P				1.000 1.000	-0.715** -0.687**	-0.687** -0.644**	0.783** 0.704**	0.527* 0.478*	0.745** 0.709**	0.689** 0.567**	0.364* 0.324*	0.683** 0.611**
5	Node at which first female flower app.	G P					1.000 1.000	0.583** 0.503**	-0.462* -0.548**	-0.583** -0.503**	-0.678** -0.654**	-0.488** -0.408*	-0.324* -0.302*	-0.745** -0.705**
6	Days required for first harvest of fruit	G P						1.000 1.000	-0.577** -0.509**	-0.409* -0.398*	-0.689** -0.609**	-0.794** -0.623**	-0.456* -0.472*	-0.836** -0.672**
7	No. of fruits per vine	G P							1.000 1.000	0.345* 0.324*	0.855** 0.802**	0.956** 0.867**	0.734** 0.656**	0.788** 0.673**
8	Average weight of fruit	G P								1.000 1.000	0.811** 0.775**	0.876** 0.802**	0.845** 0.882**	0.845** 0.487**
9	Average length of fruit	G P									1.000 1.000	0.892** 0.856**	0.768** 0.714**	0.823** 0.764**
10	Average diameter of fruit	G P										1.000 1.000	0.765** 0.684**	0.967** 0.447*
11	Average weight of pulp per fruit	G P											1.000 1.000	0.568** 0.452*
12	Fruit yield per vine	G P												1.000 1.000

*, ** : Significance at 5% and 1%, respectively.

Table 17. Genotypic (G) and Phenotypic (P) correlation co-efficient for yield and yield contributing characters in F₅ generation of cross IVMM-3 x Pusa Madhuras (C₄:4x5)

Sr. No.	Name of Character	S	1	2	3	4	5	6	7	8	9	10	11	12
1	Vine length	G P	1.000 1.000	0.893** 0.768**	0.955** 0.845**	0.845** 0.863**	-0.867** -0.853**	-0.856** -0.804**	0.875** 0.911**	0.786** 0.705**	0.654** 0.603**	0.465** 0.406**	0.824** 0.805**	0.856** 0.644**
2	No. of primary branches per vine	G P		1.000 1.000	-0.875 -0.806	0.764** 0.675**	-0.865** -0.806**	-0.845** -0.704**	0.865** 0.705**	0.845** 0.708**	0.721** 0.687**	0.435** 0.391**	0.858** 0.865**	0.574** 0.485*
3	Days to first female flower app.	G P			1.000 1.000	0.765** 0.704**	0.833** 0.728**	0.856** 0.803**	-0.907** -0.845**	-0.863** -0.784**	-0.656** -0.785**	-0.589** -0.558**	-0.645** -0.578**	-0.534** -0.845**
4	Number of female flower per vine	G P				1.000 1.000	-0.657** -0.894**	-0.897** -0.856**	0.866** 0.834**	0.779** 0.704**	0.645** 0.611**	0.537** 0.598**	0.564** 0.463*	0.876** 0.961**
5	Node at which first female flower app.	G P					1.000 1.000	0.786** 0.705**	-0.854** -0.802**	-0.863** -0.822**	-0.844** -0.734**	-0.587** -0.345**	-0.678** -0.586**	-0.645** -0.574**
6	Days required for first harvest of fruit	G P						1.000 1.000	-0.723** -0.657**	-0.854** -0.710**	-0.476* -0.567**	-0.856** -0.756**	-0.524** -0.503**	-0.574** -0.434*
7	No. of fruits per vine	G P							1.000 1.000	0.867** 0.817**	0.806** 0.745**	0.609** 0.583**	0.845** 0.823**	0.768** 0.645**
8	Average weight of fruit	G P								1.000 1.000	0.573** 0.544**	0.367* 0.293*	0.893** 0.684**	0.884** 0.756**
9	Average length of fruit	G P									1.000 1.000	0.864** 0.802**	0.681** 0.603**	0.867** 0.755**
74 10	Average diameter of fruit	G P										1.000 1.000	0.389* 0.296*	0.583** 0.457*
11	Average weight of pulp per fruit	G P											1.000 1.000	0.584** 0.487**
12	Fruit yield per vine	G P												1.000 1.000

*, ** : Significance at 5% and 1%, respectively.

Table 18. Genotypic (G) and phenotypic (P) correlation co-efficient for yield and yield contributing characters in F₅ generation of cross IVMM-3 x Punjab Sunheri (C₅:4x7)

Sr. No.	Name of Character	S	1	2	3	4	5	6	7	8	9	10	11	12
1	Vine length	G P	1.000 1.000	0.756** 0.677**	0.424* 0.365*	0.476** 0.402*	-0.725** -0.682**	-0.389* -0.325*	0.345* 0.312*	0.867** 0.894**	0.745** 0.673**	0.874** 0.843**	0.683** 0.672**	0.675** 0.723**
2	No. of primary branches per vine	G P		1.000 1.000	-0.856** -0.820**	0.756** 0.780*	-0.678** -0.644**	-0.756** -0.642**	0.834** 0.805**	0.834** 0.823**	0.892** 0.803**	0.835** 0.761**	0.894** 0.788**	0.856** 0.874**
3	Days to first female flower app.	G P			1.000 1.000	0.644** 0.385*	0.834** 0.795**	0.892** 0.777**	-0.854** -0.867**	-0.867** -0.896**	-0.725** -0.645**	-0.833** -0.759**	-0.805** -0.743**	-0.884** -0.803**
4	Number of female flower per vine	G P				1.000 1.000	-0.845** -0.567**	-0.830** -0.720*	0.978** 0.545**	0.723** 0.657**	0.783** 0.681**	0.729** 0.244	0.748** 0.435*	0.864** 0.463**
5	Node at which first female flower app.	G P					1.000 1.000	0.790** 0.721**	-0.567** -0.467**	-0.867** -0.733**	-0.845** -0.747**	-0.568** -0.511**	-0.794** -0.679**	-0.793** -0.694**
6	Days required for first harvest of fruit	G P						1.000 1.000	-0.866** -0.804**	-0.867** -0.873**	-0.829** -0.767**	-0.862** -0.897**	-0.692** -0.856**	-0.693** -0.599**
7	No. of fruits per vine	G P							1.000 1.000	0.856** 0.805**	0.856** 0.783**	0.839** 0.788**	0.833** 0.769**	0.589** 0.683**
8	Average weight of fruit	G P								1.000 1.000	0.867** 0.658**	0.829** 0.655**	0.782** 0.856**	0.856** 0.583**
9	Average length of fruit	G P									1.000 1.000	0.587** 0.532**	0.864** 0.854**	0.672** 0.783**
10	Average diameter of fruit	G P										1.000 1.000	0.895** 0.706**	0.855** 0.765**
11	Average weight of pulp per fruit	G P											1.000 1.000	0.684** 0.534**
12	Fruit yield per vine	G P												1.000 1.000

*, ** : Significance at 5% and 1%, respectively.

Table 19. Genotypic (G) and Phenotypic (P) correlation co-efficient for yield and yield contributing characters in F₆ generation of cross Durgapur Selection x Punjab Sunheri (C₁:2x7)

Sr. No.	Name of Character	S	1	2	3	4	5	6	7	8	9	10	11	12
1	Vine length	G P	1.000 1.000	0.543** 0.465*	0.776** 0.705**	0.674** 0.588**	0.756** 0.709**	0.885** 0.756**	0.674** 0.623**	0.846** 0.804**	0.866** 0.753**	0.845** 0.723**	0.857** 0.743**	0.643** 0.583**
2	No. of primary branches per vine	G P		1.000 1.000	-0.867** -0.796**	0.569** 0.487*	-0.485* -0.322	-0.744** -0.706**	0.564** 0.508*	0.895** 0.645**	0.834** 0.711**	0.645** 0.615**	0.842** 0.754**	0.645** 0.743**
3	Days to first female flower app.	G P			1.000 1.000	0.856** 0.833**	0.976** 0.856**	0.742** 0.705**	-0.682** -0.511*	-0.734** -0.711**	-0.743** -0.603*	-0.598** -0.489**	-0.677** -0.805**	-0.783** -0.843**
4	Number of female flower per vine	G P				1.000 1.000	-0.785** -0.647**	-0.453* -0.360	0.744** 0.434*	0.573** 0.343	0.821** 0.644**	0.684** 0.588**	0.684** 0.634**	0.634** 0.722**
5	Node at which first female flower app.	G P					1.000 1.000	0.886** 0.745**	-0.684** -0.533*	-0.833** -0.745**	-0.445* -0.367	-0.784** -0.667**	-0.643** -0.584**	-0.653** -0.604**
6	Days required for first harvest of fruit	G P						1.000 1.000	-0.780** -0.675**	-0.824** -0.734**	-0.423* -0.406*	-0.786** -0.704**	-0.832** -0.486*	-0.945** -0.734**
7	No. of fruits per vine	G P							1.000 1.000	-0.981** -0.756**	0.734** 0.711**	0.678** 0.566**	0.455* 0.583**	0.634** 0.543**
8	Average weight of fruit	G P								1.000 1.000	0.809** 0.734**	0.669** 0.590**	0.845** 0.779**	0.674** 0.519**
9	Average length of fruit	G P									1.000 1.000	0.745** 0.783**	0.683** 0.487*	0.784** 0.634**
10	Average diameter of fruit	G P										1.000 1.000	0.834** 0.739**	0.756** 0.643**
11	Average weight of pulp per fruit	G P											1.000 1.000	0.812** 0.734**
12	Fruit yield per vine	G P												1.000 1.000

*, ** : Significance at 5% and 1%, respectively.

Table 20. Genotypic (G) and Phenotypic (P) correlation co-efficient for yield and yield contributing characters in F₆ generation of cross Hara Madhu x IVMM-3 (C₂:3x4)

Sr. No.	Name of Character	S	1	2	3	4	5	6	7	8	9	10	11	12
1	Vine length	G P	1.000 1.000	0.567** 0.644**	0.634* 0.573*	0.734** 0.622**	-0.432* -0.407*	-0.564** -0.466*	0.956** 0.845**	0.544** 0.498*	0.955** 0.863**	0.935** 0.804**	0.425* 0.308	0.463* 0.673*
2	No. of primary branches per vine	G P		1.000 1.000	-0.684** -0.477**	0.934** 0.876**	-0.578** -0.655**	-0.583** -0.832**	0.885** 0.821**	0.754** 0.843**	0.908** 0.834**	0.911** 0.873**	0.432* 0.398	0.873** 0.783**
3	Days to first female flower app.	G P			1.000 1.000	0.931** 0.750**	0.343 0.309	0.734** 0.635**	-0.915** -0.865**	-0.734** -0.628**	-0.845** -0.745**	-0.964** -0.963**	-0.473** -0.408**	-0.733** -0.629**
4	Number of female flower per vine	G P				1.000 1.000	-0.454** -0.356**	-0.876** -0.795**	0.874** 0.894**	0.934** 0.856**	0.567** 0.473*	0.377 0.304	0.543** 0.508*	0.834** 0.805**
5	Node at which first female flower app.	G P					1.000 1.000	0.854** 0.833**	-0.988** -0.963**	-0.843** -0.729**	-0.648** -0.583**	-0.745** -0.711**	-0.564** -0.509*	-0.934** -0.905**
6	Days required for first harvest of fruit	G P						1.000 1.000	-0.943** -0.808**	-0.833** -0.745**	-0.739** -0.609**	-0.843** -0.804**	-0.997** -0.943**	-0.764** -0.673**
7	No. of fruits per vine	G P							1.000 1.000	0.832** 0.856**	0.544** 0.534**	0.944** 0.843**	0.927** 0.890**	0.975** 0.904**
8	Average weight of fruit	G P								1.000 1.000	0.895** 0.805**	0.934** 0.865**	0.945** 0.976**	0.966** 0.915**
9	Average length of fruit	G P									1.000 1.000	0.843** 0.832**	0.853** 0.833**	0.755** 0.674**
10	Average diameter of fruit	G P										1.000 1.000	0.811** 0.745**	0.576** 0.493*
11	Average weight of pulp per fruit	G P											1.000 1.000	0.783** 0.456*
12	Fruit yield per vine	G P												1.000 1.000

*, ** : Significance at 5% and 1%, respectively.

Table 21. Genotypic (G) and Phenotypic (P) correlation co-efficient for yield and yield contributing characters in F₆ generation of cross Hara Madhu x Punjab Sunheri (C₃:3x7)

Sr. No.	Name of Character	S	1	2	3	4	5	6	7	8	9	10	11	12
1	Vine length	G P	1.000 1.000	0.867** 0.833**	0.867** 0.805**	0.734** 0.673**	-0.966** -0.845**	-0.823** -0.734**	0.921** 0.736**	0.756** 0.675**	0.845** 0.804**	0.674** 0.564**	0.845** 0.934**	0.845** 0.743**
2	No. of primary branches per vine	G P		1.000 1.000	-0.856** -0.812**	0.436* 0.407*	-0.905** -0.898**	-0.834** -0.739**	0.654** 0.608**	0.856** 0.756**	0.854** 0.822**	0.988** 0.845**	0.845** 0.835**	0.833** 0.732**
3	Days to first female flower app.	G P			1.000 1.000	0.865** 0.846**	0.935** 0.924**	0.834** 0.784**	-0.756** -0.798**	-0.845** -0.725**	-0.955** -0.945**	-0.843** -0.967**	-0.988** -0.874**	-0.859** -0.745**
4	Number of female flower per vine	G P				1.000 1.000	-0.944** -0.832**	-0.953** -0.804**	0.867** 0.844**	0.856** 0.805**	0.934** 0.823**	0.967** 0.834**	0.845** 0.943**	0.865** 0.654**
5	Node at which first female flower app.	G P					1.000 1.000	0.965** 0.905**	-0.634** -0.685**	-0.745** -0.722**	-0.902** -0.922**	-0.965** -0.906**	-0.965** -0.966**	-0.674** -0.608**
6	Days required for first harvest of fruit	G P						1.000 1.000	-0.785** -0.876**	-0.867** -0.805**	-0.978** -0.956**	-0.805** -0.756**	-0.906** -0.911**	-0.786** -0.567**
7	No. of fruits per vine	G P							1.000 1.000	0.765 0.844	0.967** 0.954**	0.845** 0.765**	0.439* 0.409*	0.674** 0.611**
8	Average weight of fruit	G P								1.000 1.000	0.865** 0.733**	0.743** 0.654**	0.675** 0.611**	0.922** 0.546**
9	Average length of fruit	G P									1.000 1.000	0.865** 0.766**	0.965** 0.904**	0.954** 0.908**
10	Average diameter of fruit	G P										1.000 1.000	0.935** 0.927**	0.944** 0.676**
11	Average weight of pulp per fruit	G P											1.000 1.000	0.856** 0.654**
12	Fruit yield per vine	G P												1.000 1.000

*, ** : Significance at 5% and 1%, respectively.

Table 22. Genotypic (G) and Phenotypic (P) correlation co-efficient for yield and yield contributing characters in F₆ generation of cross IVMM-3 x Pusa Madhuras (C₄:4x5)

Sr. No.	Name of Character	S	1	2	3	4	5	6	7	8	9	10	11	12
1	Vine length	G P	1.000 1.000	0.756** 0.654**	0.654** 0.564*	0.856** 0.812**	-0.732** -0.834**	-0.644** -0.523**	0.923** 0.812**	0.964** 0.834**	0.545** 0.502**	0.743** 0.612**	0.934** 0.832**	0.832** 0.803**
2	No. of primary branches per vine	G P		1.000 1.000	0.845** -0.814**	0.845** 0.711**	-0.831** -0.804**	-0.645** -0.604**	0.965** 0.734**	0.843** 0.893**	0.758** 0.675**	0.945** 0.825**	0.933** 0.864**	0.843** 0.744**
3	Days to first female flower app.	G P			1.000 1.000	0.905** 0.478*	0.843** 0.347	0.864** 0.411*	-0.845** -0.785**	-0.823** -0.645**	-0.582** -0.466*	-0.988** -0.453**	-0.964** -0.365	-0.843** -0.634**
4	Number of female flower per vine	G P				1.000 1.000	-0.645** -0.564**	-0.875** -0.811**	0.834** 0.803**	0.844** 0.756**	0.854** 0.807**	0.887** 0.810**	0.834** 0.634**	0.723** 0.496
5	Node at which first female flower app.	G P					1.000 1.000	0.934** 0.824**	-0.845** -0.349	-0.844** -0.754**	-0.845** -0.814**	-0.885** -0.865**	-0.893** -0.750**	-0.745** -0.833**
6	Days required for first harvest of fruit	G P						1.000 1.000	-0.911** -0.945**	-0.744** -0.704**	-0.843** -0.803**	-0.923** -0.905**	-0.945** -0.632**	-0.832** -0.802**
7	No. of fruits per vine	G P							1.000 1.000	0.798** 0.678**	0.911** 0.864**	0.944** 0.912**	0.733** 0.704**	0.933** 0.903**
8	Average weight of fruit	G P								1.000 1.000	0.943** 0.923**	0.943** 0.914**	0.812** 0.806**	0.834** 0.723**
9	Average length of fruit	G P									1.000 1.000	0.964** 0.905**	0.934** 0.834**	0.854** 0.834**
10	Average diameter of fruit	G P										1.000 1.000	0.964** 0.835**	0.784** 0.644**
11	Average weight of pulp per fruit	G P											1.000 1.000	0.832** 0.783**
12	Fruit yield per vine	G P												1.000 1.000

*, ** : Significance at 5% and 1%, respectively.

Table 23. Genotypic (G) and Phenotypic (P) correlation co-efficient for yield and yield contributing characters in F₆ generation of cross IVMM-3 x Punjab Sunheri (C₅:4x7)

Sr. No.	Name of Character	S	1	2	3	4	5	6	7	8	9	10	11	12
1	Vine length	G P	1.000 1.000	0.943** 0.811**	0.712** 0.534**	0.844** 0.805**	-0.834** -0.853**	-0.932** -0.743**	0.534** 0.423*	0.734** 0.645**	0.945** 0.833**	0.922** 0.856**	0.943** 0.823**	0.832** 0.801**
2	No. of primary branches per vine	G P		1.000 1.000	-0.765** -0.645**	0.398 0.311	-0.903** -0.734**	-0.875** -0.758**	0.543** 0.498*	0.756** 0.623**	0.964** 0.856**	0.934** 0.834**	0.911** 0.834**	0.884** 0.812**
3	Days to first female flower app.	G P			1.000 1.000	0.745** 0.612**	0.745** 0.645**	0.845** 0.723**	-0.743** -0.703**	-0.867** -0.855**	-0.933** -0.834**	-0.942** -0.843**	-0.834** -0.801**	-0.917** -0.898**
4	Number of female flower per vine	G P				1.000 1.000	-0.743** -0.644**	-0.534** -0.454**	0.843** 0.859**	0.834** 0.756**	0.832** 0.844**	0.988** 0.974**	0.955** 0.923**	0.833** 0.974**
5	Node at which first female flower app.	G P					1.000 1.000	0.845** 0.684**	-0.677** -0.578**	-0.945** -0.927**	-0.803** -0.734**	-0.734** -0.845**	-0.904** -0.923**	-0.854** -0.804**
6	Days required for first harvest of fruit	G P						1.000 1.000	-0.782** -0.704**	-0.988** -0.893**	-0.834** -0.723**	-0.723** -0.703**	-0.953** -0.972**	0.824** -0.811**
7	No. of fruits per vine	G P							1.000 1.000	0.909** 0.821**	0.843** 0.806**	0.834** 0.765**	0.972** 0.923**	0.854** 0.832**
8	Average weight of fruit	G P								1.000 1.000	0.904** 0.933**	0.433* 0.308	0.911** 0.872**	0.822** 0.801**
9	Average length of fruit	G P									1.000 1.000	0.986** 0.911**	0.834** 0.804**	0.854** 0.812**
10	Average diameter of fruit	G P										1.000 1.000	0.843** 0.804**	0.845** 0.850**
11	Average weight of pulp per fruit	G P											1.000 1.000	0.879** 0.834**
12	Fruit yield per vine	G P												1.000 1.000

*, ** : Significance at 5% and 1%, respectively.

Table 4. Mean, range, GCV, PCV, ECV, heritability, genetic advance and per cent mean of genetic advance of two parents and F₅ population of cross Durgapur Selection x Punjab Sunheri (C₁:2x7).

Sr. No.	Character	Mean	Range	GCV (%)	PCV (%)	ECV (%)	h² (bs) (%)	GA	GAM (%)
1.	Vine length (cm)	201.38	171.34-236.14	10.76	10.84	1.91	96.94	43.59	21.16
2.	No. of primary branches per vine	2.68	2.31-2.84	11.36	11.68	1.74	98.12	0.59	22.01
3.	Days to first female flower appearance	37.34	35.14-41.95	5.68	5.76	1.79	90.91	4.10	10.98
4.	Numbers of male flower per vine	71.94	69.21-85.74	10.78	10.89	0.43	99.87	16.12	22.04
5.	Number of female flowers per vine	12.62	11.82-12.74	10.39	10.51	1.65	97.64	2.69	21.37
6.	Sex ratio	5.70	5.59-7.19	10.36	10.57	1.86	96.98	1.27	22.34
7.	Node at which first female flower appeared	4.27	4.15-4.67	6.96	7.04	1.10	97.68	0.62	14.51
8.	Days required for first harvest of fruit	71.14	70.69-84.68	6.27	6.31	0.91	97.95	9.18	12.91
9.	No. of fruits per vine	2.75	2.41-2.84	10.63	10.89	2.31	95.54	0.59	21.52
10.	Fruit yield per vine (kg)	2.30	1.64-2.56	14.12	14.92	5.48	86.26	0.55	23.92
11.	Average weight of fruit(g)	759.31	611.36-842.12	12.45	13.35	4.97	86.31	176.12	23.25

Table 4 contd...

Sr. No.	Character	Mean	Range	GCV (%)	PCV (%)	ECV (%)	h² (bs) (%)	GA	GAM (%)
12.	Average length of fruit (cm)	10.68	10.11-10.87	2.64	2.68	0.34	98.54	0.58	5.42
13.	Average diameter of fruit (cm)	10.81	9.42-11.36	5.06	5.36	1.79	88.86	1.07	10.29
14.	Average rind thickness (cm)	0.25	0.17-0.26	12.81	14.72	7.12	76.45	0.07	28.00
15.	Average pulp thickness (cm)	2.39	2.17-2.75	5.56	5.59	0.71	98.51	0.27	11.31
16.	Average fruit cavity (cm)	41.35	39.41-43.68	12.58	12.69	3.79	90.95	9.15	22.12
17.	Average weight of pulp per fruit (gm)	572.65	370.31-632.17	13.76	14.68	4.26	91.45	132.26	23.18
18.	Average weight of seed per fruit (gm)	8.72	8.23-10.79	10.74	10.76	0.30	99.94	1.93	22.13
19.	T.S.S. (%)	11.52	10.64-11.72	12.24	13.15	4.61	87.72	2.65	23.00
20.	Acidity (%)	1.19	1.15-1.31	12.31	12.76	2.98	49.39	0.23	19.34
21.	Ascorbic acid (%)	25.62	25.36-26.42	8.71	8.75	1.14	98.31	4.58	17.87
22.	Total Sugar (%)	9.52	9.27-9.59	4.88	4.82	1.68	89.41	0.91	9.62
23.	Reducing sugar (%)	7.28	7.21-7.34	6.34	6.85	0.51	82.36	0.51	7.02
24.	Non reducing sugar (%)	2.23	2.05-2.29	3.78	4.01	1.48	86.63	0.17	7.61

Table 6. Mean, range, GCV, PCV, ECV, heritability, genetic advance and per cent mean of genetic advance of two parents and F₅ population of Hara Madhu x IVMM-3 (C₂:3x4)

Sr. No.	Character	Mean	Range	GCV (%)	PCV (%)	ECV (%)	h² (bs) (%)	GA	GAM (%)
1.	Vine length (cm)	218.42	194.32-235.12	11.47	11.82	2.78	94.36	48.32	22.12
2.	No. of primary branches per vine	2.72	2.61-2.87	11.60	11.92	1.61	97.68	0.68	25.21
3.	Days to first female flower appearance	37.22	36.68-41.34	7.52	7.84	2.21	93.28	5.72	15.41
4.	Numbers of male flower per vine	65.41	61.81-72.34	10.88	11.16	2.65	93.34	15.21	23.32
5.	Number of female flowers per vine	13.02	11.88-13.68	10.64	10.78	1.63	98.70	2.86	22.15
6.	Sex ratio	5.02	4.98-6.24	11.08	11.19	1.57	98.20	1.29	22.71
7.	Node at which first female flower appeared	4.12	3.86-6.44	18.87	18.92	0.53	99.94	1.87	45.4
8.	Days required for first harvest of fruit	73.31	61.83-80.31	5.81	5.94	1.18	96.11	9.54	13.01
9.	No. of fruits per vine	2.78	2.48-2.94	15.91	16.25	3.20	96.17	0.87	31.34
10.	Fruit yield per vine (kg)	2.24	1.94-2.46	15.44	15.68	2.54	97.64	0.61	27.21
11.	Average weight of fruit(g)	898.35	617.92-944.35	11.09	11.21	1.96	97.35	177.89	22.36
12.	Average length of fruit (cm)	11.48	8.75-12.31	11.04	11.14	0.28	99.12	2.61	22.71

Table 6 contd...

Sr. No.	Character	Mean	Range	GCV (%)	PCV (%)	ECV (%)	h² (bs) (%)	GA	GAM (%)
13.	Average diameter of fruit (cm)	12.87	10.84-13.36	6.81	6.87	1.21	99.35	1.87	14.51
14.	Average rind thickness (cm)	0.19	0.17-0.21	10.13	10.68	5.21	75.81	1.16	16.66
15.	Average pulp thickness (cm)	2.42	1.98-2.61	10.22	10.34	1.42	98.11	0.52	21.82
16.	Average fruit cavity (cm)	45.64	36.48-51.75	16.12	16.21	1.09	99.58	18.43	40.41
17.	Average weight of pulp per fruit (gm)	521.12	358.71-587.84	17.37	17.82	3.11	96.83	183.72	35.30
18.	Average weight of seed per fruit (gm)	8.94	8.48-10.72	13.62	13.71	0.45	99.81	2.53	28.32
19.	T.S.S. (%)	11.64	11.12-11.85	13.35	14.43	5.73	84.52	2.84	24.42
20.	Acidity (%)	1.18	1.14-1.34	5.73	6.09	1.97	89.17	0.12	10.24
21.	Ascorbic acid (%)	26.19	25.89-26.94	10.37	11.54	1.61	78.21	4.28	16.32
22.	Total Sugar (%)	10.11	9.27-10.32	3.69	3.71	0.32	99.37	0.77	7.56
23.	Reducing sugar (%)	8.04	7.24-8.28	5.51	5.56	0.36	99.56	0.92	11.42
24.	Non reducing sugar (%)	1.92	1.82-2.43	10.21	10.49	2.44	94.51	0.40	20.81

Table 8. Mean, range, GCV, PCV, ECV, heritability, genetic advance and per cent mean of genetic advance of two parents and F₅ population of cross Hara Madhu x Punjab Sunheri (C₃:3x7)

Sr. No.	Character	Mean	Range	GCV (%)	PCV (%)	ECV (%)	h² (bs) (%)	GA	GAM (%)
1.	Vine length (cm)	221.38	215.35-239.47	13.56	15.74	7.98	74.66	55.29	25.00
2.	No. of primary branches per vine	2.32	2.24-2.51	12.08	12.84	4.48	84.78	0.57	24.61
3.	Days to first female flower appearance	38.69	35.12-43.56	6.51	8.66	5.29	60.32	4.54	11.71
4.	Numbers of male flower per vine	79.15	68.35-85.64	10.01	10.09	0.52	98.71	16.41	20.71
5.	Number of female flowers per vine	11.14	10.58-13.31	12.32	12.77	3.24	92.64	2.59	23.21
6.	Sex ratio	7.10	6.38-8.24	11.47	11.64	1.95	96.38	1.76	24.01
7.	Node at which first female flower appeared	5.01	4.86-6.40	9.51	9.53	0.62	99.61	1.03	19.57
8.	Days required for first harvest of fruit	88.24	82.64-90.00	5.72	5.97	1.64	92.24	10.21	11.46
9.	No. of fruits per vine	3.02	2.61-3.42	12.51	12.61	1.38	96.79	0.79	26.29
10.	Fruit yield per vine (kg)	1.74	1.65-1.84	16.91	19.13	8.87	79.45	0.52	29.35
11.	Average weight of fruit(g)	556.42	488.62-687.34	11.57	12.42	4.45	87.94	123.61	22.20

Table 8 contd...

Sr. No.	Character	Mean	Range	GCV (%)	PCV (%)	ECV (%)	h² (bs) (%)	GA	GAM (%)
12.	Average length of fruit (cm)	9.12	8.37-11.27	11.54	11.58	0.56	99.61	2.14	24.12
13.	Average diameter of fruit (cm)	12.24	10.42-13.21	6.42	6.56	1.24	96.32	1.47	12.01
14.	Average rind thickness (cm)	0.31	0.18-0.33	15.04	15.94	5.21	89.27	0.09	22.61
15.	Average pulp thickness (cm)	1.72	1.64-2.03	8.48	8.57	1.17	98.12	0.27	15.72
16.	Average fruit cavity (cm)	41.32	38.31-56.32	14.66	14.68	0.36	99.95	13.27	32.13
17.	Average weight of pulp per fruit (gm)	364.35	309.31-410.28	11.77	13.27	6.08	78.93	74.85	20.52
18.	Average weight of seed per fruit (gm)	7.09	6.35-9.81	18.97	18.93	0.38	99.97	2.75	38.62
19.	T.S.S. (%)	11.12	11.00-11.30	13.42	15.59	7.81	75.11	2.53	22.81
20.	Acidity (%)	1.34	1.31-1.37	11.80	12.17	2.31	55.53	0.22	16.41
21.	Ascorbic acid (%)	26.40	26.16-27.12	10.38	11.81	1.37	76.32	4.47	16.91
22.	Total Sugar (%)	8.45	8.20-9.24	4.63	4.69	0.78	97.34	0.89	10.51
23.	Reducing sugar (%)	7.25	7.21-7.34	5.33	6.15	0.82	88.12	0.48	6.62
24.	Non reducing sugar (%)	1.21	1.02-2.12	5.85	6.05	2.15	88.35	0.23	19.62

Table 10. Mean, range, GCV, PCV, ECV, heritability, genetic advance and per cent mean of genetic advance of two parents and F₅ population of cross IVMM-3 x Pusa Madhuras (C₄:4x5)

Sr. No.	Character	Mean	Range	GCV (%)	PCV (%)	ECV (%)	h² (bs) (%)	GA	GAM (%)
1.	Vine length (cm)	209.24	167.17-227.12	11.37	11.53	1.92	97.26	45.98	22.00
2.	No. of primary branches per vine	2.61	2.24-2.76	11.69	11.76	1.30	98.81	0.61	23.41
3.	Days to first female flower appearance	38.64	36.60-44.29	7.71	7.89	1.74	95.27	5.98	15.5
4.	Numbers of male flower per vine	76.12	65.81-81.92	10.56	10.65	1.42	98.26	16.82	22.14
5.	Number of female flowers per vine	12.74	9.94-13.52	10.82	10.89	1.76	97.46	2.81	22.16
6.	Sex ratio	5.97	5.62-8.33	13.59	13.78	2.18	97.56	1.74	27.62
7.	Node at which first female flower appeared	4.12	3.97-6.24	21.69	21.82	0.52	99.97	2.01	44.72
8.	Days required for first harvest of fruit	73.12	71.34-84.35	7.73	8.09	2.43	92.08	13.57	18.61
9.	No. of fruits per vine	3.15	2.64-3.38	12.30	12.38	1.27	99.94	0.76	24.15
10.	Fruit yield per vine (kg)	1.99	1.62-2.13	13.73	14.51	4.52	91.23	0.54	27.18
11.	Average weight of fruit(g)	683.24	512.32-709.13	14.66	18.81	11.76	61.72	154.12	22.63

Table 10 contd...

Sr. No.	Character	Mean	Range	GCV (%)	PCV (%)	ECV (%)	h² (bs) (%)	GA	GAM (%)
12.	Average length of fruit (cm)	9.94	8.17-10.12	5.59	5.69	1.01	97.12	1.09	11.00
13.	Average diameter of fruit (cm)	11.84	10.90-11.98	3.27	3.43	1.04	91.34	0.76	11.10
14.	Average rind thickness (cm)	0.24	0.18-0.27	14.25	16.35	8.01	76.98	0.07	29.28
15.	Average pulp thickness (cm)	2.21	1.92-2.34	10.12	11.12	1.25	99.32	0.45	20.41
16.	Average fruit cavity (cm)	39.14	32.94-49.35	12.17	12.19	0.52	99.84	9.57	24.53
17.	Average weight of pulp per fruit (gm)	503.62	475.32-530.15	17.67	23.96	16.21	77.16	100.52	20.12
18.	Average weight of seed per fruit (gm)	8.91	8.12-12.24	16.86	16.89	0.36	99.98	3.09	34.71
19.	T.S.S. (%)	11.21	10.81-11.19	15.15	15.84	3.02	89.10	2.47	22.00
20.	Acidity (%)	1.19	1.16-1.48	8.36	8.64	2.10	93.98	0.21	17.66
21.	Ascorbic acid (%)	26.15	24.42-26.48	8.32	8.65	2.36	93.40	4.32	16.51
22.	Total Sugar (%)	10.11	9.13-10.48	5.28	5.29	0.68	98.48	1.09	10.87
23.	Reducing sugar (%)	8.17	7.28-8.47	6.51	6.57	0.31	99.84	1.10	13.51
24.	Non reducing sugar (%)	1.83	1.79-1.96	6.04	6.98	1.55	64.61	0.17	9.35

Table 12. Mean, range, GCV, PCV, ECV, heritability, genetic advance and per cent mean of genetic advance of two parents and F₅ population of cross IVMM-3 x Punjab Sunheri (C₅:4x7)

Sr. No.	Character	Mean	Range	GCV (%)	PCV (%)	ECV (%)	h² (bs) (%)	GA	GAM (%)
1.	Vine length (cm)	219.35	189.32-239.15	12.67	12.99	2.92	94.96	55.23	25.24
2.	No. of primary branches per vine	2.52	2.24-2.63	12.43	12.62	1.75	98.06	0.69	27.42
3.	Days to first female flower appearance	35.75	34.00-42.38	8.12	8.18	1.58	96.32	5.98	16.71
4.	Numbers of male flower per vine	74.38	73.01-85.22	10.93	10.95	0.85	99.51	17.19	23.15
5.	Number of female flowers per vine	13.04	11.32-13.84	5.84	6.12	1.81	93.36	2.73	20.91
6.	Sex ratio	5.70	6.08-7.12	12.34	13.04	4.21	89.63	1.52	23.81
7.	Node at which first female flower appeared	4.32	3.98-5.84	16.21	16.24	0.68	99.84	1.47	33.37
8.	Days required for first harvest of fruit	76.35	69.32-84.38	5.97	6.02	0.80	98.27	9.60	12.61
9.	No. of fruits per vine	3.12	2.86-3.28	12.14	12.27	1.69	98.17	0.78	25.00
10.	Fruit yield per vine (kg)	2.74	1.57-2.92	21.58	21.75	2.87	98.29	1.15	42.02
11.	Average weight of fruit(g)	847.12	584.12-915.17	16.09	16.27	2.42	97.80	274.26	32.41

Table 12 contd....

Sr. No.	Character	Mean	Range	GCV (%)	PCV (%)	ECV (%)	h² (bs) (%)	GA	GAM (%)
12.	Average length of fruit (cm)	11.48	9.12-12.09	12.61	12.63	0.35	99.92	2.73	23.85
13.	Average diameter of fruit (cm)	12.18	10.35-13.23	7.25	7.29	0.21	99.93	1.71	14.07
14.	Average rind thickness (cm)	0.25	0.19-0.28	14.97	15.18	2.32	97.63	0.09	36.25
15.	Average pulp thickness (cm)	2.63	1.87-2.95	12.98	13.01	0.95	99.47	0.67	25.01
16.	Average fruit cavity (cm)	41.32	32.82-43.55	9.01	9.02	0.32	99.91	7.59	18.41
17.	Average weight of pulp per fruit (gm)	612.32	424.34-672.31	23.14	23.35	3.24	98.10	269.58	44.10
18.	Average weight of seed per fruit (gm)	11.18	10.12-12.21	10.25	10.27	0.81	99.41	2.31	21.72
19.	T.S.S. (%)	12.14	11.31-12.54	10.76	11.23	3.37	91.18	2.89	23.82
20.	Acidity (%)	1.21	1.17-1.32	10.21	11.72	5.78	75.86	0.21	17.41
21.	Ascorbic acid (%)	25.09	24.31-25.59	9.17	9.20	3.11	75.06	4.51	18.01
22.	Total Sugar (%)	9.52	9.23-9.81	4.02	4.07	0.62	97.67	0.79	8.31
23.	Reducing sugar (%)	7.05	6.95-7.31	7.71	7.93	0.33	67.98	0.57	8.01
24.	Non reducing sugar (%)	2.45	1.97-2.48	6.84	6.94	1.18	97.14	0.33	13.42

Table 5. Mean, range, GCV, PCV, ECV, heritability, genetic advance and per cent mean of genetic advance of two parents and F₆ population of cross Durgapur Selection x Punjab Sunheri (C₁:2x7)

Sr. No.	Character	Mean	Range	GCV (%)	PCV (%)	ECV (%)	h² (bs) (%)	GA	GAM (%)
1.	Vine length (cm)	205.41	163.83-212.64	10.94	11.31	1.94	98.27	42.63	20.85
2.	No. of primary branches per vine	2.34	2.18-2.41	11.15	11.27	1.52	98.09	0.54	23.17
3.	Days to first female flower appearance	32.00	29.09-36.28	6.77	7.04	1.92	93.64	4.11	12.84
4.	Number of male flower per vine	59.62	50.68-67.51	10.84	10.98	0.91	98.42	12.38	20.89
5.	Number of female flowers per vine	11.25	11.05-12.36	11.68	11.94	1.83	98.12	2.41	21.42
6.	Sex ratio	5.30	5.17-6.05	11.08	11.20	5.08	82.59	1.20	22.06
7.	Node at which first female flower appeared	4.19	3.86-5.13	6.71	6.78	1.04	97.26	0.59	14.18
8.	Days required for first harvest of fruit	67.32	65.13-73.23	5.75	5.98	0.94	98.12	8.01	11.94
9.	No. of fruits per vine	2.94	2.72-3.01	11.47	11.62	1.07	97.21	0.65	22.10
10.	Fruit yield per vine (kg)	2.45	2.15-2.58	14.21	15.11	1.03	99.38	0.59	24.1
11.	Average weight of fruit(g)	810.00	632.48-872.35	12.07	12.31	0.52	98.34	182.45	22.54

Table 5 contd...

Sr. No.	Character	Mean	Range	GCV (%)	PCV (%)	ECV (%)	h² (bs) (%)	GA	GAM (%)
12.	Average length of fruit (cm)	10.82	10.75-11.02	3.21	3.38	0.39	99.15	0.69	6.45
13.	Average diameter of fruit (cm)	10.94	10.42-11.28	4.92	4.96	0.41	99.48	1.11	10.18
14.	Average rind thickness (cm)	0.27	0.21-0.30	14.28	15.71	6.31	82.67	0.06	22.24
15.	Average pulp thickness (cm)	2.46	2.15-2.67	5.81	5.94	0.68	97.35	0.27	11.01
16.	Average fruit cavity (cm)	41.31	40.45-43.61	11.15	11.92	4.38	87.38	9.01	21.81
17.	Average weight of pulp per fruit (gm)	594.35	560.35-610.24	18.19	18.31	1.16	99.64	181.38	30.54
18.	Average weight of seed per fruit (gm)	8.12	7.86-9.15	11.60	11.99	0.96	99.12	1.73	21.35
19.	T.S.S. (%)	12.28	11.86-12.48	12.31	12.64	3.32	93.68	2.58	21.05
20.	Acidity (%)	1.26	1.20-1.39	5.94	6.33	2.61	82.73	0.14	11.13
21.	Ascorbic acid (%)	25.70	24.57-26.12	8.27	8.41	1.24	97.86	4.35	16.91
22.	Total Sugar (%)	9.15	8.86-9.74	4.61	4.78	0.27	99.70	0.92	10.01
23.	Reducing sugar (%)	7.62	7.23-7.84	4.96	5.18	1.24	94.41	0.78	10.21
24.	Non reducing sugar (%)	1.53	1.36-2.12	3.34	4.38	2.98	55.27	0.11	7.26

Table 7. Mean, range, GCV, PCV, ECV, heritability, genetic advance and per cent mean of genetic advance of two parents and F₆ population of Hara Madhu x IVMM-3 (C₂:3x4)

Sr. No.	Character	Mean	Range	GCV (%)	PCV (%)	ECV (%)	h² (bs) (%)	GA	GAM (%)
1.	Vine length (cm)	207.35	182.87-220.38	13.42	13.73	3.69	92.89	52.27	25.36
2.	No. of primary branches per vine	2.37	2.19-2.51	11.09	11.34	2.09	96.71	0.58	24.5
3.	Days to first female flower appearance	32.58	30.00-36.33	8.09	8.47	2.58	90.88	4.98	15.35
4.	Numbers of male flower per vine	59.14	48.94-62.38	10.82	10.97	1.27	98.71	12.94	21.92
5.	Number of female flowers per vine	11.01	9.35-11.63	13.62	16.21	8.64	76.52	2.59	23.51
6.	Sex ratio	5.37	5.20-5.61	11.34	11.47	1.61	97.65	1.25	23.01
7.	Node at which first female flower appeared	4.25	4.07-5.34	15.26	15.34	0.56	99.89	1.38	32.51
8.	Days required for first harvest of fruit	73.24	71.25-77.32	6.49	6.85	2.12	91.32	9.41	12.81
9.	No. of fruits per vine	2.51	2.07-2.74	11.09	11.12	0.76	99.78	0.61	22.81
10.	Fruit yield per vine (kg)	2.11	1.41-2.32	22.39	22.42	1.10	99.84	0.96	45.54
11.	Average weight of fruit(g)	780.12	611.63-847.31	13.26	13.27	0.66	99.92	212.76	27.34
12.	Average length of fruit (cm)	11.24	8.11-11.94	12.72	12.76	1.09	99.21	2.94	26.28

Table 7 contd...

Sr. No.	Character	Mean	Range	GCV (%)	PCV (%)	ECV (%)	h² (bs) (%)	GA	GAM (%)
13.	Average diameter of fruit (cm)	12.34	10.81-12.94	5.72	5.75	0.61	98.97	1.41	11.82
14.	Average rind thickness (cm)	0.21	0.16-0.23	10.42	12.26	6.47	75.29	0.04	19.24
15.	Average pulp thickness (cm)	2.31	1.87-2.48	11.38	11.40	0.67	99.69	0.56	24.26
16.	Average fruit cavity (cm)	43.84	39.42-61.72	14.66	14.67	0.36	99.95	13.21	30.15
17.	Average weight of pulp per fruit (gm)	492.16	347.52-567.12	11.77	13.24	6.09	78.93	98.63	20.32
18.	Average weight of seed per fruit (gm)	7.01	6.38-9.13	18.96	18.97	0.38	99.97	2.70	38.51
19.	T.S.S. (%)	11.61	11.04-11.94	13.44	15.57	7.83	75.12	2.47	21.35
20.	Acidity (%)	1.34	1.31-1.37	11.80	12.17	2.31	55.53	0.21	15.71
21.	Ascorbic acid (%)	25.48	25.11-26.39	10.38	11.81	1.37	77.38	4.51	17.72
22.	Total Sugar (%)	9.95	9.21-10.43	4.63	4.68	0.78	98.42	0.89	11.18
23.	Reducing sugar (%)	7.64	7.24-7.83	5.32	6.15	0.82	81.92	0.48	6.31
24.	Non reducing sugar (%)	2.31	2.01-2.58	5.87	6.05	2.15	88.27	0.26	11.34

Table 9. Mean, range, GCV, PCV, ECV, heritability, genetic advance and per cent mean of genetic advance of two parents and F₆ population of Hara Madhu x Punjab Sunheri (C₃:3x7)

Sr. No.	Character	Mean	Range	GCV (%)	PCV (%)	ECV (%)	h² (bs) (%)	GA	GAM (%)
1.	Vine length (cm)	211.43	193.20-224.66	12.55	12.68	3.94	90.47	48.32	22.94
2.	No. of primary branches per vine	2.20	2.14-2.36	13.31	15.68	7.10	78.12	0.52	23.61
3.	Days to first female flower appearance	31.82	29.11-41.38	7.10	7.25	2.15	94.38	6.22	19.52
4.	Numbers of male flower per vine	61.72	54.93-70.24	11.80	12.30	1.88	98.23	16.22	26.38
5.	Number of female flowers per vine	10.74	9.15-12.19	14.20	15.18	4.30	80.14	2.20	20.51
6.	Sex ratio	6.05	5.14-6.76	13.16	14.87	6.98	78.21	1.48	24.15
7.	Node at which first female flower appeared	4.37	4.08-5.52	7.67	7.70	0.54	99.56	0.78	15.79
8.	Days required for first harvest of fruit	71.68	67.31-74.52	7.85	8.89	4.06	78.91	10.81	15.21
9.	No. of fruits per vine	2.74	2.11-2.82	12.32	12.43	1.67	98.24	0.67	24.10
10.	Fruit yield per vine (kg)	1.65	1.37-1.68	12.18	13.98	6.39	98.24	0.37	22.42
11.	Average weight of fruit(g)	656.97	542.92-761.98	12.09	12.79	4.12	90.11	131.97	20.14

Table 9 contd...

Sr. No.	Character	Mean	Range	GCV (%)	PCV (%)	ECV (%)	h² (bs) (%)	GA	GAM (%)
12.	Average length of fruit (cm)	9.21	8.20-11.26	11.39	11.47	1.24	98.87	2.18	23.71
13.	Average diameter of fruit (cm)	11.10	9.42-12.10	6.81	6.84	0.52	99.31	1.47	13.21
14.	Average rind thickness (cm)	0.26	0.18-0.27	16.76	19.34	9.62	76.35	0.08	30.8
15.	Average pulp thickness (cm)	1.67	1.54-1.97	10.16	10.22	1.21	98.63	0.34	20.41
16.	Average fruit cavity (cm)	44.12	40.58-59.32	14.15	14.36	2.47	97.17	12.65	28.71
17.	Average weight of pulp per fruit (gm)	435.38	281.65-494.35	10.32	10.63	2.53	94.39	62.04	14.12
18.	Average weight of seed per fruit (gm)	7.06	6.78-7.81	14.03	14.25	2.19	97.64	2.01	28.61
19.	T.S.S. (%)	11.14	10.98-11.47	17.16	17.39	3.57	75.78	2.66	23.92
20.	Acidity (%)	1.26	1.21-1.37	10.15	10.65	1.05	77.38	0.21	16.14
21.	Ascorbic acid (%)	25.27	25.08-25.46	10.71	11.32	1.28	72.21	4.18	16.56
22.	Total Sugar (%)	8.50	8.24-9.35	5.89	5.93	0.43	99.51	1.03	12.18
23.	Reducing sugar (%)	6.32	6.04-7.19	7.17	7.29	0.89	98.62	0.94	14.96
24.	Non reducing sugar (%)	2.18	2.01-2.33	5.94	6.99	0.67	72.76	0.25	10.90

Table 11. Mean, range, GCV, PCV, ECV, heritability, genetic advance and per cent mean of genetic advance of two parents and F₆ population of cross IVMM-3 x Pusa Madhuras (C₄:4x5)

Sr. No.	Character	Mean	Range	GCV (%)	PCV (%)	ECV (%)	h² (bs) (%)	GA	GAM (%)
1.	Vine length (cm)	216.34	157.51-262.32	11.17	11.39	2.30	95.94	44.56	20.06
2.	No. of primary branches per vine	2.31	2.08-2.45	11.81	11.92	1.52	98.38	0.61	26.43
3.	Days to first female flower appearance	30.75	29.35-36.61	6.54	6.78	1.82	92.85	4.09	13.39
4.	Numbers of male flower per vine	48.02	45.12-58.34	11.65	11.84	1.86	97.65	11.41	23.73
5.	Number of female flowers per vine	12.14	10.12-12.94	12.28	12.70	3.18	93.71	2.78	22.9
6.	Sex ratio	4.32	3.84-6.78	21.55	21.82	3.40	97.59	1.89	43.83
7.	Node at which first female flower appeared	4.11	3.91-5.71	15.82	15.96	0.74	99.76	1.47	32.79
8.	Days required for first harvest of fruit	72.38	71.42-78.47	6.90	6.98	1.10	97.64	10.39	14.41
9.	No. of fruits per vine	2.68	2.35-2.78	12.69	12.94	2.24	96.98	0.65	24.36
10.	Fruit yield per vine (kg)	1.84	1.32-1.92	12.59	12.67	1.53	98.58	0.45	24.58
11.	Average weight of fruit(g)	664.35	551.82-689.87	11.91	11.96	1.09	99.18	161.81	24.4

Table 11 contd...

Sr. No.	Character	Mean	Range	GCV (%)	PCV (%)	ECV (%)	h² (bs) (%)	GA	GAM (%)
12.	Average length of fruit (cm)	8.92	8.75-9.01	7.45	8.71	0.41	68.79	0.97	10.96
13.	Average diameter of fruit (cm)	11.59	10.45-11.91	4.10	4.12	0.34	99.41	0.98	10.39
14.	Average rind thickness (cm)	0.23	0.18-0.27	12.83	13.11	2.14	79.98	0.06	26.12
15.	Average pulp thickness (cm)	2.11	1.67-2.18	10.78	10.84	0.94	99.28	0.47	22.34
16.	Average fruit cavity (cm)	35.32	32.38-52.45	21.98	22.09	2.04	99.17	15.17	43.00
17.	Average weight of pulp per fruit (gm)	441.58	358.39-510.31	12.39	14.30	4.98	75.99	88.52	20.21
18.	Average weight of seed per fruit (gm)	8.12	7.18-12.09	20.94	20.95	0.47	99.98	3.30	40.61
19.	T.S.S. (%)	11.38	11.12-11.49	15.76	16.34	2.71	78.24	2.43	21.4
20.	Acidity (%)	1.28	1.20-1.51	8.71	8.89	1.87	95.63	0.24	18.82
21.	Ascorbic acid (%)	26.47	24.27-26.87	8.23	8.27	0.65	99.37	4.34	16.43
22.	Total Sugar (%)	9.58	8.50-9.82	7.26	7.30	0.64	99.31	1.42	14.83
23.	Reducing sugar (%)	6.91	6.35-7.12	7.62	7.84	1.82	94.72	1.09	15.82
24.	Non reducing sugar (%)	2.67	2.42-2.78	6.32	6.91	2.72	84.51	0.30	11.28

Table 13. Mean, range, GCV, PCV, ECV, heritability, genetic advance and per cent mean of genetic advance of two parents and F₆ population of cross IVMM-3 x Punjab Sunheri (C₅:4x7)

Sr. No.	Character	Mean	Range	GCV (%)	PCV (%)	ECV (%)	h² (bs) (%)	GA	GAM (%)
1.	Vine length (cm)	227.34	188.32-213.68	12.48	12.96	3.43	93.03	48.52	21.35
2.	No. of primary branches per vine	2.36	2.06-2.53	11.25	11.30	1.04	99.15	0.59	25.00
3.	Days to first female flower appearance	32.12	29.35-33.62	14.09	14.15	3.79	93.10	6.71	22.15
4.	Numbers of male flower per vine	61.18	52.48-64.69	12.10	12.58	3.98	92.65	15.24	24.91
5.	Number of female flowers per vine	12.09	11.74-12.49	10.70	10.97	2.32	95.56	2.57	21.35
6.	Sex ratio	5.06	4.87-5.95	13.47	14.82	6.15	82.68	1.37	25.41
7.	Node at which first female flower appeared	4.12	4.01-5.41	11.26	11.30	0.94	99.30	0.98	23.12
8.	Days required for first harvest of fruit	69.35	64.25-76.18	6.54	6.55	1.13	97.11	9.33	13.51
9.	No. of fruits per vine	2.84	2.45-2.91	11.99	12.14	1.88	97.66	0.67	23.64
10.	Fruit yield per vine (kg)	2.56	1.48-2.87	21.06	21.16	1.98	99.14	0.95	37.42
11.	Average weight of fruit(g)	858.09	642.35-892.12	25.37	25.38	0.67	99.95	281.92	48.21

Table 13 contd...

Sr. No.	Character	Mean	Range	GCV (%)	PCV (%)	ECV (%)	h² (bs) (%)	GA	GAM (%)
12.	Average length of fruit (cm)	11.21	8.35-11.82	12.09	12.10	0.45	99.89	2.79	24.91
13.	Average diameter of fruit (cm)	12.02	10.58-12.39	7.16	7.19	0.28	99.89	1.67	13.91
14.	Average rind thickness (cm)	0.25	0.17-0.28	12.84	13.87	3.29	85.53	0.06	24.00
15.	Average pulp thickness (cm)	2.35	1.84-2.51	12.54	12.58	0.90	99.52	0.61	25.10
16.	Average fruit cavity (cm)	42.12	31.12-47.31	12.59	12.65	1.14	99.20	11.37	27.00
17.	Average weight of pulp per fruit (gm)	631.35	509.45-687.12	25.75	26.19	4.78	96.69	281.62	44.31
18.	Average weight of seed per fruit (gm)	11.31	8.95-11.86	11.36	11.38	0.96	99.32	2.35	20.81
19.	T.S.S. (%)	12.35	11.32-12.97	10.38	10.42	1.13	98.83	2.50	20.23
20.	Acidity (%)	1.26	1.21-1.40	6.36	6.48	1.27	97.26	0.17	13.52
21.	Ascorbic acid (%)	26.48	25.82-26.61	9.27	10.52	2.86	79.53	4.35	16.44
22.	Total Sugar (%)	9.61	9.14-9.72	3.90	3.91	0.71	96.89	0.76	7.92
23.	Reducing sugar (%)	7.28	6.71-7.59	5.02	6.19	1.71	66.91	0.61	8.40
24.	Non reducing sugar (%)	2.33	2.21-2.45	5.67	6.17	1.82	77.15	0.26	10.56

Table 24. Per cent incidence of different diseases and pest of muskmelon in F₅ and F₆ generation

Parents / Crosses	Downey mildew (%)		Fusarium wilt (%)		Leaf miner (%)	
	F ₅ generation	F ₆ generation	F ₅ generation	F ₆ generation	F ₅ generation	F ₆ generation
Parents						
P₂	21.56(27.87)	20.24 (27.75)	8 (16.43)	10 (18.43)	16.82 (24.38)	12.24 (20.48)
P₃	30.66 (33.78)	28.45(32.67)	7 (15.34)	8(16.43)	19.72 (26.36)	16.87 (24.74)
P₄	27.78 (31.97)	22.27(28.61)	5 (12.92)	5 (12.92)	18.96 (25.84)	15.73 (23.94)
P₅	34.38 (35.48)	30.38(33.94)	1 (5.74)	1 (5.74)	23.21 (28.38)	20.37 (26.81)
P₇	14.67 (22.82)	16.16(24.75)	1 (5.74)	1 (5.74)	18.22 (25.84)	14.28 (22.68)
Crosses						
C₁: P₂ x P₇	27.60 (31.54)	24.36 (29.64)	15 (22.79)	16 (23.85)	20.92 (27.22)	16.91 (24.37)
C₂: P₃ x P₄	30.37 (33.66)	28.27 (32.38)	5 (12.92)	5 (12.92)	20.34 (26.94)	17.19 (24.49)
C₃: P₃ x P₇	31.74 (33.61)	24.57 (29.19)	14 (21.97)	16 (23.58)	19.29 (26.42)	16.94 (24.30)
C₄: P₄ x P₅	32.11 (34.18)	30.34 (33.67)	5 (12.92)	5 (12.92)	21.39 (27.48)	18.14 (25.21)
C₅: P₄ x P₇	25.75 (30.49)	22.37 (28.44)	5 (12.92)	5 (12.92)	17.38 (24.55)	14.37 (22.28)

Figures in parentheses indicate *arc sin* transformation.

Table 25. Muskmelon fruit characters (qualitative) in F₅ and F₆ generations

Parent /crosses	Shape of fruit	Fruit colour	Rind surface of fruit	Flavor	Pulp colour
Parents					
P₂	Round	Yellowish with green strips	Smooth	Pleasant	Greenish yellow
P₃	Round	Yellowish with green ridges	Smooth	Pleasant	Pale green
P₄	Round flat	Greenish with brownish ridges	Partial Netted	Pleasant	Orange
P₅	Round	Pale yellow with dark green ridges	Sparsely netted	Pleasant	Orange
P₇	Round	Greenish yellow with green ridges	Netted	Pleasant	Orange
Crosses					
P₂ x P₇	Round	Yellowish with green ridges	Netted	Pleasant	Orange
P₃ x P₄	Round	Yellowish with green ridges	Netted	Pleasant	Orange
P₃ x P₇	Round	Pale yellowish with green ridges	Netted	Pleasant	Orange
P₄ x P₅	Round flat	Greenish yellow with ridges	Partial netted	Pleasant	Orange
P₄ x P₇	Round	Greenish yellow with ridges	Netted	Pleasant	Orange

Progeny No. 1



P_2

X



P_7



Plate I. Promising selections of cross Durgapura Selection x Punjab Sunheri ($C_1 : 2 \times 7$) in F6 generation.

Progeny No. 5



P₃

X



P₄



Plate II. Promising selections of cross Hara Madhu x IVMM-3 (C₂: 3 x 4) in F₆ generation.

Progeny No. 6



X



P₃

P₇



Plate III. Promising selections of cross Hara Madhu x Punjab Sunehari (C₃: 3 x 7) in F₆ generation.

Progeny No. 11



P₄

X



P₅



Plate IV. Promising selections of cross of IVMM-3 x Pusa Madhuras (C₄: 4 x 5) in F₆ generation.

Progeny No. 15



X



P₄

P₇



Plate V. Promising selections of cross IVMM-3 x Punjab Sunheri (C₅:4 x 7) in F₆ generation.

Progeny No. 14



P₄

X



P₇



Plate VI. Promising selections of cross IVMM-3 x Punjab Sunheri (C₅:4 x 7) in F₆ generation.

Progeny No. 13



X



P₄

P₇



Plate VII. Promising selections of cross IVMM-3 x Punjab Sunheri (C₅:4 x 7) in F₆ generation.



**View of Experimental plot in
Kharif Season**



**View of Experimental plot in
Summer Season**

*Affectionately Dedicated
to my father Late Shri. Deoram
Pandurang Gaikwad (Anna)*

And

*Mother Sau. Sanjana Deoram
Gaikwad*

*Whose affection, love, encouragement
and blessing make me able to get such
success and honor.*

*You have been my inspiration , I am
really grateful to both of your. Thanks
for yours great support and continuous
care.*

Mai..