

BREEDING OF FRUIT CROPS

HFS-504, 3(2+1)

Practical Manual



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Syllabus: Breeding of Fruit Crops, HFS-504, 3(2+1)

Practical: Exercises on bearing habit, floral biology. Pollen viability and fertility studies. Hands on practices in hybridization. Raising and handling of hybrid progenies. Evaluation of biometrical traits and quality traits. Screening for resistance against abiotic stresses. Developing breeding programme for specific traits. Visit to research stations working on fruit breeding.

Name of Students:

Roll No..... Batch.....

Session Semester.....

Course Name

Course No: Credit:

Certificate

This is to certify that Shri./Km.

ID No: has completed the practical of
courses courses No

..... as per the syllabus of M. Sc (Horticulture) Fruit

Science semester in year

.....in the respective lab/field of college.

Date:

Course Teacher

CONTENTS

| S. No | Name of Exercise | Signature |
|-------|--|-----------|
| 1. | To identify and uses of Plant Breeders Kits | |
| 2. | To learn the method of colchicines treatment in order to induce polyploidy in fruit crops. | |
| 3. | To learn the method of application of EMS in seeds for mutation | |
| 4. | To study about floral biology of Mango | |
| 5. | To study about floral biology and different cultivars of Banana | |
| 6. | To study about floral biology of Sapota | |
| 7. | To learn about pollen viability test in different fruit crops | |
| 8. | To know the procedure of emasculation and pollination of flower for making artificial crosses. | |
| 9. | To study and practice of crossing technique in major fruit crops | |
| 10. | To study about floral biology of different species of Citrus | |
| 11. | To study about floral biology and hand pollination of Custard Apple | |
| 12. | To study about different sex forms of papaya | |
| 13. | To study the breeding approaches for drought resistance | |
| 14. | To study the important fruit varieties developed through conventional breeding methods | |
| 15. | To study the estimation of variability parameters | |
| 16. | To visit to biotechnology lab and <i>in vitro</i> study of breeding technique | |

Exercise No: 1

Objective: To identify and uses of Plant Breeders Kits

A breeder wants the following tools for controlled breeding regarding work and for field observation purpose.

| S. No | Name of the kits | Uses |
|-------|-------------------------------|------|
| 1. | Fine pointed forceps: | |
| 2. | Small/ curved scissor: | |
| 3. | Long straight scissor: | |
| 4. | Needle: | |
| 5. | Sharp pointer: | |
| 6. | Magnifying lens: | |

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| 7. | U-pins (u- clips): |
| 8. | Paint brush: |
| 9. | Pencil: |
| 10. | Washing bottle or Spirit bottle: |
| 11. | Wire ring and smooth thread: |
| 12. | Small white tag: |
| 13. | Soda straw tubes: |
| 14. | Waxy threads: |

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| 15. | Luggage labels (white or yellow): |
| 16. | Aluminum label with wire: |
| 17. | Muslin cloth bag (large size): |
| 18. | Yellow sample bag: |
| 19. | Paper Bag: |
| 20. | Kite paper bag (white/red): |
| 21. | Field Notebook: |

Assignment: List the various apparatus of breeder's kit and write its uses.

(Signature of Course Instructor)

Exercise No: 2

Objective: To learn the method of colchicines treatment in order to induce polyploidy in fruit crops.

Plants having more than two sets of chromosomes are referred as polyploids. Autopolyploids can be induced by chemical mutagen like acenaphthene, colchicines, caumarin etc. The colchicines is most widely used for chromosome doubling. Colchicines inhibit the formation of spindles fibre during metaphase. As a result, karyokinensis does not occur and the chromosome number of treated cells gets doubled.

Material required:

Procedure:

Seed treatment:

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Shoot apex:

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Observations: 10 seedlings should be treated and to be observe

| | Morphological characters treated plants | Morphological characters untreated plants |
|-----------------------------|--|--|
| Seed treatment | | |
| Seedling treatment | | |
| Short apex treatment | | |

The observation for polyploidy to be recorded throughout the semester

(Signature of Course Instructor)

Exercise No: 3

Objective: To learn the method of application of EMS in seeds for mutation

Among the chemical mutagens, the Ethylmethane sulphonate (EMS) is frequently used for induction of mutation.

Material required:

Procedure:

Observation: 10 treated and 10 untreated seedlings to be transplanted for recording observation

1. Percentage of germination

Untreated.....

Treated.....

2. Morphological characters (after 90 days)

| | | Seedling number | | | | | | | | | |
|-------------------|-----------|-----------------|---|---|---|---|---|---|---|---|----|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Height | Untreated | | | | | | | | | | |
| | Treated | | | | | | | | | | |
| Girth | Untreated | | | | | | | | | | |
| | Treated | | | | | | | | | | |
| Leaf area | Untreated | | | | | | | | | | |
| | Treated | | | | | | | | | | |
| Internodal length | Untreated | | | | | | | | | | |
| | Treated | | | | | | | | | | |

3. Floral character

| | | Seedling number | | | | | | | | | |
|-------------------------------------|-----------|-----------------|---|---|---|---|---|---|---|---|----|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Height of 1 st flowering | Untreated | | | | | | | | | | |
| | Treated | | | | | | | | | | |
| Sex of flower | Untreated | | | | | | | | | | |
| | Treated | | | | | | | | | | |
| Sessile on with pedicel | Untreated | | | | | | | | | | |
| | Treated | | | | | | | | | | |

(Signature of Course Instructor)

Observation: Time of anthesis (out of 10 selected flowers)

| | Time | | | | | | | |
|------------------------------|---------|---------------|---------|---------------|---------|---------------|----------|---------------|
| | 7.00 am | | 8.00 am | | 9.00 am | | 10.00 am | |
| | Male | Hermaphrodite | Male | Hermaphrodite | Male | Hermaphrodite | Male | Hermaphrodite |
| No of flower | | | | | | | | |
| Percentage of flowers opened | | | | | | | | |

Time of dehiscence (out of 10 selected flowers)

| | Time | | | | | | | |
|------------------------------|---------|--|---------|--|---------|--|----------|--|
| | 7.00 am | | 8.00 am | | 9.00 am | | 10.00 am | |
| | | | | | | | | |
| No of flower | | | | | | | | |
| Percentage of flowers opened | | | | | | | | |

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(Signature of Course Instructor)

Cultivar Details:

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Draw well-labelled diagram



(Signature of Course Instructor)

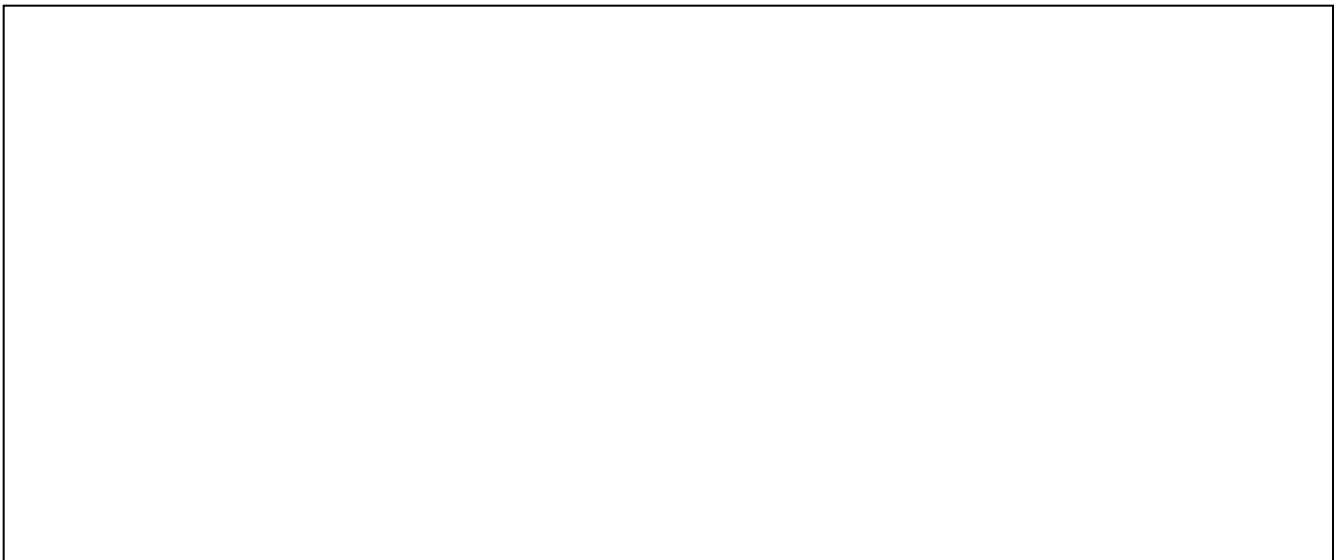
Qualitative Observations:

| S No | Qualitative characters | Description |
|-------------|-------------------------------|--------------------|
| 1. | Corolla colour | |
| 2. | Calyx colour | |
| 3. | Anther colour | |
| 4. | Stigma colour | |
| 5. | Position of ovary | |

Qualitative observations:

| S No | Qualitative characters | Average |
|-------------|-------------------------------|----------------|
| 1. | Number of petals | |
| 2. | Number of stamens | |
| 3. | Number of sepals | |
| 4. | Length of pistils | |
| 5. | Length of stamen | |

Draw well labeled diagram of Sapota flower and its parts



(Signature of Course Instructor)

The pollen viability percentage at any given time after dehiscence of anthers work out as

$$\text{Pollen viability \%} = \frac{\text{No of stained pollen grain}}{\text{Total number of pollen grain}} \times 100$$

Observation:

| Crop | Test | Stained pollen (No) | Unstained pollen (No) | Pollen Viability |
|------|------|---------------------|-----------------------|------------------|
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(Signature of Course Instructor)

Observation: Record the number of fruit set

| Date | Female parent | Male Parent | Date of pollination | Fruit set (Yes/No) |
|-------------|----------------------|--------------------|----------------------------|---------------------------|
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(Signature of Course Instructor)

Exercise No: 9

Objective: To study and practice of crossing technique in major fruit crops

Hybridization refers to mating or crossing of two plants or lines of diverse genotypes to obtain a viable hybrid progeny. The seed as well as the progeny resulting from hybridization are known as 'hybrid' or F₁.

Crossing techniques:

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Material required:

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Hybridization Technique:

Selection of parents:

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Evaluation of parents:

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Emasculation:

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Bagging:

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Tagging:
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Pollination:
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Harvesting and storage of F1 seeds:
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(Signature of Course Instructor)

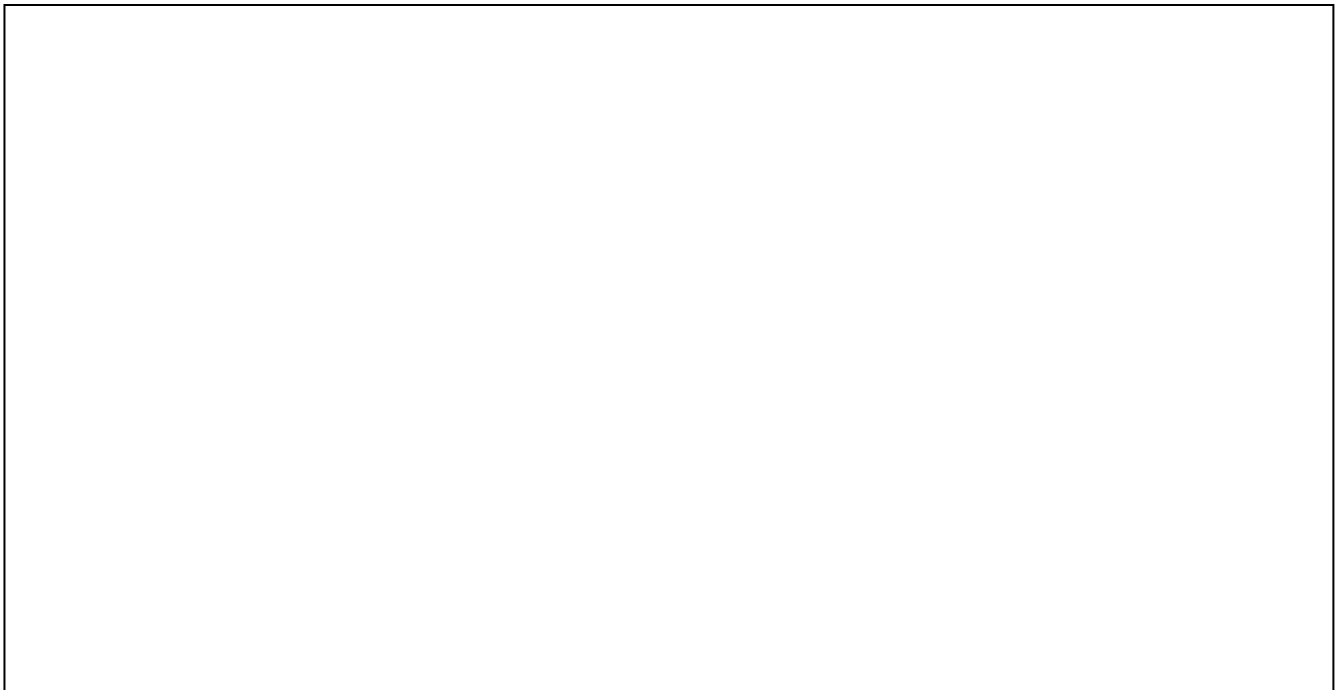
Qualitative observation

| S. No | Qualitative characters | Description |
|-------|------------------------|-------------|
| 1. | Petal (present/absent) | |
| 2. | Calyx colour | |
| 3. | Anther colour | |
| 4. | Stigma colour | |
| 5. | Position of ovary | |

Qualitative observation

| S. No | Qualitative characters | Average |
|-------|------------------------|---------|
| 1. | Number of stamens | |
| 2. | Number of sepals | |
| 3. | Length of pistils | |
| 4. | Length of stamen | |

Draw well labeled diagram of citrus flower and its parts



(Signature of Course Instructor)

Exercise No: 11

Objective: To study about floral biology and hand pollination of Custard Apple

Material required:

Floral biology, anthesis and pollination:

Hand Pollination procedure:

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Observation: Record the number of fruit set

| Date | Female parent | Male Parent | Date of pollination | Fruit set (Yes/No) | Fruit Shape |
|-------------|----------------------|--------------------|----------------------------|---------------------------|--------------------|
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(Signature of Course Instructor)

Exercise No: 12

Objective: To study about different sex forms of papaya

Papaya is a polygamous species; many forms of inflorescence have been reported. In general, there are three types of flowers namely staminate, pistillate and hermaphrodite. Staminate flower is produced by male plant, while teratological staminate flower is produced by sex reversing male plants. Pistillate flower is produced by female plants. Elongata, reduced elongata, carpelloid elongata, pentandria and carpelloid pentandria are normally produced by hermaphrodite plants. According to Storey (1958), there are 15 comparable classes found in male plants as well as in hermaphrodite plants. There are 32 heritable sex forms in papaya. Cultivated papayas belong to two major sex forms.

Material required:

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Floral biology, anthesis and pollination:

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Assignment: Draw well labelled diagram

(Signature of Course Instructor)

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4. Manipulation of Somaclonal Variation:

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Problems in draught resistance breeding:

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(Signature of Course Instructor)

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| Papaya | | | |
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| Guava | | | |
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| Pomegranate | | | |
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|--------|--|--|--|
| Apple | | | |
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| Citrus | | | |
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(Signature of Course Instructor)

Estimation of genetic Variability, Heritability and Genetic Advance:

The genetic variability present in breeding populations can be assessed by three ways

✓ By using simple measure of variability:

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✓ By estimating the various components of variance:

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✓ By studying the genetic diversity within a population:

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Define/Eplain

Variability:.....
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Heritability:.....
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Standard Error:
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Coefficient of variation:
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(Signature of Course Instructor)

Exercise No: 16

Objective: To visit to biotechnology lab and *in vitro* study of breeding technique

(Signature of Course instructor)