

MODE OF REPRODUCTION IN RELATION TO BREEDING METHODS

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ABSTRACT:

In natural reproduction a portion gets detached from the body of mother plant and its detached portion grows up into a new independent plant under suitable conditions. The special cells or asexual reproductive units are produced by the parent body which grow themselves up into new individuals without two such cells fusing together as in sexual reproduction. The zygote develops into a new plant. The main difference between sexual and asexual reproduction is that in asexual reproduction only one parent's sex is concerned while in sexual reproduction both parent sexes are concerned. Meiosis and fertilisation are the regular and constant features of amphimixis. Occasionally, irregularities occur in them in which fertilisation is omitted. Even then the embryo develops from egg cell or from cells associated with it. When the pollens of a flower fall on the stigma of another flower on the same plant, it is termed as geitonogamy and genetically is equal to self pollination. Sometimes it occurs in maize where males are on top and females are laterally female on the same plant resulting in geitonogamy.

Keywords- Amphimixis, Apomixis, Parthenogenesis, Apogamy, Apospory, Autogamy, Allogamy, Geitonogamy.

The breeding methods that may be employed in a particular crop are determined by the mode of reproduction. This relationship will become clearer as the breeding methods used differ in different crops.

METHODS OF REPRODUCTION

There are three methods of reproduction among plants:

1. Vegetative
2. Asexual
3. Sexual

VEGETATIVE REPRODUCTION:

In natural reproduction a portion gets detached from the body of mother plant and its detached portion grows up into a new independent plant under suitable conditions. These natural methods are:

1. UNDERGROUND STEMS

In any flowering plants the underground stems modified and buds are produced on them which gradually grow up into new plants.

- (a)- Rhizome, e.g. canna (*canna Indica L.*), ginger (*Zingiberoffucinalis* Rose), turmeric (*Curcuma domestica* Val)
- (b)- Tuber, e.g. potato (*Solanum Tuberosum L.*)
- (c)- Bulb, e.g. onion (*Allium cepa* L.)

(d)-Corm, e.g. taro (*Clocasiaantiquorum*schot.)

2. SUB AERIAL STEMS

The runner, stolon sucker, etc. sub aerial stems give to rise to new plants, e.g. strawberry, mint, of rose, etc.

3. BULBILS

In garlic *Alliumsativum* L. Some of the low flower of the inflorescence becomes modified into small multicellular bodies known as bulbils. They fall on the ground and grow up into new plants.¹

ARTIFICIAL:

In artificial vegetative reproduction, a portion is separated out from the body of the of the mother plant by special methods:

1- Cutting: Stem and root cuttings are taken from plants and put into moist soil where they strike root at the base and develop adventitious roots which grow into new plants. Example

(a)- Stem Cutting- Sugarcane, Durante etc

(b)- Root Cutting- Lemon, Citrus etc.

2- Layering: It is generally practised in plants like lemon, rose, grape-vine, jasmines, etc.

3- Goole: This method is usually employed for propagating lemon, orange, pummelo, litchi, etc.

4- Grafting: Different types of grafting are met and used in different fruit plants horticulture.

ASEXUAL REPRODUCTION:

In this method, the special cells or asexual reproductive units are produced by the parent body which grow themselves up into new individuals without two such cells fusing together as in sexual reproduction. Asexual reproduction takes place by two methods as by fission and by spore formation and is only found in the lower plants.

SEXUAL REPRODUCTION:

This consists in fusion of two sexual reproductive units called gametes. The product of fusion is called the zygotes. The zygote develops into a new plant. The main difference between sexual and asexual reproduction is that in asexual reproduction only one parents sex is concerned while in sexual reproduction both parent sex are concerned. These are two postulate of sexual reproduction.

1. **Isogamy:** If the gamete of both the parents are essential similar, that is morphologically not differentiated into male and female they are known as Isogamete. The fusion of such Similar gamers is known as conjugation and the zygote formed is called the Zygospor. This type of sexual reproduction is known as isogamy and is found only in lower plants such as *Mucorordi Spirogyrawhich* are not important from plant breeding point of view.

2. **Heterogamy:** In all the higher plants gamers are dissimilar that is morphological differentiated into male and female. They are known as heterogametes and the plants bearing such gametes are said to be

¹SumanaBhattacharry, Method of plant Reproduction (with experiment),www.biologydiscussion.com

heterogamous. The union of dissimilar gametes is known as fertilisation and they Zygote formed is called oospore. This type of sexual reproduction is most common in the flowering plants and can be divided into two types:

1. Amphimixis- Normal sexual reproduction
2. Apomixis- Abnormal sexual reproduction

Amphimixis

A flower contains the sexual reproductive structure of the plant and commonly consists of four floral organs, sepals petals, stamens and pistils². The stamens (Microsporophylls) and the the pistils (Megasporephylls) function in the production of seeds. Each stamen bears four pollen sacs (Microsporangia) in its anther within the microsporangia there are many microscope mother cells in which meiosis take place and four pollen grains microspores are produced from each microspores mother cell. This process of microspores or pollen development is known as microporogenesis. The pollen is then transferred to the stigma of overt pollination and starts to germinate. As the pollen germinates on stigma and penetrates into style, the generative nucleus divides mitotically into two male gametes and this process is known as microgametogenesis in plants and spermatogenesis in animal. The contents within the pollen and the pollen tube formed by the germination of microscope constitute male gametophyte of angiosperm that is result of microgametogenesis is male gametophyte. The ovary of a carpel contains ovules (megasporeangia). Each ovule has within it a megaspore mother cell which undergoes meiosis and produces four megaspore a-ranged in a linear row linear tetrad. From linear tetrad, three megaspore degenerateand one remains functional. This process of development of megaspores is known as megaspore-genesis. The nucleus of the functional megaspore usually divides three times mitotically giving rise to an 8-nucleus structure called female gametophyte or embryo-sac. This process of development of female gametophyte from megaspore is known as mega-gametogenesis. The eight nuclei of embryo-sac are organised in a definite order ultimately resulting in the formation of antipodal cells, egg apparatus containing egg cell and synergies, and secondary nucleus.

Apomixis

Meiosis and fertilisation are the regular and constant features of amphimixis. Occasionally, irregularities occur in them in which fertilisation is omitted. Even them the embryo develops from egg cell or from cells associated with it. This is called apomixis.

Apomixis is an abnormal sexual reproduction in which the embryo develops from the egg cell associated with it without fertilisation and with or without meiosis.

TYPES OF APOMIXIS

- 1- Parthenogenesis.
- 2- Apogamy.
- 3- Apospory.

²Oregon State University, Reproductive plants parts, extension.oregonstate.edu

PARTHENOGENESIS

Parthenogenesis means the development of an embryo directly from the egg cell or male gamete. Parthenogenesis of normal haploid egg into an embryo has been noticed in *solanum nigrum*L. and is termed as haploid parthenogenesis. The plants developed from such embryo are haploid and usually sterile. Gases are also known in *Nicotiana* and *crepis* where such embryos have been reported from male gametes (Androgenesis). A second type of parthenogenesis called diploid parthenogenesis, has also been noticed. It gives a diploid plant and has been noticed in *araxacum* and others.

APOGAMY

An embryo may sometimes develop from the cells other than egg cells that is synergids or antipodal cells of embryo sac. This is called apogamy. Here the synergids or antipodal cells may be haploid or diploid. If embryo develops from haploid synergids or antipodal cells, it is called haploid apogamy and if from diploid it is called diploid apogamy. Apogamy has been observed in *Alchemilla*, *Antennaria*, *Allium* and several other plants.

APOSPORY

Development of cells other than embryo sac cells, i.e integuments and nucleus, into embryos is known as apospory. These embryos are always diploid and result in supernumerary embryos.

MODE OF REPRODUCTION

There are three modes of reproduction in heterogamous plants and these are:

- 1- Autogamy or self pollination
- 2- Allogamy or cross pollination
- 3- Geitonogamy

AUTOGAMY

It is the transfer of pollens from an anther to a stigma within the same flower and is always found in bisexual crops conditions for the self pollination are:

1. Bisexuality: In this both male and female reproductive organ are present in the same flower. Without this condition self pollination is never possible and, therefore bisexuality is the first and foremost rule for the self pollination.
2. Homogamy: This is the condition in which the anthers and the stigmas of a bisexual flower mature at the same time resulting in the self pollination.
3. Cleistogamy: In this condition the bisexual flowers never open and, therefore the self pollination is only the way of pollination. It occurs in economic crop dealt under plant breedings.

ALLOGAMY

It is the transference of pollens from one plant to the stigmas in flowers on a different plant. It may occur both in bisexual and unisexual flowers but it is the rule in unisexual flowers. Nature favours cross pollination and the agencies which help in bringing the cross pollination in flowers.

- 1- Air (Anemophily)

- 2- Water (Hydrophily)
- 3- Insects (Entomophily)
- 4- Animals (Zoophily)

There are many reasons on account of which cross pollination takes place in the crop. These reasons are known as contrivances of cross pollination.

GEITONOGAMY

When the pollens of a flower falls on the stigma of another flower on the same plant, it is termed as geitonogamy and genetically is equal to self pollination. Sometimes it occurs in maize where males are on top and females are laterally female on the same plant resulting in geitonogamy.

Self pollination results in purity but continuous selfing in cross pollinated crop gives rise to weaker progenies. Cross pollination offspring adapted to struggle for existence more abundant and viable seeds and new varieties.

CONCLUSION

The breeding methods, in vogue, have been developed on the basis of nature of reproduction in crop. The plant breeder must know all the facts concerned with mechanism of reproduction and particularly he must appreciate the distinction between asexually and sexually reproduced types, the amount of self and cross pollination and the incidence of sterility and income partibility so that the proper method can be applied to a crop improvement.

