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Dichogamy in Fruit Crops

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Abstract – **Dichogamy promotes cross pollination even in the hermaphrodite species. Dichogamy is mainly two types: viz. i) protogyny and ii) protandry. When pistil matures before anthers, it is called** protogyny **such as in Banana, Fig. When anthers mature before pistil, it is known as protoandry and other type of dichogamy also found in fruits such as *Heterodichogamy:* Pecanut, Pistachionut, *Protogynous, diurnally synchronous dichogamy (PDSD):* Avocado, *Duodichogamy :* Chestnut, Brideliatomentosa. It is major constraint in fruit cultivation because it prevents self pollination. So this article shows the causes, effects and importance of dichogamy in fruit crops.**

Keywords – **Dichogamy, Fruits, Protondry, Protogyny.**

I. INTRODUCTION

Dichogamy (from the Greek *dikho*-apart and *gamous*-marriage) it refers to maturation of anthers and stigma of the same flowers at different times. Dichogamy promotes cross pollination even in the hermaphrodite species. Dichogamy is mainly two types: viz. i) protogyny and ii) protandry. When pistil matures before anthers, it is called **protogyny** such as in Banana, Fig. When anthers mature before pistil, it is known as **protoandry**. Following types of dichogamy found in fruit crops: -

a) Protoandry - relating to an organism, especially a plant, in which the male reproductive organs mature before the female reproductive organs.**2.** Of or relating to the earlier arrival of males than of females at a breeding site: protandrous migration.

b) Protogyny - relating to a flower in which the shedding of pollen occurs after the stigma has stopped being receptive; having female sex organs maturing before the male.

In cherimoya flowers, their stigmas usually lose their receptivity before anthers shed their pollen. Very commonly all flowers on a single tree and even in an orchard synchronize their sexual cycle and most of the open flowers are either in female or in male phase with sparse overlap through the season . Due to this fact and the above-mentioned absence of efficient pollinators, in many countries, including Spain, natural pollination commonly derives in low fruit set and small fruits of reduced marketability.

1. Types of dichogamy as following:

a) ***Protondry :*** Walnut, Pecanuts, Coconut, Anonamuricata, Aonla, Passion Fruit
b) ***Protogyny :*** Banana, Fig, Annona, Pomegranate, Plum, Sapota, Strawberry, Avocado
c) ***Heterodichogamy :*** Pecanut, Pistachionut
d) ***PDSD :*** Avocado**,**
e) ***Duodichogamy :*** Chestnut, Brideliatomentosa
f) ***Duodichogamy :*** Chestnut, Brideliatomentosa

c) Heterodichogamy - It differs from normal dichogamy, in that it involves two mating types (protogyny and protandry) that occur at a 1 : 1 ratio in a population. Flowering phases of the two mating types are synchronized and reciprocal, which was considered to ensure between-type outcrossing. **(Gleeson, 1982 in walnuts).**This study aims to quantify the flowering pattern and pollination efficacy in *Juglans mandshurica*, a wind-pollinated heterodichogamous tree. Ex.- Pecanut-Protogynous cultivars have long and thin bracts and protoandrous cultivars have short and broad bracts. Pecanut flowering can be divided into very early, early, mid, late and very late season. protoandrous (Type-I) and protogynous (Type-II) types. Pecans are wind-pollinated. Trees are monoecious, meaning both male and female flowers are on the same tree. Thus, self-pollinationis possible, but ultimately undesirable. There are two main pecan flowering types: protandrous and protogynous. When male flowers release their pollen before female flowers are receptive, those flowers are protandrous (also called Type I). When female flowers are receptive to pollen before pollen is shed from the male flowers on the sa0me tree it is called a protogynous flower or Type II.Some protandrous (Type I) pecan trees include Caddo, Cape Fear, Cherokee, Cheyenne, Creek, Desirable, Gafford, Giles, Jackson, Oconee, Oklahoma, Pawnee, Peruque, and Western. Some protogynous (Type II) pecan trees are Burkett, Candy, Choctaw, Elliot, Forkert, Kanza, Kiowa, Mahan, Maramec, Mohawk, Mount, Oakla, Podsednik, Schley, Shoshoni, Stuart, Sumner, and Wichita.

Pecan has what is called dichogamous flowering, when male and female flowers mature at different times. Dichogamy promotes cross-pollination within and between species. It is also known as heterodichogamy. Dichogamy may be an intermediary step between synchronous dichogamy and dioecy (male and female flowers on separate plants). The degree of dichogamy is variable within pecan trees and can be affected by weather. Moist, warm springs favor male flowers, whereas cool, dry springs favor female flowers. Some members of the hickory family may switch flowering type depending on the environment in the year. This has been documented in Shagbark (*Carya ovata*) and Mockernut (*Caryatomentosa*) hickories. Complete dichogamy means that no self-pollination is possible. Incomplete dichogamy results in some level of selfing. Dichogamy encourages cross pollination and discourages self-pollination. Self-pollination can lead to inbreeding depression in some plants. Inbreeding depression occurs when two closely related individuals mate. Some species have a strong negative response to this situation, whereas some have an intermediate response, and some little to none. There can

be ramifications of selfing, including fruit abortion, suppressed kernel development, and low plant vigor. The unfit do not survive, thus resulting in a reduction in the number of successful mating individuals within a population. Selfing also limits the gene flow from other populations. Genes from other populations help to perpetuate individuals that adapt to environmental stresses. Species with a strong tendency against self-pollination have greater genetic diversity within populations. Within pecans, the level of inbreeding is low or inbred seedlings die early and never enter the mating process.

Thompson and Romberg (1985) reported that a single gene determines dichogamy in pecan trees. This means that the trait is qualitative, or is controlled by a single gene or very few genes. They reported that protogyny is the dominant trait and protandry is recessive. This is common throughout the hickory family. There are benefits to dichogamy, with the largest being genetic variation. More genetic variation leads to better pecan tree survival, continued evolution, and better climate adaptation. Inbreeding, mating of close relatives or selfing, tends to bring out bad traits and thus ultimately makes the tree non-competitive with its non-inbred neighbors

d) Protogynous, diurnally synchronous dichogamy (Avocado):

The basic facts of avocado flower behavior have been deciphered. Its protogynous diurnally synchronous dichogamy operates under normal conditions in the following way: 1. Each and every flower opens twice. At the first opening it is functionally female – the pistil is mature, the stigma is receptive while the pollen sacs remain closed. At the second opening the flower is functionally male: dehiscence of the pollen sac occurs and pollen is being shed while the upper part of the style is frequently shriveled and brown. 2. All flowers of the tree or cultivar are female before noon and male in the afternoon (A group) or are female in the afternoon and male before noon (B group). 3. The elapsed time between the first and second opening is about 24 hours for A group flowers and about 12 hours for B group flowers (Bergh 1975 in Avocado)

e) Duodichogamy:

Flowering plants commonly separate male and female function in time, but rarely are the two stages synchronized within and among individuals. One such temporal mating system is duodichogamy in which each plant produces two batches of male flowers that are temporally separated by a batch of female flowers, with within-individual synchrony and among-individual asynchrony to ensure mating partners. Duodichogamy is known only from a few species in four genera in unrelated families. We report on duodichogamy in the Chinese tree species Brideliatomentosa (Phyllanthaceae). There are some examples as following-

II. Effects and Uses of Dichogamy

It is affect to pollination and fertilization process, due to dichogamy unfruitfulness, irregular bearing such types of problems are generate if cross pollination also not occur in the absence pollinizers an pollinators. Because of dichogamy self pollination is not possible so cross pollination occurs or in some fruitscrops fruits develop/produce by parthenocarpically. It is useful in hybridization of fruits crops because for hybridization. Protoandry and protogyny type phenomena is found in so many fruit crops so these fruit crops self pollination is not possible than usually cross pollination is occurs in these plants so we can improve that the genotypes of these crop via cross pollination because we can control cross pollination, but not in self pollination. So dichogamy is good in that condition where we want to pollinate plants with oneself than this phenomena is required. It has some disadvantages in case of farmers usually farmers don't know about these things so its problematic for them to produce crop because if they don't know about it (dichogamy type of flower behavior) so than they do not do anything for it `artificial pollination, they won't use of pollinators and pollinizer.

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