

Transformation of Dioecious Carica papaya plant into Monoecious plant

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Abstract –Agriculture is an important sector in India and is the backbone of the country's economy. Out of the many crops grown in the country, fruit crops play a crucial role in the human diet since they provide the body with essential vitamins, minerals, fibre and carbohydrates. Fruit is a fleshy ripened, edible part of a perennial plant associated with the development of the flower. In this project, we are considering Papaya (*Carica papaya*). Papaya is a dioecious plant, which implies the user must have at least one male plant growing in the vicinity for the fruit-bearing female plants to be pollinated. A dioecious plant is a plant where the male and female reproductive systems turn out to be on two different plants. This is contrary to the monoecious plant system in which a single plant bears both male and female reproductive systems. The project aims to cut down the additional workload required to cultivate both male and female plants of Papaya. Papaya appears as a dioecious plant in nature, but the project attempted to use the technique of bud grafting to create a monoecious papaya plant. Unlike the traditional dioecious papaya plant, the hybrid plant from the project does not require a separate male or female plant as it contains male and female reproductive systems of its own. The male flowers on the plant can fertilize the female flowers, and they can also cross-pollinate with other plants in the vicinity.

pollination, the species of such plants are termed as monoecious plants. Similarly, if only the male or the female reproductive system is present on the same plant but not both, the only cross-pollination can occur. Such species of plants are known as dioecious plants.

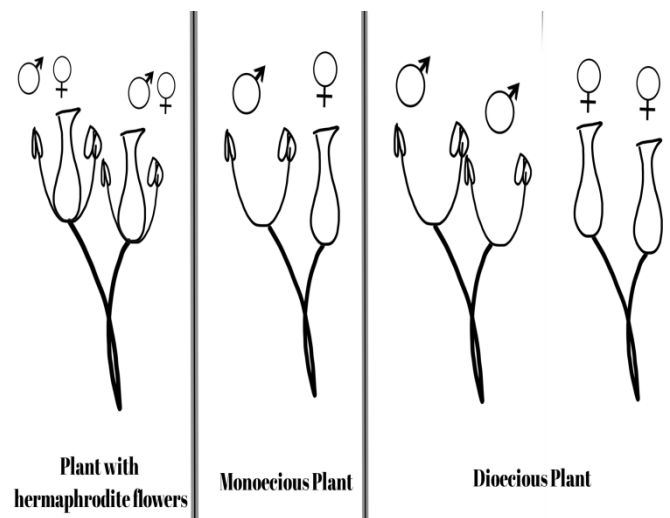


Figure 1- Difference between Monoecious and Dioecious flowering plants

Key Words: Dioecious, Monoecious, Carica, Papaya, Grafting, Budding

1. INTRODUCTION

India is the largest producer of Papaya, with an output of approximately 3 million tones per year. Indian states like Andhra Pradesh, Gujarat, Karnataka, Madhya Pradesh, Maharashtra are the highest papaya producers. "Pusa Delicious" is one of the best papaya variants grown in the country. Some of its physical characteristics include deep orange colour, sweet taste and high yielding properties. Papaya (*Carica papaya*), also called papaw or pawpaw, belongs to the accepted species in the genus Carica of the family Caricaceae. Papaya cultivation has its origin in Costa Rica and South Mexico. The papaya plant is dioecious, and hence only cross-pollination is possible. Commonly a flower bears both; the stamens and carpels, making it a perfect flower. This characteristic of the flower can also be described as bisexual or hermaphroditic. Concerning the above phenomena, if separate staminate and carpellate flowers are found on the same plant (as shown below in the diagram) and show self or cross-

1.1 Proposed Project

The project proposes a system with an experimentally grown monoecious plant of Papaya, produced from a dioecious plant of Papaya. The prime technique used for this is bud grafting. The main aim is to create a system that has advantages over the dioecious plant system. Maximum pollination through self-pollination, reduction in space required to plant extra male plants, increase crop yield are some of the benefits the grafted resultant plant offers. Cost-cutting is also possible as resources needed for one single plant are less than two separate plants.

2. Methodology

To carry out this particular technique, we need to have both female and male papaya plants at least 7-8 months old. We have used a bud from a male papaya plant as an scion and grafted it into our female papaya plant of interest. The exact process can be reversed (using female bud as scion), but the resultant plant's yield is affected. The first step to be followed involves cutting a bud from the male plant into a triangular Shape (scion); the scion

has to be of the same size as that of the stock in the female plant.

A very sharp chisel is to be considered to make the incision on the male plant so as to not damage or disrupt the scion. The chisel taken has to be sterilized with alcohol prior to the process. Furthermore, slice a surface cut on the female papaya tree of the same size as that of the scion so that it fits in it perfectly.

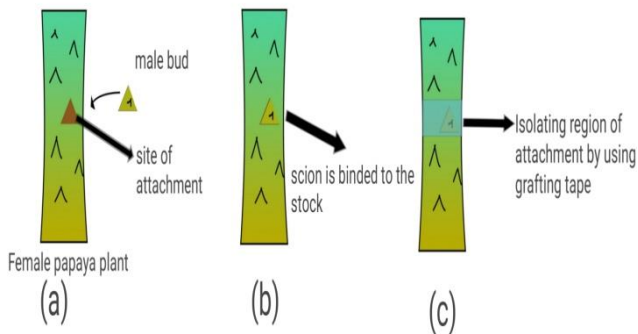


Figure 2-Steps involved in grafting

The last step involves attaching the scion to the stock before they both are placed together. Care should be taken that both the pieces are appropriately sterilized with an adequate quantity of sterilizing alcohol, assuring their surfaces are clean and free from unwanted microbiological entities. When cut with utmost precision, both the pieces complement each other. The area of interest is to be covered with the help of polyethene grafting tape to keep it isolated from the surrounding environment, which results in proper conjugation of the bud and prevents it from deteriorating.

A total of 10 plants were considered with two scions grafted on each resulting in 20 sites of attachment to increase the chances of having a favourable result. An observative phase of 6-8 weeks is required for the scion to bind to the stock. Once the binding step is done, it is mandatory to remove the grafting tape so as to not resist the growth of the upcoming bud. A well-grown bud is observed at the area of interest after about 2-3 months when grown under favourable conditions, which will further develop into the desired male branch. The formation of a complete branch from the bud may take up to 4-5 months depending on the environment provided to it, shortly after the growth of the whole branch flowering is observed.

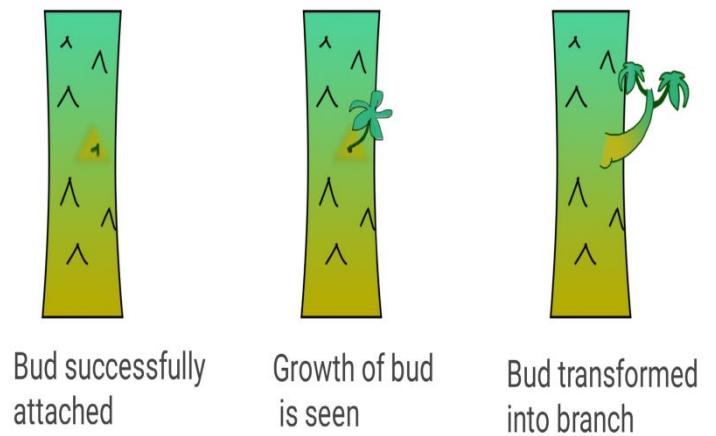


Figure 3-Stages of bud growth

Outputs:-

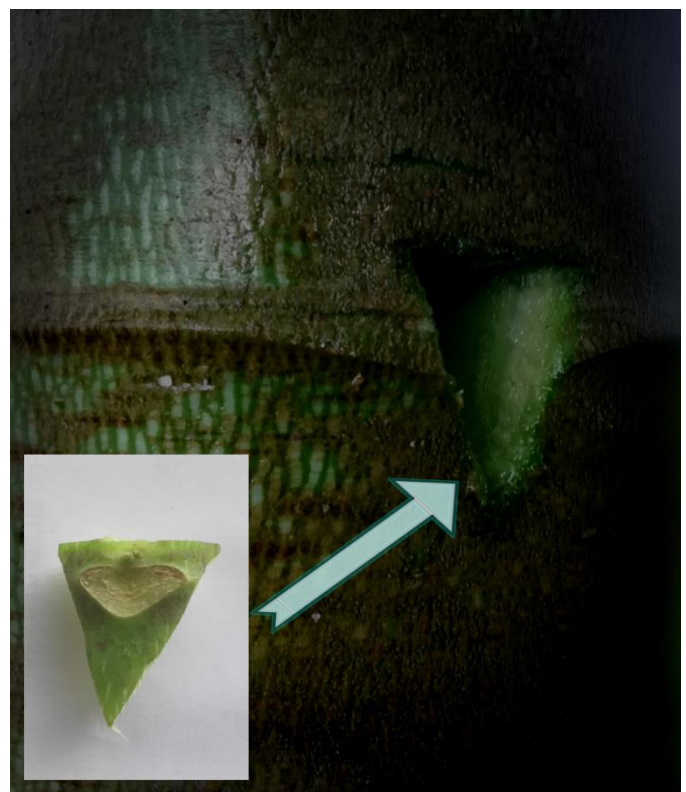


Figure 4-Scion (male papaya) and stock (female papaya)



Figure 5-Binding of scion to stock



Figure 7-Final result



Figure 6-Isolation area of interest with grafting tape

Observation table

Sr No	Number of Plant Selected as scion	Total Explant inserted on scion	Buds Survived after removal of grafting tape	Success rate
1	10 Female papaya	20 (2 on each plant)	3 out of 20	15%

3. CONCLUSION

The project results and analysis show that the resultant papaya plant is a monoecious plant that highlights the advantages of being a plant with distinct reproductive organs on the same plant. Humans have made it possible to induce monoecious characteristics in plants that were initially dioecious. Since all the buds do not survive, an increase in the success rate can be achieved through persistent efforts, expertise and precision.

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