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BEARING FRUIT BY MALE *CARICA PAPAYA* SIMILAR TO THAT OF A FEMALE PLANT PROVIDES A POTENTIAL SOURCE FOR UNDERSTANDING *HOMO SAPIENS* EVOLUTION

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Abstract

The papaya plant *Carica papaya* (family: Caricaceae), locally known as Papita, is cultivated commonly in different parts of Sindh-Pakistan specially in Karachi. It was reported hermaphrodite. Recently it has been reported to be an important plant, due to having X and Y chromosomes. As it has been already reported that the papaya sex chromosomes have virtually all of the features that the human sex chromosomes have. In the present paper observations are made that not all the male papaya plants due to male (mM) characteristic but some of them are hermaphrodite in characteristic (mmM = XXY = mMh = XYh), exactly identical to a normal male and have been recorded bearing fruits like the female papaya plants (mm = XX). This characteristic of the male papaya plant provides a clicking source for positive understanding of *Homo sapiens* evolution from a male (Aadam), that how the female sex chromosomes (XX) were evolved from a hermaphrodite (XXY). This theory has been proposed as "Aadam Hypothesis". In the present paper the theory of "Aadam Hypothesis" has been also supported by Natural Method of Propagation (NMP) of two different plant species *Bryophyllum pinnatum* and *Kalanchoe verticillata* (syn *K. tubiflora*) having budding system for the propagation of fertile plantlets on scientific grounds.

Introduction

The plants are categorized as a "monoecious" having bisexual flowers e.g. mustard plant or "unisexual" male and female flowers on the same plant, e.g. corn (Fig. 1P) and cucurbits but the "dioecious" plants are those which have separate male plants bearing only male flowers and separate female plants having only female flowers. The two most common examples of this category are the date palm tree having 2n = 36 and papaya tree having 2n = 18. Observations have been recorded since 2004 that male *Carica papaya* plants bear fruits. The observations and results are discussed for the positive understanding of human evolution from a male, in the light of two verses from Holy Qur'an *Yaaa - 'ayyuhan-naasut-taquu Rabbakumullazii khalaqakum-min-nafsinw-waahida-tinw-wa khalaqa minhaa zawjahaa* (4: 4: 1) *Translation*: "O mankind! Be afraid of your Lord who created you from a single man and from him created his mate": and the other verse, *Wallaahu 'ambatakum-minal-'ardi nabaataa* (29: 70: 17). *Translation*: And Allah hath caused you to grow as a growth of plants from the earth and also reported by some scientists such as Dutta (1972); Storey (1976); Fujisawa *et al*., (2001); Farooq & Shakoori (2002); Liu *et al*., (2004); Nicolas *et al*., (2005); Albert *et al*., (2010) and Riley (2010).

Materials and Methods

Carica papaya male, female and hermaphrodite plants were studied in different areas of Karachi, Sindh-Pakistan such as Orangi Town, Liaquatabad Town, Gulshan-e-Iqbal Town, Malir Town, Korangi Town, Landhi Town, Gadap Town, North Karachi Town, Baldia Town, especially the fruit farms at Kathore, Malir, Memon Goth and Hub Choki, two of them are shown in (Fig. 1A&B). Beside this two species of plants viz. *Bryophyllum pinnatum* (family Crassulaceae) and *Kalanchoe verticillata* (*K. tubiflora*) were also taken into consideration for their growth from leaves by means of Natural Method of Propagation, through adventitious foliar budding process.

Results and Discussions

It was observed that the male and female plants of *Carica papaya* differ from each other in the case of flowers. The male flowers containing Calyx, Corolla & Androecium (Anther) are small, numerous, different aged and have a common stalk, which is very long (more than 10 inches) nearly equal to the leaf petiole (Fig. 1F, G). The female flowers contains Calyx, Corolla & Gynoecium (Ovary) are big in size as compared to male flowers, not more than 7 flowers with a common stalk, which is very short (less than 5 inches), when the female flower opens, the baby papaya is already present in it (Fig. 1C,D) as also found in cucurbits e.g., bitter gourd (Karaila), lufa (Tori), pumpkin (Loki) (Fig. 1Q) and long cucumber (kakri) as shown in Fig. 1R etc.

In each hermaphrodite plant (Fig. 1H-K), from 1-10 fruits were recorded. These fruits were usually smaller than the fruits of female plants. The colour of the male plant fruit was similar as that of the female plant fruits before and after ripening stage (Fig. 1E, I-K). The taste of the male plant fruit was reported not as good as the taste of female plant fruit by the people but, during the present experiment the taste of the male papaya plant (MPP) fruit was found more sweet as compared to female papaya plant (FPP) fruit. The female plant bears the fruit whole year but in the male plant fruiting was observed from March-June. The fruiting was noted again and again in the same male plant, like the female plant. The above observation indicates that the papaya plant contains some of those characters like hermaphrodite, which are capable of producing fruits like female plants. In the same way the papaya plant seems to be theoretically trioecious 'mM' as male, 'mm' as female and mmM as hermaphrodite also recorded by Liu *et al*., (2004) as shown in (Fig. 1H-M). As 'm' (m = X) is recessive, 'M' (M = Y) is dominant and mM = XY is dominant, so female (mm) will be homozygous recessive, male (mM) heterozygous dominant and hermaphrodite (mmM) heterozygous dominant. In appearance both a normal male and a hermaphrodite looks identical to each other i.e. mM = mmM as shown in Fig. 1F&H and also reported by Storey (1976). The hermaphrodite mmM = mMh = XYh = XXY is capable of producing XXY, XX and XY individuals. These three options from a hermaphrodite plant/individual including their filial-1 generation have been shown theoretically as below in Table 1.

Dutta (1972) reported Natural Method of Propagation (NMP) by adventitious budding from leaf i.e., non-sexual and vegetative part of the plant, in two species of plants viz. *Bryophylum pinnatum* (C.N. Sprout leaf plant or Air plant, also called miracle leaf), Ali & Qaiser (2002) and *Kalanchoe verticillata* also called *K. tubiflora* (Riha & Subik 1981). In

the sprout leaf plant when its leaf falls down/kept on soil or in water, the adventitious (foliar) buds develop at the end of a veinlet from the leaf margin. These buds grow up into new plants. They remain attached to the grower leaf until develop the root system and become able to pass their life as independent individuals (Dutta, 1972), as shown in Fig. 1N. In this case the adventitious buds develop when the leaf (at any stage, full grown or not full grown) falls on the soil. Whereas in the case of *K. verticillata* the adventitious (foliar) buds develop at the initial stage of leaf growth, as the leaf matures, the buds (4-6 plantlets at the upper tip of the leaf) also become mature, having 4 small leaves in them as shown in Fig. 1O. They detached and fall down on ground/soil and soon develop roots in a few days and become independent plants. Due to this reason the older leaves of *K. verticillata* are without foliar buds, because the buds have fallen down whereas the new leaves of *K. verticillata* are with foliar buds (Dutta, 1972) as shown in Fig. 1O. Now the question is what should be the chromosome number of the foliar buds/or the plantlets grown through NMP? The answer is, the chromosome number should be the same i.e. if the 1st plant has 2n = 250, ultimately the second plantlet grown from NMP will have the same chromosome number. But if the plant/individual is hermaphrodite in characteristic then there will be three possibilities as presented in (Table 1).

Table 1. Showing three possibilities of individuals genetically produced from a hermaphrodite individual.

	XXY ⟶	XXY,	or XX,	or XY	
	Hermaphrodite	Hermaphrodite	Female (♀)	Male (♂)	
1)	XXY⟶ XXY	= XX, XX, XY, XX, XX, XY, XY, XY, YY	=	4 ♂: 4 ♀. OR (1 ♂: 1 ♀)	
	(Hermaphrodite) Herm.	Here YY is lethal, excluding this total 8 possible combinations are rationed			
2)	XXY⟶ XX	= XX, XX, XX, XX, XY, XY,	=	2 ♂: 4 ♀. OR (1 ♂: 2 ♀)	
	(Hermaphrodite) Female			Here there is no lethal.	
3)	XXY⟶ XY	= XX, XX, XY, XY, XY, YY,	=	4 ♂: 2 ♀ (YY = lethal) so (3 ♂: 2 ♀)	
	(Hermaphrodite) Male	Here YY is lethal, including this lethal, there are 4 ♂: & 2 ♀ or 2 ♂: 1 ♀			

Storey (1976) hypothesized that male and hermaphrodite papaya plants have the same genotype based on frequent sex reversals of male-to-hermaphrodite and hermaphrodite-to-male flower. As it has been observed in the present work that not all the male papaya plants bear the fruit due to pure dominant male (mM), but some male papaya plants bear the fruit due to hermaphrodite in characteristic i.e. mmM = mMh = xYh = XXY. It may be like the case of cucurbits, where the creeper bears the male and female flowers on the same branch. These male and female flowers get separated their sex gene (male & female) from a common source of gene. In the same way the hermaphrodite gene may get separation from each other giving rise to separate male and female flowers or plants/individual. Theoretically the possibility may be shown as follows with different abbreviation as before.

mmM (Hermaphrodite) ⟶ mmM, mm, mM

mm = Flower with fruits due to female homozygous recessive characteristic

mM = Flower without fruits due to male heterozygous dominant characteristic

mmM = Flower with or without fruits due to hermaphrodite dominant characteristics

Storey (1976) also suggested that since 32 of the 35 species of papaya in the family Caricaceae are dioecious, the divergence of these two mM = xY and mmM = xYh chromosomes might have been the result of human selection for hermaphrodite. If this was the case, it would put the divergence of Y and Yh in just thousands of years, but in the present work, opposite seems to be true for the same opinion/idea that the hermaphrodite may give rise to a male, female or hermaphrodite, because hermaphrodite is capable of this characteristic. On the other hand Fujisawa *et al*., (2001) also presented this idea from male, Liverwort which can give rise, not only to male but also to female as well, as described below.

Fujisawa *et al*., (2001) reported that only from XY, the female (XX) and male (XY) may be obtained genetically e.g., the liverwort *Marchantia polymorpha* has X and Y chromosomes in the respective female and male haploids. They presented the successful explanation of representational difference analyses to isolate (2:6 = 1:3) DNA markers for the sex chromosomes. Two female-specific and six male-specific DNA fragments were genetically confirmed to originate from X and Y chromosomes respectively. This report, which is a scientific attempt, proves that liverwort with XY chromosome can give rise XX and XY genetically. The ratio was 6 male: 2 female or 3 male: 1 female including the YY as lethal case, but if the lethal case is excluded then the ratio will be 2 male: 1 female. This example may also be accepted for "Adam Hypothesis", i.e., the 1st plant/individual will produce the same chromosome number in the 2nd plant individual grown by the budding system, but the sex may be the same or different in case of hermaphrodite, as shown below:

XY ⟶ (Natural Method of Propagation; Adventitious budding like process) ⟶ XX, XY, XY, YY = 3 ♂: 1 ♀ or 2 ♂: 1 ♀ here lethal YY is excluded.

The above experiment by Fujisawa *et al*., (2001) genetically proves on scientific grounds that from male plant/individual both male and female may be obtained, as presented in option # 2 and 3 from hermaphrodite in Table 1,

which are being clearly and fully supported by Fujisawa *et al*., (2001). Because in the present assumption, the first producer has been supposed as hermaphrodite and hermaphrodite is capable of producing both male and female. Therefore option # 2 shows that if XX (female) is produced then the ratio would be 1 male: 2 female in F-1 generation, whereas if XY (male) is produced as shown in option # 3, then the ratio would be 1 female: 2 male in F-1 generation, while the option # 1 is fully supported by NMP of different species of plants, in which the 1st producer plant will produce the other plant, having the same chromosome number, but may produce the same or different sex in plants/individuals. If male or hermaphrodite are considered together, as both are identical to each other.

Liu *et al*. (2004) reported that when the scientists investigated more thoroughly, they discovered that papaya sex chromosome have virtually all of the features that the human sex chromosomes have. Comparison of 13 male MSY and hermaphrodite MSY, DNA sequences showed that they were nearly identical, suggesting that the Y and Yh chromosomes might have originated from the same ancestral chromosome. The option # 1 presented in the results is also fully supported and encouraged by Liu *et al*., (2004) in the case of papaya of positive understanding for human sex chromosomes. Because, if plant/individual (human) is supposed as male it may genetically give rise to female and male as well (as reported by Fujisawa *et al*., 2001) and if it is supposed to be hermaphrodite, which is nearly identical to a normal male, then hermaphrodite is capable to produce the hermaphrodite, the female and the male as well. This clearly means that the both M = Y and mM = Yh are exactly identical to each other genotypically and may be called as Dominant Heterozygous Hermaphrodite. This dominant Heterozygous Hermaphrodite male may give rise to a recessive homozygous female (XX) as shown below:

mmM ----------→ mm OR XXY ----------→ XX

Panhwar (2005) reported that the male flowers have 5-partite-tubular corolla with ten stamens and rudimentary ovary. The hermaphrodite flowers are like the pistillate flowers, but bear well developed stamens. The sex of the flowers on some plant can undergo changes with age. The present work is in line to the above report because the said report supports the change of sex with age and hermaphrodite characteristic due to presence of rudimentary ovary in male flowers as described in the present work.

Conclusions

1. Natural Method of Propagation (NMP) takes place naturally by means of budding like process in favourable conditions of healthy environment, frequent food supply and for the production of healthy individual.
2. In term of plants and animals, it is asexual method of propagation, for increasing the population of an individual/organism, where there is very little or no population i.e. single individual/plant.
3. NMP takes place by means of non-reproductive part of the plant/individual body say leaf, which is vegetative part of the plant, not the floral part of the plant.
4. NMP does not occur by means of reproductive organs as in sexual reproduction, where fusion of two male and female sexual reproductive units, called gametes is necessary for fertilization.
5. The plant/individual grown by NMP due to foliar budding may have the male sex, the female sex (Fujisawa *et al*., 2001) or both sex (hermaphrodite) e.g. Hydra (Vidyarthi 1979, Albert *et al*., 2010 & Riley, 2010).
6. The hard part of the leaf Mid-rib plays the main role in this process as presented in the paper. The foliar bud arises at the margin of the leaf lamina where the sub-mid-rib vein ends in veinlet (Dutta 1972).
7. Papaya plant is un-branched mostly, but some times it is found branched, from the main stalk in both male and female papaya plant.
8. Hermaphrodite, papaya can bear fruits like female papaya plant which support the idea of hermaphrodite (XXY), sex chromosome in the male *Homo sapiens*, still being reported in this modern age of science (Source: Internet).
9. Papaya sex chromosomes have virtually all the features that the human sex chromosomes have (Liu *et al*., 2004).
10. Presence of permanent mammary glands in all male human beings, confirms the non-functional (recessive) female part coming from primitive ancestral stalk tree gene, due to XXY chromosome.
11. Beside the "Eve Hypothesis" (Berkeley's Group of Molecular and Geneticists who proposed "Eve Hypothesis" in 1987), the "Aadam Hypothesis" should also be taken into consideration for the evolution of *Homo sapiens* i.e. from male to female (Fujisawa *et al*., 2001). It will have more clues on scientific grounds.
12. NMP is the most primitive asexual type of propagation, found in plants and animals.
13. NMP not only takes place in unicellular but also in multi-cellular (Protoctista) organisms as well.
14. Male papaya plant flower do not contain ovary but it bears the fruits containing the seeds in them. Practically observed and experienced in this paper (as shown in Fig. 1L&M) and also reported by Storey (1976).
15. A single pre existing plant/individual can give rise directly to a new second individual by Natural Method of Propagation (NMP) through budding, asexually from somatic cells of the plant leaf as we observed in *K. verticillata* (Syn. *K. tubiflora*) and *B. pinnatum*.
16. The second evolving plantlet/individual from the pre-existing plant/individual get nourishment from the 1st individual.
17. The number of chromosome pair of the second evolving plantlet/individual from the 1st pre-existing individual will be ultimately the same, due to budding from the somatic cells of the 1st individual body.
18. The male papaya plant (MPP) fruit has long stalk as compared to female papaya plant (FPP) fruit having very short stalk and directly attached to the main stem of the tree.
19. The petals of Corolla persist in the male plant fruit and may be seen clearly in matured (yellow, ripen) fruits as shown in Fig. 1M.
20. Male papaya plant (MPP) fruits, were more sweet and tasty as compared to female papaya plant (FPP) fruits.
21. Human has been reported and hypothesized as hermaphrodite (Story, 1976).

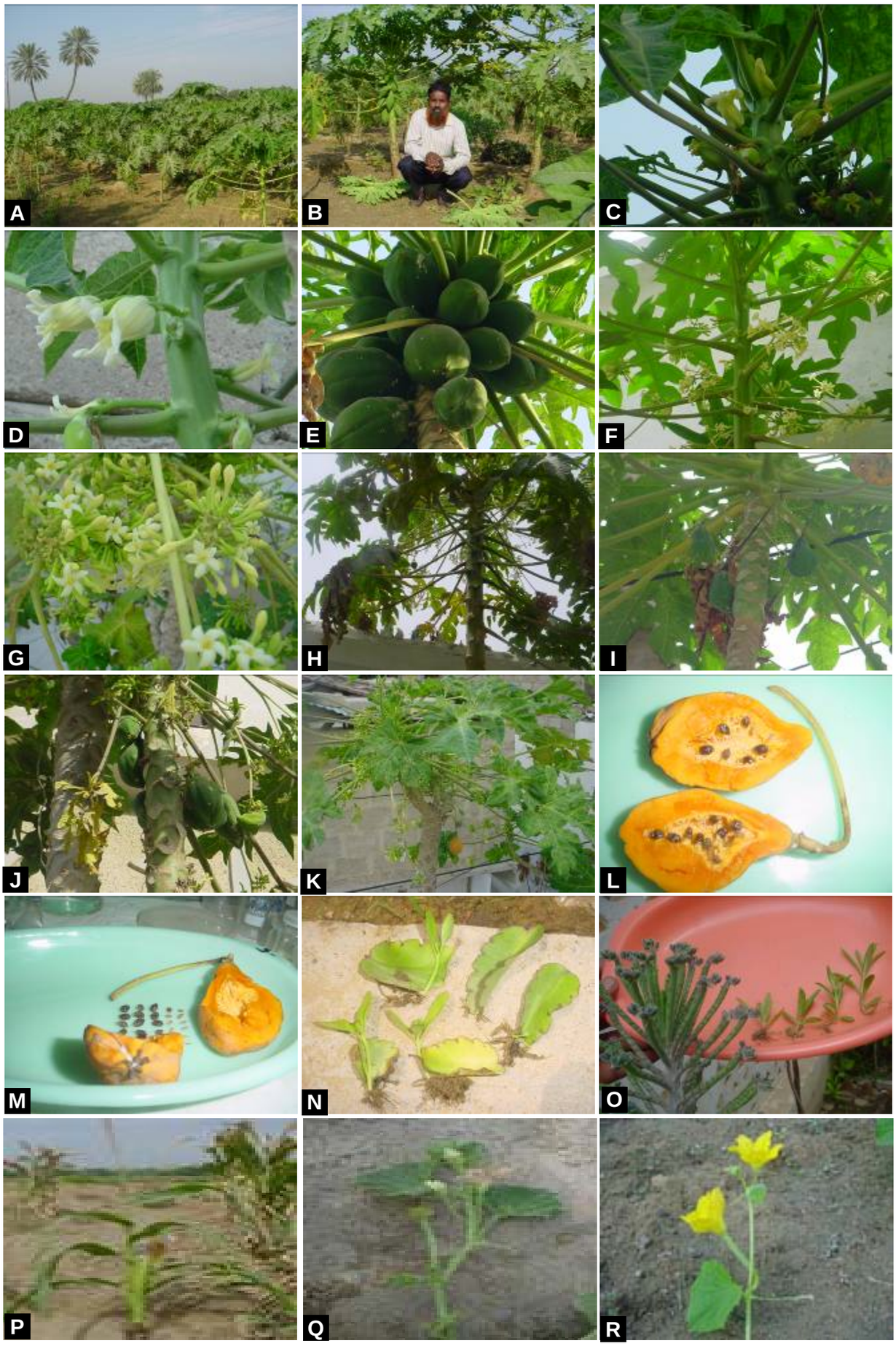
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Fig. 1. A-O: A= Papaya orchid at Kathore, B= Papaya male and female plants in Memon Goth papaya orchid, C= Female flower (normal size), D= Female flower magnified, E= Female plant fruits, F= Male flowering plant, G= Male magnified flowers, H= Hermaphrodite plant with male flowers and a small fruit, I= 3 fruits in hermaphrodite plant, J= 6 fruits in hermaphrodite plant with long stalk, K= Ripen fruit in hermaphrodite plant, L= Hermaphrodite plant fruit with seeds and long stalk (petiol), M= Hermaphrodite plant fruit showing persistent corolla (5 petals), N= Plantlet growing from the leaves of *B. pinnatum* asexually by NMP, O= 4-6 plantlet on each leaf of *K. tubiflora* by NMP, P= natural separation of male and female characters from a common source eg., maize, showing female flower at lower side and male flower on top of the plant, Q= natural separation of male and female characters from a common source eg., pumpkin showing female flower and male flower separating from and common source, R= natural separation of male and female characters from a common source eg., long cucumber showing male and female flower separately.

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