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Breeding of Loquat (Japanese Plum)

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The loquat (*Eriobotrya japonica* Lindl.) is a popular subtropical fruit tree that belongs to the Rosaceae family, subfamily Pomoideae, which also includes other pome fruits like apple and pear. It is well-known around the world for its excellent nutritional, medicinal, economic, and ecological advantages (Hussain *et al.*, 2011). According to new research, loquat leaves contain a number of essential pharmacological chemicals that have anticancer, anti-inflammatory, and hypoglycemic properties (Chen *et al.*, 2007). Both the fruits and leaves of the loquat are commonly used in Chinese herbal medicines to treat coughs and asthma.

Breeding Objectives

i. Producing seedless loquat is a lucrative commercial goal as well as a valuable horticultural goal. The loquat fruit contains 1-5 seeds under open pollination circumstances. Because the seeds are relatively large and take up roughly 20-30% of the fruit's volume, the fruit is tough to eat fresh (Sadamatsu *et al*., 2004). As a result, efforts should be made to establish triploid loquat varieties. Parthenocarpy will be the next feature to be addressed in triploids in order to eliminate the need for pollination or gibberellin administration. It is necessary to investigate the development of seedless triploids from tetraploid x diploid crosses.

ii. To combine as many high-quality features as feasible, breeding activities are required. The small size of the fruit and the high acidity of the loquat have been important determinants of the commodity value in commercial loquat production. Loquat cultivar having strong aroma also attracts more customers in the markets.

iii. Tree characteristics-Trees should have characteristics such as greater adaptability, moderate vigour, and a longer flowering and ripening season.

iv. Rootstock selection - Rootstock selection from *Eriobotrya species* with excellent compatibility indicates that rootstock selection and breeding can improve loquat yield.

v. Cultivars that are resistant to pests and diseases, such as the codling moth, canker, and purple spot, are needed.

vi. Loquat genomic analysis is required for scion and rootstock enhancement (Janick, 2007).

Cytogenetics

The Maloideae, including loquat, are functional diploids (2n =2x = 34) is an evergreen fruit tree in the Amygaloideae subfamily of the Rosaceae for whick an allopolyploid origin has been suggested (Chevreau *et al*., 1985). Exploitation of triploid (2n = 3x= 51) plant to induce seedlessness is a promising technique which is naturally existing in Rosaceae species including loquat (Liang *et al*., 2007).

Inheritance Pattern

i. The heredity for colour of peel and flesh is attributed to incomplete dominant inheritance controlled by one pair or several pair of genes.
ii. A single recessive gene confers resistance to loquat canker (Hiehata *et al.*, 2012).
iii. Cultivars with a brief juvenile phase may aid in obtaining faster results from a crossing programme in order to demonstrate solid verification of the economic features' inheritance trend.

Breeding constraints

Except in a few nations with a small genetic base, there is no unique breeding problem with loquat. Thus, genetic variety can be increased by introduction, mutation, and hybridization. Crop is highly heterozygous because it is a self-incompatible species that favours cross pollination. Self-incompatibility, on the other hand, can be used to make crosses without emasculation or fertilization.

Species Diversity

1. *E. cavaleriei*
2. *E. elliptica*
3. *E. fragrans*
4. *E. henryi*
5. *E. hookeriana*
6. *E. japonica*
7. *E. malipoensis*

Crop Improvement Methods

1. Selection

When it comes to isolating superior kinds from a population, selection is crucial. The majority of planted loquat cultivars are seedlings. In China, a vast number of cultivars produced by selection are kept. From the progeny of seedlings transplanted from China, two remarkable loquat selections, 'Tanaka' and 'Mogi,' have been recorded from Japan (Lin *et al.*, 2007).

The development of seedless loquat will be the next major step in the commercialization of the fruit. Seedless triploids selected from uncommon spontaneous occurrences in diploid open pollinated seed obtained from non-reduction in megaspores are expected to have a wide range of size, colour, ripening season, and adaptability.

2. Hybridization

Loquat hybridization programme was started in China and Japan. The released cultivars of China are Zaozhong No. 6, Zhongjing, Xiangzhong No. 11, 82-6-26. Three new cultivars were developed in Japan, crossed by Mogi x Tanaka. These are Tsukumo, Togoshi and Ootatsu (Lin, 2003). Ferreres *et al.* (2009) also reported that Mizuho' cultivar results from 'Kusunoki' x 'Tanaka' cross. 'Centenária' and 'Mizumo' developed from 'Mizuho' x 'Mogui' cross.

3. Mutation Breeding

Mutation breeding may be attempted as a complementary tool in loquat breeding for desirable characters. Jiang *et al.* (2007) obtained some favourable and unfavourable variants when used g ray through 60Co in loquat cv. 'Jiefangzhong'. They reported that shoots had a strong sensitivity to a ray irradiation and the mutagenesis effect was significant.Ethyl methyl sulfonate (EMS) could also be used for the induction mutant. Qin *et al.* (2011) recorded over 50% death rate of anther-derived embryos when EMS concentration ranged from 0.1 to 0.9% and the exposure time of treatment was 0.5, 1 and 2 h, respectively. A new loquat cultivar

Piera have been identified and may be resulted from the spontaneous bud mutation of 'Algerie', which flowers, sets and ripens repeatedly throughout the year. This variety is capable to flower in 13 different flushes (Reig and Agusti, 2007).

4. Biotechnology

The use of molecular markers to identify loquat germplasm resources is a reliable method. RAPD markers have been used for loquat cultivar in China (Xiaoying *et al.,* 2011), Turkey (Uzun *et al.*, 2012) and Spain (Vilanova *et al.*, 2001). Pedigree of loquat cultivar 'Chuannong No.1' has been identified using RAPD molecular markers. Genetic diversity was assessed by SSR markers in 40 loquat genotypes (Soriano *et al.,* 2005). The development of SSRs from loquat is a powerful tool for creating linkage maps, which can be used to determine where different horticultural traits are located (Blasco *et al.*, 2014).

Varietal Diversity

1. Golden Yellow
2. Golden Nugget
3. Cardona
4. Piera
5. Improved Golden Yellow
6. Pale Yellow
7. Large Round
8. Tanaka
9. California Advance
10. FireBall
11. Matchless
12. Mammoth
13. Large Agra

Future Thrust

Loquat is a tasty and appealing non-climacteric fruit that has a long shelf life and may be eaten both fresh and cooked. Its fruit, on the other hand, comprises a great number of big seeds with soft pulp. Efforts should be made for triploidy breeding, either through induced mutations or by crossing tetraploids (4x) with commercial diploids, to achieve seedlessness (2x). The majority of modern loquat cultivars are the product of open pollinated seedling selection as well as appraisal and selection of existing cultivars. Hybridization and recurrent selection should be prioritized for further advancement in loquat breeding in order to produce superior clones that are adaptable to specific locales. After long-term investigations, breeding and utilization of dwarfing rootstocks employing species like *E. deflexa* and *E. prinoides* would considerably improve loquat output. Although quince rootstocks have been used to dwarf loquats, compatibility issues have arisen, possibly due to differing growth habit.

However, combining traditional and molecular breeding efforts to attain the necessary loquat improvement goals would be the ideal option.

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