# POLYEMBRYONY IN CITRUS CULTIVARS IN SRI LANKA

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Polyembryony is the formation of more than one embryo in a seed, a phenomenon first recorded by Schacht in 1859. Most citrus cultivars produce polyembroyonic seeds which consist of one sexual or gametic embryo developed from the fertilized egg cell and up to six or more asexual embryos.

According to Strassburger (1921), the asexual embryos develop from the nucellar cells and nearby tissues following the stimulus of pollination. Therefore, these asexual embryos have the same genetic constitution as the female parent. The genetic uniformity of the nucellar seedlings of selected cultivars makes them useful as root stocks in large scale citrus orchards. However, mutant characters may be found more frequently in seedlings growing from nucellar embryo than in bud mutations (Tosuke, *et al.*, 1966). It was reported in Sri Lanka that the seedless Bibile Sweet Orange appears to have arisen as a nucellar seedling variant of the Bibile Orange which is very seedy (Richard, 1949). On the other hand, the nucellar embryony brings about a serious problem in hybridization breeding. Due to the large number of asexual embryos difficulties arise in distinguishing the zygotic embryo from the nucellar ones.

A need always existed to study the extend of polyembryony in citrus cultivars in Sri Lanka as many of them produce polyembryonic seeds. Therefore, this study was carried out to distinguish the mono embryonic cultivars from the polyembryonic cultivars and to estimate the extend of polyembryony. The time period for seedling emergence and percentage of germination were also studied.

## EXPERIMENT

The cultivars used in this experiment were collected form both dry zone (Bibile & Moneragala) and wet zone (Karalliadda & Pilimathalawa).

The botanical names of the species and cultivars used in this experiment are given in Table 1. Seeds were extracted from ripe fruits and washed thoroughly to remove the slimy substance on the surface. After air-drying for few hours, 100 seeds (25 seeds per replicate) of each cultivar were sown directly in pots, each pot to have only one seed. Seedlings emerged were counted every two days up to ninety days to determine the time period for 50 percent seedling emergence. Finally, seedlings were uprooted to find out the number of seedlings per seed. This experiment was conducted in two years, 1988 and 1989.

## RESULTS AND DISCUSSION

Table 1 shows the percentage of germination and the time period for 50% seedling emergence. Over 80% germination was observed in Philippine Red Lime, Lemon, Pumelo, Grape fruit, Marmalade and Sour orange. 60 - 70% germination was observed in Mandarin, Lime and Sweet Orange. Lowest germination (45%) was found in Kudaludehi. The time period for seedling emergence was less in Lemon, Grape fruit and Lime.

As shown in Table 2, Pumelo and lemon seeds were 100% monoembryonic. Over 90% of the seeds were found monoembryonic in Sour orange, Kudaludehi and Philippine Red Lime. Grape fruit, Mandarine and Sweet orange cultivars showed high percentages of polyembrony ranging from 30 to 60. Lime (cv. Local) and Marmalade orange showed 25.2 and 21.3 percent polyembryony, respectively.

Many polyembryonic cultivars produced only two seedlings from a seed (Table 2). Sweet orange had the highest percentage of triembryony. Monoembryonic seed with all the stored food material available for the development of a single seedling produces a strong and vigorous seedling. Lemon and Pumelo seedlings were well developed while Sweet orange and Lime with small seeds produced less vigorous seedlings.

In grafted plants, characteristics of the fruits such as size, colour, flavour, etc. are influenced by the root stock used in the propagation. Therefore, the quality of the fruits can vary if the characteristics of the root stocks used to raise the plants are different. This condition can be overcome by the use of nucellar seedlings of the selected cultivars

as root stocks to raise plants for an orchard. Since the root stocks will be of identical genotype, we can expect the fruits to be of a standard quality. Nucellar seedlings with their tap root system also establish well in dry areas. The disadvantage of using the nucellar seedling is the unproductive juvenile phase of the plant.

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Table 1: Citrus species and their germination percentages

| Botanical name of the species | Common name | Average germination % | Days to 50% emergence |
|---|---|---|---|
| *Citrus aurantifolia* (Chirstm.) Swingle | Lime (cv.Philipppine Red Lime) | 97.0 | 15 - 20 |
| *Citrus limon* (L) Burm. f. | Lemon (cv. Local) | 91.0 | 15 - 20 |
| *Citrus maxima* (Burm.) merril | Pummelo, Shaddock (cv. Pink) | 89.0 | 20 - 25 |
| *Citrus * paradisi* Macf. | Grape fruit (cv. Local) | 85.0 | 15 - 20 |
| *Citrus aurantium* L. | Marmalade Orange An introduction | 80.0 | 20 - 25 |
| *Citrus aurantium* L. | Sour Orange (cv local) | 78.0 | 20 - 25 |
| *Citrus reticulata* Blanco | Mandarin (cv. Local) | 70.0 | 20 - 25 |
| *Citrus aurantifolia* | Lime (cv. Local) | 65.0 | 20 - 25 |
| *Citrus sinensis* (L.) Osbeck | Sweet Orange (cv. Bible) | 61.0 | 20 - 25 |
| *Citrus hystrix* DC | Rough lemon (cv. Kudaludehi) | 45.0 | 20 - 25 |

Table 2: Percentage of monoembryony and polyembryony in citrus cultivars

| Name of Cultivar | Average % of monoembryony | Average % of polyembryony | Average % of diembryony | Average % of triembryony |
|---|---|---|---|---|
| Pumelo (cv. pink) | 100.0 | 0.0 | 0.0 | 0.0 |
| Lemon (cv. local) | 100.0 | 0.0 | 0.0 | 0.0 |
| Rough Lemon (cv. Kudaludehi) | 97.7 | 2.3 | 2.3 | 0.0 |
| Sour orange (cv. local) | 97.6 | 2.3 | 2.3 | 0.0 |
| Lime (cv. Philippine red lime) | 91.7 | 8.3 | 8.3 | 0.0 |
| Marmalade | 78.6 | 21.3 | 21.3 | 0.0 |
| Lime (cv. local) | 74.8 | 25.2 | 21.7 | 3.4 |
| Sweet orange (cv. Bible) | 63.8 | 36.1 | 29.4 | 6.7 |
| Mandarine (cv. local) | 58.9 | 41.0 | 39.9 | 1.2 |
| Grape fruit (cv. local) | 40.0 | 59.9 | 58.6 | 1.3 |

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