



Germination studies in passion fruit (*Passiflora edulis*) hybrids

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ABSTRACT

Passion fruit is a perennial woody vine with axillary tendrils, belonging to the family *Passifloraceae* comprising of around 500 species. Passion fruit is valued for its fruit juice with excellent aroma, which is a good source of vitamins, minerals and phytochemicals. There are mainly two types of passion fruit under cultivation. They are the yellow passion fruit (*Passiflora edulis* f. *flavicarpa* Degener) and the purple passion fruit (*Passiflora edulis* f. *edulis* Sims). Germination studies conducted will give inference on the vigour of hybrid seedlings, which will help in finding out superior seedlings. The selfed progeny and hybrids were evaluated for germination characteristic like seed germination per cent, seedling height, seedling vigour index etc. In the present study, hybrids like H6 (P6 x P2) with highest values for seed germination per cent (90.12 %), seedling vigour index (15.09) and comparatively higher leaf area (170.83 cm²), seedling height (16.83 cm) and seedling girth (0.80 cm) as well as hybrid H4 (P5 x P4) with highest values for leaf area (181.17 cm²), and seedling height (18.00 cm) can be considered superior in seedling characters.

Keywords: Hybrids, germination characters, passion fruit, seedling

Passion fruit is a perennial woody vine with axillary tendrils, belonging to the family *Passifloraceae* comprising of around 500 species. South America is the centre of diversity of the *Passiflora* genus with the presence of 95 per cent of all species (Nakasone and Paull, 1998). Approximately 40 species are indigenous to Asia and the South Pacific islands (Vieira and Carneiro, 2006). There are mainly two types of passion fruit under cultivation. They are the yellow passion fruit (*Passiflora edulis* f. *flavicarpa* Degener) which is suited to tropical conditions or the plains and the purple passion fruit (*Passiflora edulis* f. *edulis* Sims) which grows best under sub-tropical conditions or high altitudes. Purple passion fruit is native of tropical America and yellow passion fruit is considered as a mutant of purple variety, or as a natural hybrid between purple and another related species of passion fruit. Passion fruit is valued for its fruit juice with excellent aroma, which is a good source of vitamins, minerals and phytochemicals. Due to the nutritional and medicinal properties of passion fruit, passion fruit is gaining popularity. Germination studies in passion fruit hybrids are meagre and basic evaluation of passion fruit hybrids can help in identifying superior hybrids.

There are reports suggesting that the germination period of passion fruit seeds in summer is shorter, while the period is longer in the coldest months (José *et al.*, 1991). They conducted germination studies in fourteen promising passion fruit types obtained from different parts of South India. The study revealed that seeds started germinating five days after sowing and extended

upto 30 days. Studies on germination per cent of passion fruit has also been recorded and it varied from 18-95 according to Jose *et al.* (1991). In a germination study conducted by Joy *et al.* (2015), maximum germination of 95 per cent was recorded by Kaveri and 134 P had 85 per cent seed germination.

Souto *et al.* (2017) evaluated the germination and early growth characters of passion fruit hybrid seedlings, obtained from different crosses. The hybrids from different genetic combinations were obtained from crosses between progenies from the breeding program of the Universidade Federal de Viçosa with hybrids of the Empresa Brasileira de Pesquisa Agropecuária and of the Viveiros Flora Brasil. They reported significant variation in germination and seedling characters like mean time germination, emergence speed index, seedling height, the length of shoots and roots, and the individual seedling dry matter (root + shoot). Based on their study, hybrid HB₂ (UFVM0212 x BRS Sol do Cerrado) had superior germination and seedling quality and recommended HB₂ as a genotype with potential for breeding programs for seed characters. Tripathi (2018), in a germination study has reported that sprouting of seeds started in about 12-15 days after sowing and germination is completed in about a month. A group of seeds sown without pre-treatment in Puerto Rico in commercial potting mixture started germinating in 14 days and completed germination in 24 days with 61 per cent germination. Research work on germination studies in passion fruit hybrids in India is very meagre. So this research is a beginning to the germination studies in passion fruit.

Short Communication

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Hybridization programme has been conducted in six superior accessions, viz., P₁, P₂, P₃, P₄, P₅ and P₆. The hybridization programme resulted in 1 selfed progeny and 8 hybrids. Passion fruit seeds are recalcitrant and loss viability with storage period. Seeds were extracted from the fruits obtained in the crosses and the selfed progeny and sown in the nursery in poly bags of 25 centimeters length and 15 centimeters width, filled with equal proportion of sand, soil and farmyard manure.

The experiment was carried out in CRD, with 9 treatments, including 8 hybrids and 1 selfed cross, replicated thrice. In a replication 30 seeds were sown. These are the eight hybrids and one selfed progeny obtained from the hybridization programme- S₁ - P₃ x P₃, H₁ - P₃ x P₆, H₂ - P₄ x P₂, H₃ - P₄ x P₆, H₄ - P₅ x P₄, H₅ - P₆ x P₁, H₆ - P₆ x P₂, H₇ - P₆ x P₄, H₈ - P₆ x P₅

Germination was observed up to 30 days from the day of seed sowing. Germination per cent was calculated as the mean of the three replications, each replication containing 30 seeds. Per cent seed germination was calculated using the formula,

$$\text{Seed germination (\%)} = \frac{\text{No. of seeds germinated}}{\text{Total no. of seeds sown}} \times 100$$

Time taken for germination was recorded and expressed as the number of days for germination.

Seedling vigour index was calculated using the following formula at 90 days after sowing,

$$\text{SVI} = \text{Seed germination (\%)} \times \text{seedling length}$$

Fully developed leaves were counted at 90 days after sowing, to get the number of leaves in the selfed and hybrid seedlings.

Total leaf area was calculated by drawing the sketch of leaf in a graph paper and was expressed in cm².

Shoot length was measured from the point of attachment at the ground level to the tip of the plant and expressed in cm.

Seedling girth was recorded with the help of digital calipers and expressed in cm.

Observations recorded on germination characters were analysed statistically in Randomized Block Design and significance was tested using analysis of variance technique (Panse and Sukhatme, 1985).

Observations on days for germination, seedling vigour index, number of leaves, total leaf area, seedling height and seedling girth were taken and the results are given in Table 1. Days taken for germination showed significant difference among the hybrids. The early germination was observed in H₅ (13.00 days) followed by H₈ (14.33 days) which was *at par* with H₂ (15.00 days). Late germination was recorded in H₁ and H₃ (19.33 days), which were *at par* with S₁ (18.33 days)

As per the reports of José *et al.* (1991), the germination period in passion fruit seeds was shorter in summer months compared to colder months, when the photoperiod was longer. The present study was also conducted in summer, which might have contributed to the shorter germination period in passion fruit hybrids.

According to Vieira and Carneiro (2006), yellow passion fruit seeds germinated within two to three weeks after sowing. In the present study also, the seeds of the crosses involving yellow parent had taken two weeks time for germination. Rego *et al.* (2014) reported that seed coat of yellow passion fruit is hard which inhibit water uptake to an extent, mechanical restraint to radicle protrusion and also interfere with gas exchange. In the present study, the time taken for germination of passion fruit hybrid/ selfed seeds ranged between 13.00 to 19.33 days, comparatively larger duration when compared to other fruit crops which might be due to the hard seed coat as reported by Rego *et al.* (2014).

The present results are in conformity with the finding of Joy *et al.* (2015) who found that passion fruit seeds started germinating five days after sowing and the germination extended up to 30 days.

The hybrids showed significant difference with respect to per cent seed germination. The highest seed germination per cent was observed in H₆ (90.12 %) which was on par with H₃ (86.74 %), H₇ (85.45 %) and H₅ (85.04 %). It was followed by H₈ (83.11 %), which was on par with S₁ (82.98 %), H₁ (78.78 %) and H₄ (78.49 %). The lowest seed germination per cent was recorded in H₂ (76.26 %)

According to Joy *et al.* (2015), germination per cent of different passion fruit accessions varied and it was in the range of 18 - 95 per cent. The maximum germination of 95 per cent was reported in Kaveri, followed by 88 per cent in 142 P and 85 per cent in 134 P. In the present study germination per cent varied between 76.26 to 90.12 per cent. The high germination per cent could be attributed to the difference in the genetic make-up of the hybrids.

Ghosh *et al.* (2017) in a study conducted to find best pre-germination methods to enhance the germination in *P. edulis* var. *flavicarpa*, reported a germination of 89.51 per cent which is comparable with the results of the present study.

The highest seedling vigour index was exhibited by H₆ (15.09) which was on par with H₄ (14.17), H₇ (14.05), H₅ (13.75), H₃ (12.87) and H₈ (12.73). The lowest seedling vigour index was observed in H₂ (8.39) which was on par with S₁ (9.67) and H₁ (9.73).

Gurung *et al.* (2014) reported a vigour index of 15.36 in the control treatment, which is comparable with the values obtained in the present study. The significant

Table 1: Germination characters of passion fruit selfed and hybrid seedlings

| Selfed/ Hybrid | Days for germination | Seed germination (%) | Seedling vigour index | Number of leaves | Total leaf area (cm ²) | Seedling height (cm) | Seedling girth (cm) |
|---|-------------------------|----------------------------|-----------------------------|---------------------|--|----------------------------|---------------------------|
| S ₁ (P ₃ x P ₃) | 18.33 | 82.98 | 9.67 | 7.00 | 111.83 | 11.67 | 0.57 |
| H ₁ (P ₃ x P ₆) | 19.33 | 78.78 | 9.73 | 6.67 | 106.17 | 12.33 | 0.57 |
| H ₂ (P ₄ x P ₂) | 15.00 | 76.26 | 8.39 | 5.00 | 103.67 | 11.00 | 0.70 |
| H ₃ (P ₄ x P ₆) | 19.33 | 86.74 | 12.87 | 5.00 | 100.83 | 14.83 | 0.63 |
| H ₄ (P ₅ x P ₄) | 17.33 | 78.49 | 14.17 | 10.33 | 181.17 | 18.00 | 1.20 |
| H ₅ (P ₆ x P ₁) | 13.00 | 85.04 | 13.75 | 7.33 | 131.83 | 16.17 | 0.60 |
| H ₆ (P ₆ x P ₂) | 16.33 | 90.12 | 15.09 | 8.33 | 170.83 | 16.83 | 0.80 |
| H ₇ (P ₆ x P ₄) | 15.67 | 85.45 | 14.05 | 8.00 | 153.83 | 16.50 | 0.60 |
| H ₈ (P ₆ x P ₅) | 14.33 | 83.11 | 12.73 | 5.33 | 123.83 | 15.33 | 0.63 |
| LSD. (0.05) | 1.32 | 5.80 | 3.10 | 1.95 | 23.26 | 4.75 | NS |

variations in seedling vigour index observed in the present study, might be due to the difference in the genetic make-up of the hybrids which is in agreement with the reports of Souto *et al.* (2017) that germination characters in passion fruit seedlings were connected to genotype of the plant.

The highest number of leaves was recorded in H₄ (10.33), which was superior to all other treatments and was followed by H₆ (8.33) after 90 days of germination. The least number of leaves was observed in H₂ (5.00) which was on par with H₃ (5.00), H₈ (5.33) and H₁ (6.67)

Ghosh *et al.* (2017) found that number of leaves were 11.20 and 3.53 which agrees with the results of the present study, since the number of leaves ranged between 5.00 and 10.33.

The highest total leaf area was exhibited by H₄ (181.17 cm²) which was on par with H₆ (170.83 cm²). The lowest total leaf area was observed in H₃ (100.83 cm²) which was on par with H₂ (103.67 cm²), H₁ (106.17 cm²), S₁ (111.83 cm²) and H₈ (123.83 cm²) The significant variations in total leaf area could be due to the differences observed in number of leaves. The hybrids H₅ and H₇ which had more number of leaves, 10.33 and 8.33 respectively, recorded the highest leaf area, since leaf area is dependent on number of leaves.

Seedling height of different hybrids also varied significantly and was found maximum in H₄ (18.00 cm) which was *at par* with H₆ (16.83 cm), H₇ (16.50 cm), H₅ (16.17 cm), H₈ (15.33 cm) and H₃ (14.83 cm). H₂ recorded the lowest seedling height of 11.00 cm, which was on par with S₁ (11.67 cm) and H₁ (12.33 cm).

Gurung *et al.* (2014) recorded a seedling height of 13.10 cm in the control treatment. Ghosh *et al.* (2017) also reported a seedling height of 15.88 cm in passion fruit seedling in the control treatment when conducted

a pre germination study in passion fruit. The present results are in accordance with these findings.

Seedling girth of different hybrids did not vary significantly. It was in the range of 0.57 cm (S₁ and H₁) to 1.20 cm in H₄.

Similar studies in passion fruit hybrid seedlings were reported earlier. Commercially passion fruit plants are propagated by seeds, however, irregular germination results in lack of uniformity in progeny. The germination characteristics of any plant are directly linked to the genotype. Souto *et al.* (2017) evaluated the germination and early growth characters of passion fruit hybrid seedlings. They recommended HB₂ as a genotype with good potential for breeding programs since it showed superior germination and seedling characters. In the present experiment also, significant differences could be observed in the hybrid seedlings with respect to seed germination, seedling height, leaf number and leaf area, which is in agreement with the report of Souto *et al.* (2017). In the present study, hybrids like H₆ (P₆ x P₂) with highest values for seed germination per cent (90.12 %), seedling vigour index (15.09), higher leaf area (170.83 cm²), seedling height (16.83 cm) and seedling girth (0.80 cm) as well as hybrid H₄ (P₅ x P₄) with highest values for leaf area (181.17 cm²), seedling height (18.00 cm) with comparatively higher seedling vigour index can be considered superior in seedling characters.

REFERENCES

- Ghosh, A., Dey, K., Bauri, F. K., and Dey, A. N. 2017. Effects of different pre-germination treatment methods on the germination and seedling growth of yellow passion fruit (*Passiflora edulis* var. *flavicarpa*). *Int. J. Curr. Microbiol. App. Sci.*, **6**(4): 630-636.

- Gurung, N., Swamy, G. S. K., Sarkar, S.K., and Ubale, N. B. 2014. Effect of chemicals and growth regulators on germination, vigour and growth of passion fruit (*Passiflora edulis* Sims.). *Bioscan*, **9**(1): 155-157.
- Jose, S.A.R., Ferreira, F.R. and Vaz, R. L. 1991. A cultura do maracujá no Brasil. Funep, Jaboticabal.
- Joy, P.P., Joseph, A. and Anjana, R. 2015. Evaluation of passion fruit types for commercial cultivation in Kerala. Kerala State Council for Science, Technology and Environment. 214p.
- Nakasone, H. Y. and R. E. Paull. 1998. Passion-fruit. p. 270–291. In: H. Y. Nakasone and Paull, R. E. (eds.). Tropical Fruits. CABI Publishing, Wallingford, Oxfordshire, UK.
- Panase, V.G. and Sukhatme, P. V. 1985. Statistical Methods for Agricultural Workers. ICAR, New Delhi, 381p.
- Rego, M.M., Rego, E.R., Nattrodt, L.P.U., Barroso, P. A., Finger, F. L. and Otoni, W. C. 2014. Evaluation of different methods to overcome *in vitro* seed dormancy from yellow passion fruit. *Afr. J Biotechnol.*, **13** (36): 3657-3665.
- Souto, A.G.L., Cremasco, J.P.G., Maitan, M.Q., Azevedo, J. L. F., Ribeiro, M. R., and Carlos Santos, C. E. M. 2017. Seed germination and vigor of passion fruit hybrids. *Comunicata Scientiae*, **8**(1): 134-138.
- Vieira, M.L.C. and Carneiro, M.S. 2006. *Passiflora* spp. Passion fruit. In: Biotechnology of fruit and nut crops. Richard E. Litz (Ed.). Cromwell Press, London, pp. 436-453.