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Study on viability of Surinam cherry (*Eugenia uniflora* L.) seeds on germination behaviour and Vigour of the seedling

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Abstract
The experiment on effect of seed sowing from the day of extraction to 90 days after extraction at 10 days interval on seed viability revealed that significantly minimum number of days for initiation of germination (13.67 days), complete germination (30.67 days),fifty per cent germination (21.00 days), maximum germination percentage (100.00%) and survivability percentage (95.83%) was noticed in the seeds which were sown on the day of extraction. Seedling growth parameters like longest root length (8.03 cm), shoot length (7.08 cm), vigour index-I (1511.67), vigour index-II (16.67), fresh weight (46.83 mg), dry weight (15.67 mg), at 30, 60, 90 and 120 days after transplanting was also maximum in seeds sown on the day of extraction. Delay in seed sowing caused a considerable decrease in all these parameters.

Keywords: Viability, Surinam, Vigour, *Eugenia uniflora* L.

Introduction
Surinam cherry (*Eugenia uniflora* L.) commonly called as pitanga or Brazillian cherry or pumpkin cherry is an underutilized minor fruit crop having its own medicinal value, belongs to family myrtaceae and native of Surinam, South American country and hence it got its name as a surinam cherry. Pitanga can be used as a live fence and ornamental plant as it grow slowly. Fruits are rich source of vitamin-C (26.3 mg/100g) and Vitamin-A *i.e.*, 1200-2000 IU (Santos *et al*., 2010 and Lira *et al*., 2007) [14, 9]. Fruits are uses for making jam, jelly, or pickles. Brazilians ferment the juice into vinegar or wine and prepare distilled liquor (Ferreira *et al*., 1987) [7]. This species has also attracted the attention of the pharmaceutical industry, since fruits are rich in vitamins and antioxidants and also due to properties like antinociceptive, hypothermic effect, antidiabetic and antibacterial effect of leaf extract (Fadeyi and Akpan, 1989) [6].

Surinam cherry is commercially propagated by seeds and vegetative methods like grafting. To undertake propagation by vegetative means, production of healthy and vigorous rootstock is very important. Prolonging the viability of seeds until next fruiting season would facilitate the availability of seeds for various plantation programs and also for use by local farmers throughout the year. Seeds are recalcitrant and are relatively high in moisture content and possess a characteristic feature of losing their viability during desiccation. Since surinam cherry is hardy, dwarf in stature and fruits are available almost throughout the year it can be used as a rootstock for different species of myrtaceae family like jamun, guava and rose apple *etc*. Keeping this in view the present research work was carried out to study the viability of Surinam cherry seeds.

Material and Methods
The present investigation was carried out in college of Horticulture Mysuru during 2017-18. The experiment was laid out with completely randomized design having ten treatments and three replications.

Seeds required for the experiment were extracted from the freshly harvested fully ripe fruits and seeds were treated with GA_3 (500 ppm). Extracted seeds were sown in portrays at 10 days intervals *i.e.*,sowing on the day of extraction, 10, 20, 30, 40, 50, 60, 70, 80, 90 days after extraction (T_1, T_2, T_3, T_4, T_5, T_6, T_7, T_8, T_9 and T_{10}, respectively)using cocopeat as a media in laboratory condition. The germination of the seeds was studied in lab condition. After one month, when seedling attained height of 5-7 cm are transplanted to polythene bags of size 5×8 inches. Polythene bags were filled with soil, sand and farm yard manure in the proportion of 1:1:1. Watering was done immediately after transplanting and weeding was done as and when required.

Observation like number of days taken for initiation of germination, complete germination and per cent germination. Seedling growth characters like shoot length, root length, fresh weight and dry weight were recorded.

The data generated from study were subjected to analysis by using standard method suggested by Panse and Sukhatme (1985) [11].

Results and Discussion

Germination behavior

The seeds which are sown on the day of extraction (T_1) took minimum number of days for initiation of germination, fifty per cent and complete germination (13.67, 21.00 and 30.67 days, respectively) while seeds which were sown at 90 days after extraction took maximum number of days for initiation of germination and complete germination (22.67 and 38.67 days, respectively) and seeds which were sown at 70 days after extraction took maximum (25.67 days) number of days for fifty per cent germination.

It may be due to desiccation of seeds during storage period. Early seed germination begins with the imbibition of water by the seed and increase in fresh weight due to increasing water uptake. The fresh weight of the seed begins to increase again as water up take drives the emergence of the radical. The time needed for seed to germinate is related to the difference in the seeds threshold water potential and the seeds water content. The difference is the basis for the hydro time model (Bradford, 1990) [3].

Maximum number of days taken for initiation and 50 per cent germination might be due to that, as recalcitrant seeds must not dry below 30 to 50 per cent or else, they will slowly lose their ability to germinate, as reported by Venkat (2004) [16] in Rangpur lime. These observations are in line with findings of Devi *et al*. (2016) [4] in jamun.

Per cent germination and survivability

Germination percentage and survivability percentages was also found to be maximum (100.00 and 95.83%, respectively) in case of fresh seeds and minimum per cent germination and survivability (86.67 and 66.67%, respectively) was observed in seeds which were sown at 90 days after extraction.

According to Abbas *et al*. (2003) [1] in jamun, mean germination percentage and germination speed were decreased with the reduction in moisture content. Loss in seed viability and vigour were found to be associated with increased electrolyte leakage as the moisture content reduced below 30 per cent. Similar findings were obtained by Mahasin and Mustafa (2015) [10] in mango, Anandanlakhmi *et al*. (2005) [2] in jamun and Ray and Sharma (1987) [13] in litchi. This could be attributed to the seed deterioration during storage, leading to reduction in vigour, germination rate, enzymatic activity, respiration, increase in permeability and susceptibility in stresses and decrease in seedling growth rate as reported by Verma *et al.* (1998) [17] in kiwifruit. Similar results were reported by Sivasubramaniam and Selvarani (2012) [15] and Gowda *et al*. (2011) [8] in jamun.

Seedling growth parameter

Seedling growth character like shoot length and root length which was found maximum (7.08 and 8.03 cm respectively) in seeds which were sown on the day of extraction whereas it was found minimum (5.59 and 5.13 cm respectively) values for seeds which were sown 90 days after extraction. Seeds which were sown on the day of extraction shown maximum (46.83 and 15.67 mg) fresh and dry weight whereas seeds which were sown at 90 days after extraction shown minimum (26.83 and 8.27 mg) values for the same.

This could be due to higher germination capacity of the fresh seed, which resulted in normal seedlings with longer shoot. A trend of decrease in shoot length was observed with delay in sowing of seeds after extraction. This may be due to decreased mobilization of reserve substances during the germination of the stored seeds. The increased fresh and dry weight of seedling may be due to the enhanced root and shoot length (Dhakal and Pandey, 2001) [5].

Vigour index-I and II

Seedling vigour index -I and II was found highest (1512 and 17 respectively) in seeds which were sown on the day of extraction whereas it was minimum (0929 and 05 respectively) in case of seeds which were sown at 90 days after extraction.

Among the different tretments fresh sown seeds showed high percentage of survivability and high seedling vigour index and seeds sown after 90 days after extraction shown minimum values for the same (Table 1 and 3). This could be attributed to the seed deterioration during storage, leading to reduction in vigour, germination rate, enzymatic activity, respiration, increase in permeability and susceptibility in stresses and decrease in seedling growth rate as reported by Verma *et al.* (1998) [17]. Similar results were obtained for Sivasubramaniam and Selvarani (2012) [15] in jamun, Gowda *et al*. (2011) [8] in jamun, Parameswari *et al*. (2001) [12] in tamarind. In jack seed germination was highest when fresh seeds were subjected for germination compared to stored seeds, the viability of seed decreased gradually with the increase in storage period.

Table 1: Effect of sowing time on moisture per cent and germination characters of surinam cherry seeds

Treatments	Days taken for			Moisture per cent	Germination Percentage (%)	Survivability percentage (%)
	Initiation of germination	Complete germination	Fifty per cent germination			
T_1(00 days)	13.67	30.67	21.00	54.10	100.00 (89.48) *	95.83 (82.74) *
T_2 (10 days)	14.67	31.33	21.00	53.17	100.00 (89.48)	95.83 (82.74)
T_3 (20 days)	15.00	31.67	23.33	53.10	96.67 (83.50)	91.67 (76.02)
T_4 (30 days)	17.67	32.00	24.00	51.90	100.00 (89.48)	91.67 (76.02)
T_5 (40 days)	18.33	35.00	24.67	50.53	100.00 (89.48)	87.50 (72.92)
T_6 (50 days)	18.67	35.33	25.33	50.43	96.67 (83.50)	83.33 (66.19)
T_7 (60 days)	19.67	36.33	25.33	49.03	100.00	79.17

					(89.48)	(63.09)
T_8 (70 days)	20.00	36.67	25.67	48.20	100.00 (89.48)	75.00 (60.51)
T_9 (80 days)	20.33	38.00	25.00	47.03	93.33 (77.54)	70.83 (57.41)
T_{10} (90 days)	22.67	38.67	24.67	46.17	86.67 (68.85)	66.67 (54.82)
S.Em ±	00.47	00.69	00.48	00.42	02.11	04.93
C.D @ 5%	01.39	02.03	01.42	01.22	06.21	14.54

* Values in parenthesis are arc sin transformation dat

Table 2: Effect of sowing time of surinam cherry seeds on root length, shoot length, fresh weight and dry weight.

Treatments	During transplanting			
	Root length (cm)	Shoot length (cm)	Fresh weight (mg)	Dry weight (mg)
T_1(00 days)	8.03	7.08	46.83	15.67
T_2 (10 days)	7.85	7.07	42.67	13.17
T_3 (20 days)	7.15	6.75	38.50	12.50
T_4 (30 days)	6.37	6.68	35.00	12.00
T_5 (40 days)	5.82	6.65	33.17	11.83
T_6 (50 days)	5.65	6.54	30.90	09.03
T_7 (60 days)	5.37	6.51	29.67	08.62
T_8 (70 days)	5.23	6.33	30.33	08.45
T_9 (80 days)	5.22	5.92	27.83	08.27
T_{10} (90 days)	5.13	5.59	26.83	07.96
S.Em ±	0.24	0.135	01.17	00.43
C.D @ 5%	0.72	0.4	03.45	01.26

Table 3: Effect of sowing time of surinam cherry seeds on – vigour index

Treatments	Seedling vigour index-I	Seedling vigour index-II
T_1(00 days)	1512	17
T_2 (10 days)	1492	13
T_3 (20 days)	1342	12
T_4 (30 days)	1305	12
T_5 (40 days)	1247	12
T_6 (50 days)	1178	08
T_7 (60 days)	1188	08
T_8 (70 days)	1157	07
T_9 (80 days)	1039	60
T_{10} (90 days)	0929	05
S.Em ±	34.30	0.5
C.D @ 5%	101.2	1.5

Conclusion

The fresh seeds which were sown on the day of extraction showed better performance in terms of germination behavior and Vigour index of the seedling compared to stored seeds.

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