

## Seed Germination and Dormancy Studies in Some *Annona* Species

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*Annona* (Custard apple) is the most ancient fruit of India. There are over fifty species in the genus *Annona*, but only six species produce fruits of commercial significance. The failure of germination of viable seeds create problems to the growers and nursery men. There are many instances where the seeds of fruit crop in dryland horticulture have failed to germinate and huge quantities of seed and money is wasted. With a view to develop germination protocol the present investigation was undertaken since the method is not available in ISTA Rules [1].

The fully ripened fruits of the cultivars of *Annona atemoya* viz. Bullock Heart, Pink Mammoth, and Island Gems and *Annona squamosa* viz. Balanagar, British Guiana and Washington were collected from Arid Zone Fruit Project, MPKV, Rahuri during October 1997. The seeds were separated from the flesh attached to them by soaking the fruits in water for about two hours and then rubbing by hand. The seeds were then dried in shade for about 15 days. The infected and immature seeds were discarded from the seeds by water floatation method.

In order to detect the presence of dormancy, the seeds were subjected to quick viability test (TZ test) and germination test simultaneously as prescribed by ISTA [1] for other species. For conducting tetrazolium test, 400 seeds were selected from the seed lot of each cultivar and deep soaked in water for a period of 24 hours in order to loosen the seed coat. After removal of seed coat the seeds were rinsed with water and then longitudinal cut were made in the seeds. Then these longitudinal section were soaked in 0.5 per cent tetrazolium salt solution and kept in darkness for 16 hours. The seeds were then evaluated for viability as per ISTA [1] method. The results were reported as the percentage of viable seed.

For germination test, 100 seeds of each cultivar were kept for germination in three replications by using between paper method (BP) each at 20°, 20-30° (i.e. 20°C for 16 hours and 30°C for 8 hours per day) and 30°C temperature in the germinator. The seeds were observed regularly on alternate days for germination, it was continued till the seedlings showed all essential structures such as radicle, plumule and cotyledon. On the final count, the values of normal seedling were recorded and expressed as percentage.

The seeds of cv. Bullock Heart of *Annona atemoya* which exhibited dormancy were subjected to various physio-chemical treatments for breaking dormancy viz. conc.  $H_2SO_4$  for 15 min., conc.  $H_2SO_4 + GA_3$  250 ppm, conc.  $H_2SO_4 + GA_3$  500 ppm, conc.  $HNO_3$  for 15 min., 50 % conc.  $HNO_3$  for 15 min., stratification and mechanical scarification. The seeds were tested for germination after the treatment at 30°C temperature. The experiments were conducted in CRD and data were analyzed.

The initial seed viability, as determined by T.Z test was 100 per cent in Bullock Heart and Pink Mammoth, the cultivars of *Annona atemoya*, followed by 90 percent in Balanagar and Washington, the cultivars of *A.squamosa* whereas, it was lowest (83.7%) in Island Gems the cultivar of *A.atemoya*. The differences in mean germination percentage were significant for different temperature treatments and cultivars (Table 1). The time required for first and final count was 11 and 24 days respectively in Pink Mammoth, Balanagar and Washington whereas 13 and 25 days in rest of species. All the six cultivars of *Annona* species exhibited zero percent germination at 20°C temperature. While it was significantly higher in British Guiana (92%) and Washington (90%) at 20-30°C temperature as compared to 30°C

Table 1. Effect of temperature regimes on seed quality parameters in *Annona* species.

| Species/<br>Variety |                 | Initial<br>Viability<br>(%) | Germination Percentage |             |      |         | Shoot length (cm) |             |      |         | Root length (cm) |             |      |         |  |
|---------------------|-----------------|-----------------------------|------------------------|-------------|------|---------|-------------------|-------------|------|---------|------------------|-------------|------|---------|--|
|                     |                 |                             | 20°C                   | 20-<br>30°C | 30°C | Mean    | 20°C              | 20-<br>30°C | 30°C | Mean    | 20°C             | 20-<br>30°C | 30°C | Mean    |  |
| Annona atemoya      |                 |                             |                        |             |      |         |                   |             |      |         |                  |             |      |         |  |
| 1                   | Bullock Heart   | 100                         | 00                     | 30          | 27   | 28.5    | 00                | 3.5         | 11.3 | 7.4     | 00               | 3.3         | 5.0  | 4.1     |  |
| 2                   | Pink Mammoth    | 100                         | 00                     | 75          | 86   | 80.5    | 00                | 5.7         | 15.3 | 10.5    | 00               | 3.4         | 5.6  | 4.5     |  |
| 3                   | Island Gems     | 83.7                        | 00                     | 57          | 70   | 63.5    | 00                | 6.5         | 13.9 | 10.2    | 00               | 5.4         | 5.4  | 5.4     |  |
| Annona squamosa     |                 |                             |                        |             |      |         |                   |             |      |         |                  |             |      |         |  |
| 4                   | British Guiyana | 85                          | 00                     | 92          | 84   | 88.0    | 00                | 7.5         | 14.0 | 10.8    | 00               | 3.8         | 5.1  | 4.4     |  |
| 5                   | Baianagar       | 90                          | 00                     | 62          | 81   | 71.5    | 00                | 6.4         | 13.3 | 9.8     | 00               | 3.5         | 5.0  | 4.2     |  |
| 6                   | Washington      | 90                          | 00                     | 90          | 86   | 88.0    | 00                | 6.6         | 12.6 | 9.6     | 00               | 4.5         | 5.7  | 5.1     |  |
| Mean                |                 | -                           | 00                     | 67.7        | 72.3 | 70.0    | 00                | 6.00        | 13.4 | 9.7     | 00               | 4.0         | 5.3  | 4.6     |  |
| Factors             |                 |                             |                        | S.E. +      |      | C.D. 5% |                   | S.E. +      |      | C.D. 5% |                  | S.E. +      |      | C.D. 5% |  |
| A Species           |                 |                             |                        | 0.73        |      | 2.09    |                   | 0.46        |      | 1.32    |                  | 0.18        |      | 0.56    |  |
| B Temperature       |                 |                             |                        | 0.52        |      | 1.48    |                   | 0.33        |      | 0.93    |                  | 0.13        |      | 0.39    |  |
| C interaction       |                 |                             |                        | 1.27        |      | 3.62    |                   | 0.80        |      | 2.28    |                  | 0.31        |      | 0.97    |  |

Table 2. Effect of treatments on germination of *Annona atemoya* cv. Bullock Heart at 30 °C temperature.

| SN | Treatment                                                                    | Germination<br>(%) | Hard seed<br>(%) | Shoot length<br>(cm) | Root length<br>(cm) |
|----|------------------------------------------------------------------------------|--------------------|------------------|----------------------|---------------------|
| 1  | Control                                                                      | 27 (31.3)          | 73               | 11.3                 | 3.9                 |
| 2  | Conc. H <sub>2</sub> SO <sub>4</sub> for 15 min.                             | 15 (22.8)          | 85               | 16.9                 | 7.2                 |
| 3  | Conc. H <sub>2</sub> SO <sub>4</sub> for 15 min. + GA <sub>3</sub> (250 ppm) | 24 (29.3)          | 76               | 10.5                 | 3.5                 |
| 4  | Conc. H <sub>2</sub> SO <sub>4</sub> for 15 min.+ GA <sub>3</sub> (500ppm)   | 24 (29.3)          | 76               | 8.3                  | 5.6                 |
| 5  | Conc. HNO <sub>3</sub> for 15 min.                                           | 32 (34.4)          | 68               | 14.3                 | 7.1                 |
| 6  | 50% conc, HNO <sub>3</sub> for 15 min.                                       | 82 (64.9)          | 18               | 10.9                 | 6.8                 |
| 7  | Stratification at 5°C for 7 days                                             | 72 (58.0)          | 28               | 12.7                 | 7.4                 |
| 8  | Mechanical scarification                                                     | 32 (34.4)          | 68               | 13.6                 | 7.9                 |
|    | S.E. +                                                                       | 1.31               | -                | 0.57                 | 0.58                |
|    | C.D. at 5%                                                                   | 3.95               | -                | 1.71                 | 1.75                |

temperature. This indicated that 20-30°C (alternate temperature) is suitable for better germination in these two cultivars. In case of Pink Mammoth, Island Gems and Balanagar, 30°C temperature was quite favourable for satisfactory germination of 86, 70 and 81 percent respectively. This suggested that 30°C temperature regimes was suitable for satisfactory germination of these three cultivars. The variation in percentage of germination ranged from 70-92% was mainly due to varietal differences and temperature. The germination was only 30 and 27

percent at 20-30°C and 30°C temperature in cv. Bullock Heart indicated possibility of dormancy. The seed dormancy has been reported in *Annona diversifolia* [2], *Annona squamosa* [3, 4].

The root shoot and length were significantly influenced by various temperature regimes. It was significantly higher at 30°C temperature as compared to 20°C and 20-30°C temperature. Among the cultivars, British Guiyana exhibited highest shoot length whereas, root length was highest in Island Gems.

Bullock Heart the cultivar of *Annona atemoya* possessed dormancy. A number of physio-chemical treatments were tried for breaking the dormancy of Bullock Heart seeds (Table 2). The seeds treated with 50 % concentrated Nitric acid for 15 minutes exhibited significantly higher germination (82%) than other treatments. It was followed by the treatment of seeds with stratification at 5 °C for 7 days (72%). The improved germination with these treatments could be attributed to breaking the impermeability of seed coat to water and or gases or leaching out germination inhibitors such as phenolic compounds present in seed coat [5]. Stino *et al* [4] reported that enhanced germination up to 82 % in Custard apple of *Annona squamosa* by acid scarification followed by soaking in warm water at 40°C for 24 hours. The germination was 32 percent in the treatment of concentrated Nitric acid. This may be due to the burning of embryonic tissue by nitric acid.

Therefore, germination test in the species can be conducted in BP at 30°C. Nitric acid treatment (50% conc.) for 15 minutes is helpful for increasing the germination in the cultivars which exhibit dormancy.

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