Salacia chinensis L. – Utility and Propagation Techniques

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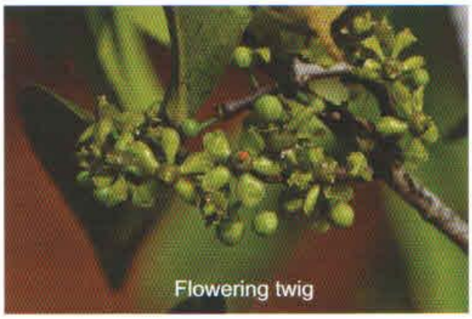
Medicinal Plant Wealth of Western Ghats Mountains (a global biodiversity hot-spot) in India are becoming globally significant to newfound curative properties. *Salacia chinensis* L. is one of the elements of these mountains. *Salacinol* and related compounds from this species are used in the treatment of diabetes. Destructive harvesting of *Salacia* roots has resulted in population decline (> 50 %) in the last decade. Assessment for anti-diabetic activity of alternative plant parts such as stems, seeds, leaves is one approach to develop sustainable harvest strategy. Reducing harvest pressure on wild population and developing viable commercial cultivation that caters ever increasing demand of raw material by the pharmaceutical industry is a huge challenge. Systematic approach should be made towards scientific cultivation of *Salacia*. Present write up discusses investigations of seed germination and the factors affecting the same.



Flowering twig

About *Salacia chinensis* L.: *Salacia chinensis* L.[Synonym- *Salacia prinoides* (Willd.) DC.], family - Celastraceae is an evergreen climbing shrub or a small tree occurring in India, Sri Lanka, China, Malaysia, Java and Philippines. It occurs in pockets mainly around the Sahyadri – Konkan corridor area of the northern Western Ghats. It is locally referred as *Saptarangi, Ekanayakam, Ponkoranti, Saptachakri* or *Ingali*. *S. chinensis* has gained importance as a rich repository of chemical constituents contributing to various medicinal properties. Phytochemical profiling reveals the presence of constituents such as *salacinol, kotalanol, neokotalanol* and *mangiferin*. Though extracts of *S. chinensis* exhibit medicinal activity against tumors, mutagenicity, hepatitis, arthritis, cardiac disorders and mental disorders, traditional medicinal systems have restricted use of *Salacia* primarily as an anti-diabetic agent.

Diabetes Management:

International Diabetes Federation (IDF) predicted the growth of diabetic patients from 366 million in 2011 to 552 million in 2030. It is also known that management of type 2 diabetes by insulin therapy results in insulin resistance, anorexia nervosa, brain atrophy and fatty liver during chronic treatments. In contrast, the use of *Salacia* under prescribed dosage is considered completely safe. As a result, demand for raw material of *Salacia* (*S. chinensis* L., *S. oblonga* Wall., *S. reticulate* Wight) has witnessed a steep increase and it currently exceeds 100 metric tons per year. About 95 % supply coming from the wild populations of Western Ghats. Presently, only the roots are exploited for their medicinal properties, making the harvesting destructive. Combination of these two threats have necessitated the need to scientifically study various propagation techniques of the species.

Morphological characters:

Outer side of the root has a golden yellow cork layer whereas the inner side has several pink-red concentric rings of bark and wood tissue. The leaves are thinly coriaceous with 1.75 - 3.5 cm in length, 1 - 1.5 cm in width, elliptical, serrate, acute, opposite to sub opposite. Flowers are yellow, 1.25 cm in diameter, 3- 6 individuals from small tubercles in the axils of leaves. Fruits of *Salacia chinensis* L. are green when unripe and turn red upon ripening. They are edible, berry type - usually solitary. They are sub-globose to ellipsoid and are about 13 – 23 mm in diameter. Fruit pulp is mucilaginous. Average seed weight is 0.48 g ± 0.08 g. Seeds are brown in colour. They are large, occupying almost 90% of the fruit. Most of the fruits bear only one seed each. Only about 2 % fruits have double seeds.

Propagation Trials:

Though in field, lateral roots of *Salacia* are seen to develop into independent individuals, efforts were focused on propagation through seeds. Fruits were de-pulped and the fresh seeds were sown in germination trays. To study the effect of storage on germination, some seeds were stored in vermiculite to maintain moisture at room temperature and were subsequently sown at fortnightly interval.

Observations Related to Germination:

When fresh seeds were sown immediately after harvesting and de-pulping, the germination started within 45 – 50 days and 50 % germination was achieved in next fortnight. Upto 7 months of storage of seeds in vermiculite, the germination percentage was more than 90. Thus, the seeds are orthodox. Considering this high germination percentage, no further experimentations were carried out about seed soaking and/or gibberellic acid dip. As the storage time increased beyond 7 months, there was a significant decrease in the germination percentage (50 - 60 %).

It was also observed that 4 % seedlings were conjointed doublet type, whereas 2 % seedlings were conjointed triplet type. We also encountered 0.04 % albino individuals suggesting feeble homozygous nature within the seedlings.

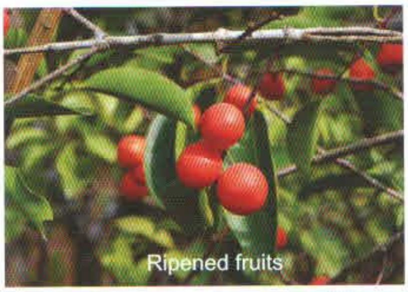
Average days required for germination were influenced significantly by number of days of storage of seeds prior to sowing (r^2 = 0.9781, p value < 0.05). More the days of storage, more were the days required for germination. Though there was a negative correlation between the average days required for germination and fresh seed weight (r^2 = 0.5537), dry seed weight (r^2 = 0.8499) and seed moisture (r^2 = 0.8447), the correlation was statistically not significant (p value > 0.05). Similarly, seed dry weight and seed moisture content were negatively correlated with days required for 50% germination ($r^2 = 0.8394$, p value < 0.05 and $r^2 = 0.8447$, p value < 0.05; respectively).

Observations Related to Relative Humidity:

To study the effect of relative humidity on germination, 100 seeds were sown in a humidity chamber (relative humidity= 80 - 90 %) and other set of 100 seeds was sown outside the humidity chamber (relative humidity = 35 - 50 %). Seeds in humidity chamber required much lesser period for first germination (35 days) and for 50 % germination (52 days) as compared to performance of the seed set sown outside the humidity chamber (53 and 100 days, respectively).

Treatment of Seedlings with Manures:

The seedlings thus obtained were transplanted into nursery bags. Different treatments of organic manures (poultry, vermicompost), inorganic fertilizers (urea, di-ammonium phosphate, Suphala), microbial source [phosphate solubilizing bacteria (PSB)], foliar sprays of enzymes (biozyme), micro-nutrients (Rexolin) and growth hormones (gibberellic acid) were tried to establish the best amongst the lot. Benefits of adding cocopeat to the basic potting mixture of soil and farm yard manure were also evaluated. Evaluations were carried out by comparing biomass and Dickson Quality Index (DQI).


Ripened fruits


Root showing concentric rings

Addition of cocopeat improved performance of almost all the additives. Probably, increase in the porosity due to cocopeat addition allowed roots to grow more profusely, thereby increasing the nutrient uptake and increasing the biomass. In potting mixtures without cocopeat, biomass of all the treatments did not differ significantly than control - seedlings without any additives (p value > 0.05). However, almost all the treatments for seedlings from nursery bags with cocopeat had better biomass than their control counterpart. Here, mean seedling biomass of seedlings obtained from sets receiving Rexolin foliar spray (one tail p value = 0.006), biozyme foliar spray (one tail p value = 0.025), gibberellic acid foliar spray (one tail p value = 0.014) and PSB soil application (one tail p value = 0.011) were significantly more than the mean biomass of control.

In the set of experiments having no cocopeat in potting mixture, DQI of only the seedlings receiving urea was better than control (p value > 0.05, statistically not significant) while others had mean DQI values equal to or less than mean value of control. In the other case of potting mixture having cocopeat, though DQI of seedlings receiving urea, Rexolin, biozyme and gibberellic acid had higher values than control, the differences were statistically not significant (p value > 0.05). DQI on only PSB treatment was significantly more than DQI of control (one tail p value = 0.024).

Recommendations:

Thus, we recommend seed sowing with minimum time period of storage. If the storage is inevitable, precautions should be taken to store them in vermiculite, thereby maintaining seed moisture content. Seed sowing in humidity chamber further improves germination performance. To ensure better DQI and more biomass, cocopeat should be added to the potting mixture. Foliar sprays of micronutrients, enzymes and growth hormones and soil application of phosophate solubilizing bacteria improved health of the seedling.

Seedlings thus obtained can be transplanted into larger nursery bags at least once after 6 months of first transplanting and after a year from first transplanting; they may be planted into field at a distance of 2 ft × 2 ft for intense cultivation.

Systematic cultivation of *Salacia chinensis* L. shall result in quality planting material QPM and shall allow pharmaceutical industry an assured, authentic supply without endangering the wild population.

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