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NATURAL SEED GERMINATION STUDIES OF ENDEMIC AND ENDANGERED TREE SPECIES OF SHOREA TUMBUGGAIA ROXB OF TIRUMALA HILLS

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ABSTRACT

The distribution of Shorea tumbuggaia is very important endemic and endangered globally threaten plant of sheshachallum hills. It is very useful for its timber, medicine and pharmaceutical properties. The present work is aimed to develop protocol for invivo seed germination method for rapid and large scale propagation by using seeds. In S. tumbuggaia the fruit infestation was 70%but seedling production is was 0.01%. By using nursery techniques, forest soils and vermicompost. The germination and survival rate is increased to 4-56%.

Abbreveations: Shorea tumbuggaia; In vivo germination; Nursery Techniques, forest soil, vermicompost.

INTRODUCTION

The genus *Shorea* (family Dipterocarpaceae) is native to Southeast Asia, from northern India to Malaysia, Indonesia and the Philippines. It is a tropical genus with 196 species of mainly rainforest trees, out of which 148 species are currently listed in the IUCNRed List; majority of them are listed as critically endangered. *Shorea tumbuggaia Roxb* is tree taxa, IUCN Red List of Threatened belonging to the family Dipterocarpaceae. It is endemic and medicinally (Ankanna S Savithramma N 2013; Ashton PS1980), very important plant of Seshachalum hills of India. Now it is in the endangered status (Ganesh P and Sudarsanam G. 2014, Madhavachetty K 2008), more over basic studies on the physiology, morphology (Solomon Raju AJ. et al., 2011 & 2013), phytochemistry (Patile KS. et al., 2004) technique of most of these species are conducted at a slow pace. There is few reports on distribution and phytochemical analysis. So for there is no reports on the conservation status of this plant.

This is the first report on germination studies and *Invivo* studies *Shorea tumbuggaia* from tirumala region of Eastern Ghats.

The distribution of *Shorea tumbuggaia* in tirumal is located in Akasaganga, Papavinasanam, Japali, Microstation, Darmagiri, Venugopal gudi and Seshatherdam. It is also located in Sadasivakona which is located between Ranigunta and Papanaidu peta. There is less distribution of this plant in Talakona area also. For this research study I have selected Akasaganga, Papavinasanam and Japali area during the flowing and fruiting season of 2014-16. *Shorea tumbuggaia Roxb.* Belonging to the family Dipterocarpaceae, is globally threatened medicinal tree tax is valued for its timber and pharmaceutical properties. Now this tree is facing high risk of extinction in wild due to ecological conditions specially Forest fires and other anthropogenic pressures seem to have affected the vegetation considerably. There is an urgent need to protect this endangered and endemic plant in Seshachalum area(Figure-1).

REASONS FOR THE ENDANGERED STATUS OF THE SHOREA TUMBUGGAIA

The reason for endangered status of the plant in tirumal region is phenology status of the flower that is continued up to the seed formation. Even though massive flowers were present in that there is no anthers found in the flowers. The fruits are winged and mature with 20-30 days. The seeds lack Dormanancy, some seeds germinate before falling from the tree and some seed germinate as soon as they fallen from trees. The poor seed set is due to the high temperature. The healthy fruiting occurs in ever 1-3 years, but not in every year. This is common in *Shorea* species. The germination is very fast as soon as the seed is fallen Hypocotyle comes out in the form of long ,cylindrical red color structure and penetrate into the litter and produce root, only 1or2 plants are produced with root,shoot and leaf [fig-3]. The percentage of germination is high but seed ling production is very less of 0.01%. Seed predation can be very high and crops can be completely wiped out. The major losses are caused by insect pest was also observed on other Shorea species (Atluri JB 2004 and Maury G 1978). The seeds are infected by both pre and post dispersal Insects. Some seed born fungal infections most probably takes place during the flowering period or at the early stage of fructification. The seed collection is very difficult because so many Aunts cover total tree. The seeds are collected by moving the tree mechanically or the seeds which are fallen on the ground. The collected seeds cannot store artificially. Bacteria viruses and especially fungi cause loss of seed viability. Finally the percentage of healthy seed is only 3-5% only after

collection. The study reveals that seed predator absence of seed dormancy, incomplete seed germination, an able to preserve seed artificially for long time, Seedlings and saplings in nurseries also damaged by insects and other pest might Leeds to the endangered status of the plant.

MATERIAL AND METHODS

Plant material

The seeds of *Shorea tumbuggaia* were procured from localareas of Tirumala Hills and was identified and authenticated atS. V. University, Dept of Botany, Tirupati.

Cutting test

It is the simplest viability testing method is direct eye inspection of seeds which have been cut open with a knife, scalpel or by mechanically.

Tetrazolium test

Preparation of the staining solution The chemical used for this test is a cream or light yellow coloured water soluble powder called 2,3,5,- triphenyl tctrazolium chloride. Several concentrations of tetrazolium solution ranging from 0.1 to 100%are used with comparable results. Generally 0.1% to 0.3% is suitablefor germination. To prepare a 1.0% solution, one gramof tetrazolium salt is dissolved in the distilled or tap water tomake 100m!. The pH of the solution should be around 7.0for the properstaining tooccur. Solutions of pH4 or lower will not stain even viable embryos and solution of pH more than 8 will result in too intense staining. The seeds should be randomly selected from the pure seed component arid counted in replicates before conditining. In order to ensure a contact of the tetrazolium solution with the embryo. Some conditioning and preparatory steps may be essential for these depend on the type of the seed. Permeability and thickness of the seed coat. Location of the embryo.

Hydrogen Peroxide

Hydrogen peroxide (H_2O_2) has a stimulating effect on seed germination and has been used in a rapid test for germination.

Cold Treatement

Seeds are planted in plastic boxes containing the appropriate substrate and moisture and held at 10C for 7 days and then transferred to another chamber at 25C. Seedling counts are made 4 days later.

RESULT AND DISCUSSION

In *Shorea tumbuggaia* seed germination is cryptocotylar, semi-hypogeal and rapid. The hypocotyle is red, long cylindrical takes different twist and eventually penetrate into the into the soil to produce root system and leaves. Seeds die if moisture content is too low and temperature is too high. They difficult to store store for artificial regeneration and same they are aften described as recalicitrant. Even though natural germination is difficult we succeeded to some extent (Figure- 1). Before germination selection of health seeds are are very important, for that purity test are conducted. The concept of seed purity includes both physical purity and genetic purity. To determine physical purity, a random sample of the seed lot must be examined carefully by hand, often using a microscope. Each seed is observed by a trained analyst. This test is very tedious and time-consuming, but is necessary to evaluate the degree of contamination.

The TZ test distinguishes between viable and dead tissues based on the respiration activity of seeds (i.e., dehydrogenase enzymes activity). The tetrazolium test is used to give a quick estimate of germination potential. The result of a tetrazolium test will generally predict the germination test result closely, however the tetrazolium test will not detect certain types of abnormalities nor will it give any indication of disease levels, chemical damage or dormancy. The tetrazolium test should be used when seeds have to be sown shortly after harvest or to detect the presence of sprouting and various types of harvesting and/or processing damage (heat damage, mechanical damage, insect damage). The tetrazolium test is not suitable for carry over seed.

Nursery Technique

Field germination in an operational nursery will often differ from test germination. It may be considerably higher than that in the ideal conditions of a laboratory test and somewhat lower than that in a research nursery. It should differ very little from a test carried out in the same nursery in advance of the main sowings. Observations on the differences between laboratory and nursery germination in trials. Differences varied with species and in some cases speed of germination was affected more than the final numbers germinated.

Variation between nurseries may be associated with a number of different climatic, soil or cultural factors. As an example Roney and Brown (1978) found that germination of *Pinus ponderosa* was 38 % better if the seeds were covered with a depth of 1.5 cm of grit than if

covered with a depth of 0.4 cm. Frequency of watering also has a significant effect on germination (Costales and Veracion 1978).

Research on establishment and maintenance of dipterocarp plantations has been pursued now for almost seventy years. Efforts were especially intensive in three countries: India, Indonesia and Malaysia. In India the research concentrated mainly on *Shorea robusta* because of its abundance and its significance for agroforestry systems.In India, the earliest plantation efforts recorded are for *Shorea robusta* in 1860 at Barielly in Uttar Pradesh and *Hopea parviflora* in 1880 in South Kanara, Karnataka. Generative propagation is still the prevailing method of plant production in *S. tumbuggaia* is technically not a problem if seeds are planted immediately after collection. Planting stock production of the commercially most important dipterocarp species, whether from seeds or from cuttings, has largely been solved. In nursery practice, a seedling is a very young tree that has not been transplanted, i.e. is growing where it germinated. (Ford-Robertson 1983). Seedling planting stock for most dipterocarp species is usually potted and leaves the nursery after about 9 months. The seedling height is about 25-50 cm. Planting stock production of the commercially most important dipterocarp species, whether from seeds or from cuttings, has largely been solved.

In *S. tumbuggaia* Fruit infestation was 70%. In the healthy fruit, seed lings established rate was 40%, but it was only 10-14% compared to the total fruits produced (Figure-6). In this technique for the germination of seeds we have used forest soil and vermicompost for the germination, the plants are germinated very quickly and percentage of germination and survival is very high. The percentage of germination in soil is 76% (Figure-2). The survival of plants after 3month is 4-56% only. The plants will be very healthy for 1-2months then the plants are attacked by insect and bettles.

Few records exist on pests of seedlings and saplings in nurseries, though some reports are available for natural forests. Insects are the main source of damage as leaf feeders, borers, suckers and in gall formation. The other pests recorded are wild boars, rodents and nematodes(Figure-2). There are few reports of leaf damage to seedlings and saplings (Becker 1983, Tho and Norhara 1983) and the defence properties of essential oils in mature leaves were discussed by Becker (1981). Shoot and root borers were recorded on various dipterocarp species (Beeson 1941, Chatterjee and Thapa 1970, Daljeet-Singh 1975, 1977, Sen-Sarma and Thakur 1986, Shamsuddin 1991, Smits *et al.* 1991). Therefore, shoot boring insects are a problem for reforestation programmes. Planting trials with *Shorea ovalis, S. leprosula, S.*

acuminata and S. *parvifolia* were conducted in Malaysia, where 50% of *S. acuminata* and 7.3-16.5% of the other *Shorea* seedlings were attacked by shoot borers (Daljeet-Singh1975). Further research is going on in this plant.

- A

B

C

D

A. *Shorea tumbuggaia Roxb* in tirumal forest

B. *Shorea tumbuggaia Roxb* in flowering stage

C. *Shorea tumbuggaia Roxb* seeds

D. *Shorea tumbuggaia Roxb* infected seed

Figure 1: Shorea tumbuggaia Roxb in flowering stagein Tirumala forest.

STAGE-1 **STAGE-2** **STAGE-3**

INFECTED AND INCOMPLETE GERMINATED PLANTS OF SHOREA TUMBUGGAIAIN NATURAL GERMINATION

Figure 2: Natural Seed Germination of Shorea Tumbuggaia.

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