



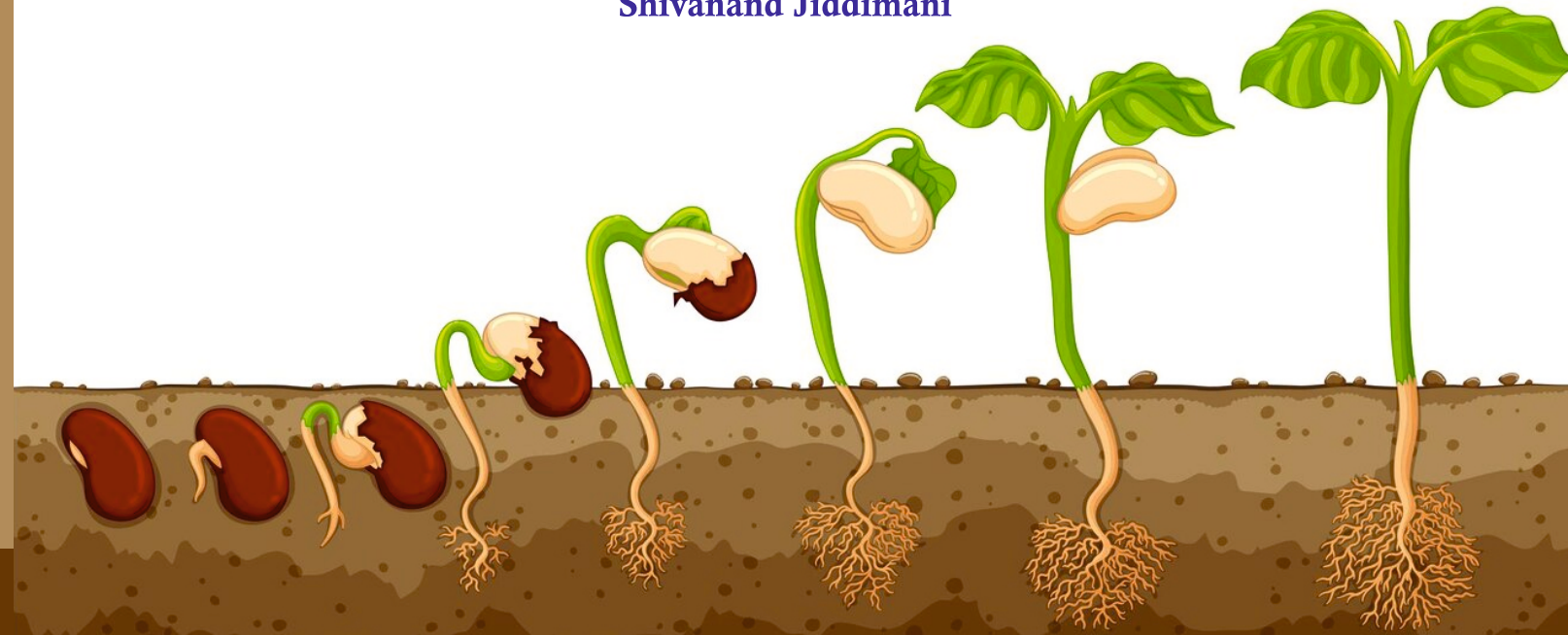
Shivanand Jiddimani born and brought up in Belagavi, Karnataka. He has completed his graduation in Forestry from UAS, Dharwad in 2016, then he got selected and worked as RFO in Karnataka Forest Department for one year. He is currently undergoing ACF training at Central Academy for state forest service, Coimbatore, Tamil Nadu. Among his hobbies include Singing, Running, playing football and Volley ball.

Being a Forest Officer, he believes in” Three Tire Principles” often called “Three R's"Reduce, Reuse and Recycle" is foundational for creating a sustainable future. Each of these steps addresses a different aspect of waste reduction and resource conservation:

These principles together encourage a lifestyle shift toward conscious and sustainable living.

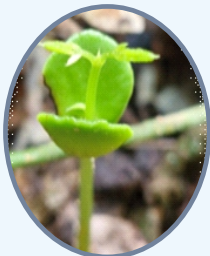
SEED GERMINATION

Shivanand Jiddimani





SEED GERMINATION



CENTRAL ACADEMY FOR STATE FOREST SERVICE
COIMBATORE



2024

FOREWORD

It gives me immense pleasure to present this book on the practical knowledge of “Seed Germination”. In an age where technology has increasingly transformed education, it is vital that we stay connected to the foundational processes of nature that sustain life on Earth. Seed germination, as a cornerstone of agriculture, forest and ecological renewal, represents one of nature's most remarkable transformations: a small, dormant seed emerging as a vibrant life form.

This book has been written to equip officer trainees with hands-on knowledge, fostering curiosity and respect for the growth processes that begin with a single seed. By understanding the methods and factors that influence germination, learners will gain practical insights that extend beyond the classroom and develop skills that can be applied in diverse fields, from agriculture to environmental stewardship.

I congratulate officer trainee Shri Shivanand Jiddimani, who have created this valuable resource. I am confident that it will inspire our OTs to cultivate not only plants, but also nurture a deep appreciation for the wonders of the natural world. May this guide encourage exploration and patience, and develop the qualities that are as essential in life as they are in the nurturing of seeds.

Best wishes,



V. Thirunavukarasu, IFS
APCCF & Principal, CASFOS, Coimbatore.

PREFACE

Seed germination is a crucial process in the life cycle of plants, initiating their growth from seed to seedling. Understanding the mechanisms of seed germination, particularly epigeal and hypogeal types, is fundamental for anyone involved in agriculture, forestry, or botany. These two germination strategies not only affect the initial growth pattern of plants but also influence how we approach plant care, nursery management, and reforestation efforts.

In epigeal germination, the seed's cotyledons are pushed above the soil surface, enabling direct exposure to sunlight, which is essential for photosynthesis. This type of germination is common in plants like Sanda wood, *Strychnos nux-vomica* and *Sapindus emarginatus* etc and is more vulnerable to environmental stressors such as frost or herbivory due to the exposed cotyledons. However, the early photosynthesis capability can offer a growth advantage under favourable conditions.

In contrast, hypogeal germination keeps the cotyledons below the soil, with the first true leaves emerging above. This protects the cotyledons from environmental damage but delays photosynthesis. Plants like *Syzygium cumini* and Jack fruit plants, *Myristica* plants, *Swietenia mahogany* etc follows this pattern. The protected nature of hypogeal germination provides resilience against unfavourable weather or grazing pressures.

For practitioners in agriculture or agroforestry, understanding the practical implications of these germination types aids in choosing appropriate species for specific climates and soils. It also guides strategies for plantation department, spacing, and the timing of operations to ensure optimal plant growth and survival. By mastering the

nuances of epigeal and hypogeal germination, growers can improve crop success and ecosystem restoration efforts, ensuring both agricultural as well as forest productivity and environmental sustainability.

Shivanand Jiddimani

Officer Trainee, SFS 2022-24 Batch -II Coimbatore.

ACKNOWLEDGEMENT

I would like to express my special thanks of gratitude to Sullia, FRO, Shri Manjunath N for his guidance, support and for providing field staff for field observation in order to complete this work.

I would like to extend my gratitude to Shri K. V. Karikaln, IFS. Conservator of Forest (Mangalore circle) and Shri Anthony Mariyappa, IFS. Deputy Conservator of Forest (Mangalore division) for providing a valuable inputs and wonderful opportunity for successful completion of this job.

I would also like to extend my gratitude to Shri V. Thirunavukkarasu, IFS our respected Principal sir of CASFOS Coimbatore, and our beloved Course Director Shri Anisha Kalkoor, IFS for their support and knowledge contributions during my OJT.

CONTENTS

I. Introduction

II. Details of Plant Species

1.	<i>Acacia auriculiformis</i>	1
2.	<i>Anacardium accedentalea</i>	2
3.	<i>Adenanthera pavonina</i>	3
4.	<i>Ailanthus malabaricum</i>	4
5.	<i>Annona squamosa</i>	5
6.	<i>Artocarpus integrifolia</i>	6
7.	<i>Artocarpus hirsutus</i>	7
8.	<i>Artocarpus lakoocha</i>	8
9.	<i>Butea superba</i>	9
10.	<i>Bombax ceiba</i>	10
11.	<i>Callophyllum inopylum</i>	11
12.	<i>Caryota urens</i>	12
13.	<i>Myristica malabarica</i>	13
14.	<i>Pongamia pinnata</i>	14

15.	<i>Polyalthia longifolia</i>	15
16.	<i>Pterocarpus marsupium</i>	16
17.	<i>Samenea samana</i>	17
18.	<i>Sapindus emerginatus</i>	18
19.	<i>Santalum album</i>	19
20.	<i>Sterculia guttata</i>	20
21.	<i>Strychnos nux-vomica</i>	21
22.	<i>Schleichera oleosa</i>	22
23.	<i>Swietenia mahagoni</i>	23
24.	<i>Syzygium cumini</i>	24
25.	<i>Tamarindus indica</i>	25
26.	<i>Terminalia bellerica</i>	26
27.	<i>Terminalia tomentosa</i>	27
28.	<i>Terminalia catappa</i>	28
29.	<i>Vateria indica</i>	29

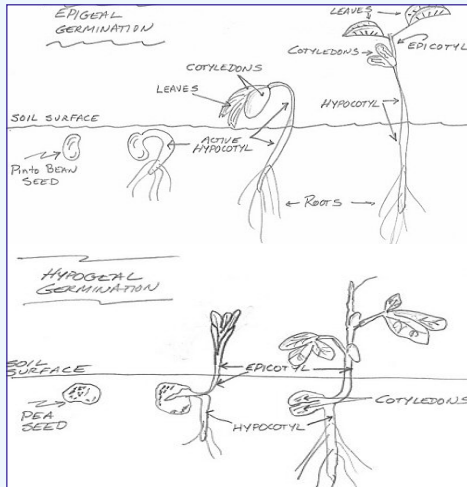
I. Introduction

Theoretically we all know the “Germination” definition, which means the fundamental process by which different plant species grow from a single seed into a plant. It has been classified as Hypogeal and epigeal. **Epigeal** and **Hypogeal** are terms used to describe the position of the cotyledonary node during germination, indicating whether the node is above or below ground once the seedling has become established. **Epi** means above while.

During our PUC and degree classes in botany subject we all studied well and got good marks about seed germination. Usually in our training period the batches will comprises of officer trainees of botany, zoology, Engineering and B tech, Agriculture, Veterinary, Forestry etc.

For biology background officer trainees, it is easy to understand the terms Epigeal and Hypogeal. But for Engineering, Math's, physics background officer trainees, they can study theoretically but practically it may difficult to understand the concept.

- ◆ In my four-month OJT period I was allotted Suliya range, which covers western ghat. In OJT period we undergone the rainy season that is in June and July. In this season, one day I went to forest along with our field staff, in order to collect seeds from forest area. On that date I had clear observation on the germinated seeds.
- ◆ Then I started thinking about the collection of photos, so that finally I have made one collective document in the form of PPT and documented with 29 different species, which includes some endemic species of western ghat.



- ◆ In this document mainly I focused on germination type, along with that I have mentioned some information about the seed viability, germination percentage, number of seeds per kg.
- ◆ Hence, the aim of this article is to give the clear picture about how the germination will take place, and how the Plumule and Radical will grows with color pictures.
- ◆ Which I have collected during my OJT period (Mangalore Division, Sullia Range).



Acacia auriculiformis

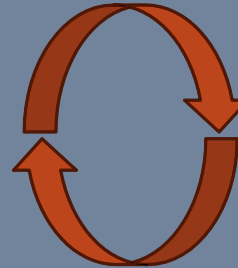
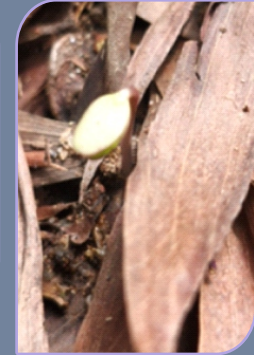
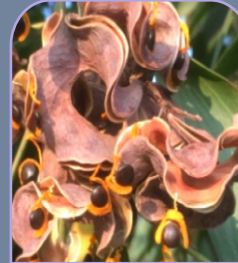
Fruit : Dehiscent pod

Seed viability : several year

Germination perc : 40-100%

Germination type : Epigeal

Total seeds : 5500-75000/kg



Anacardium accedentalea

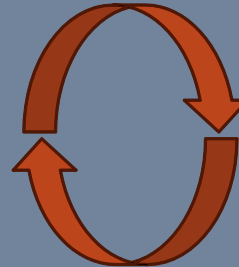
Fruit : Drupe, kidney shaped

Seed viability : 12-14 Months

Germination perc : 80-90%

Germination type : Epigeal

Total seeds : 150-200/kg



Adenanthera pavonina

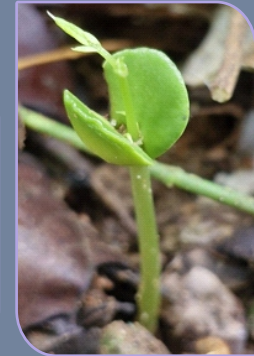
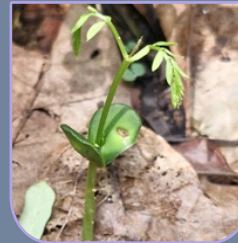
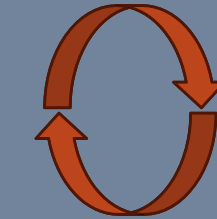
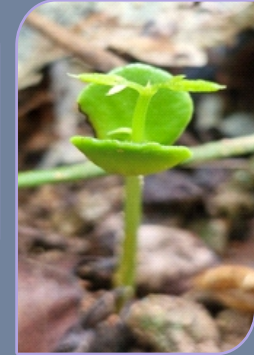
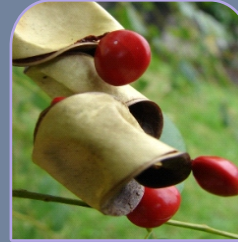
Fruit : Dehiscent pod
(8-12 seeds)

Seed viability : 2 years

Germination perc : 75-88%

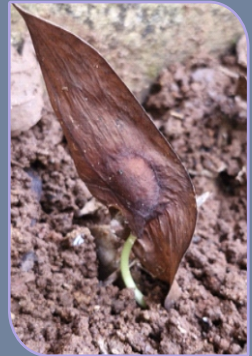
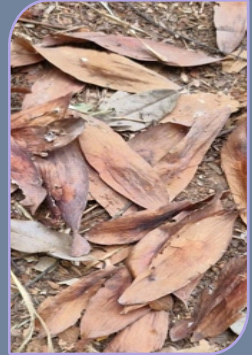
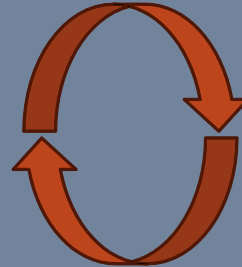
Germination type : Epigeal

Total seeds : 3750/kg



Ailanthus malabaricum

Fruit	: Samara fruit
Seed viability	: 3 months
Germination perc	: 50–70%
Germination type	: Epigeal
Total seeds	: 9500seeds/kg



Annona squamosa

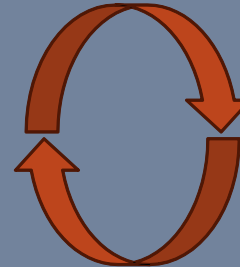
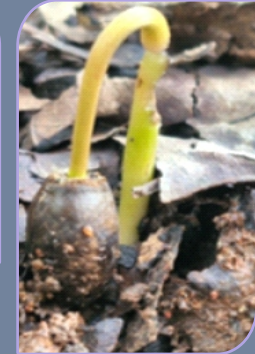
Fruit : Fleshy
aggregate
fruit/syncarp

Seed viability : Several years
under dry

Germination perc : 61-83.66%

Germination type : Epigeal

Total seeds : 2000/kg



Artocarpus integrifolia

Fruit : aggregate
fruit/sorosis

Seed viability : 15 days

Germination perc : 85-90%

Germination type : Hypogeal

Total seeds : 500-600/kg



Artocarpus hirsutus

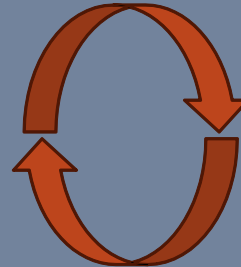
Fruit : Aggregate fruit

Seed viability : 1 month

Germination perc : 70-75%

Germination type : Hypogeal

Total seeds : 774/kg



Artocarpus lakoocha

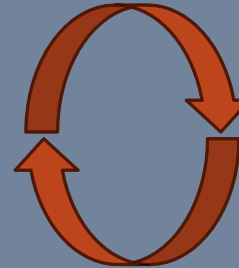
Fruit : Aggregate fruit

Seed viability : 1 week

Germination perc : 98.6%(lab)

Germination type : Hypogeal

Total seeds : 1600-5000/kg



Butea superba

Fruit	: Flat pod with one seed
Seed viability	: Up to one year
Germination perc	: 70-80%
Germination type	: Hypogeal
Total seeds	: 1480/kg



Bombax ceiba

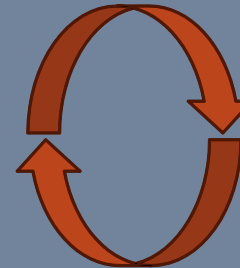
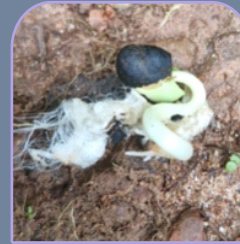
Fruit : Capsule
obovoid seeds
with silky floss

Seed viability : Very short lived

Germination perc : 100%

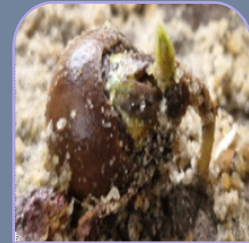
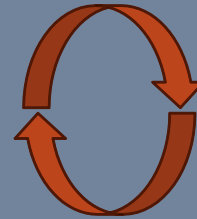
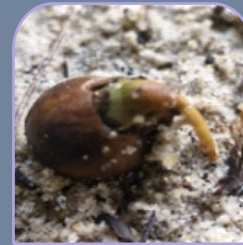
Germination type : Epigeal

Total seeds : 21430-
38500/kg



Callophylum inopylum

Fruit	: Ovoid drupe
Seed viability	: 1 month to 14 months
Germination perc	: 25-30%
Germination type	: Hypogeal
Total seeds	: 135-215/kg



Caryota urens

Fruit : Drupe with pulp

Seed viability : up to year

Germination perc : 50-60%

Germination type : Hypogeal

Total seeds : 900-1630 seeds/kg



Myristica malabarica

Fruit : Capsule, aril covering seed

Seed viability : Up to one year

Germination perc : 93.2%

Germination type : Hypogeal

Total seeds : 66/kg



Pongamia pinnata

Fruit : Indehiscent pod

Seed viability : 6 months

Germination perc : 80%

Germination type : Epigeal

Total seeds : 500/kg



Polyalthia longifolia

Fruit : Drupe coffee berry like

Seed viability : 3 months

Germination perc : 20%

Germination type : Hypogeal

Total seeds : 1200/kg



Pterocarpus morsupium

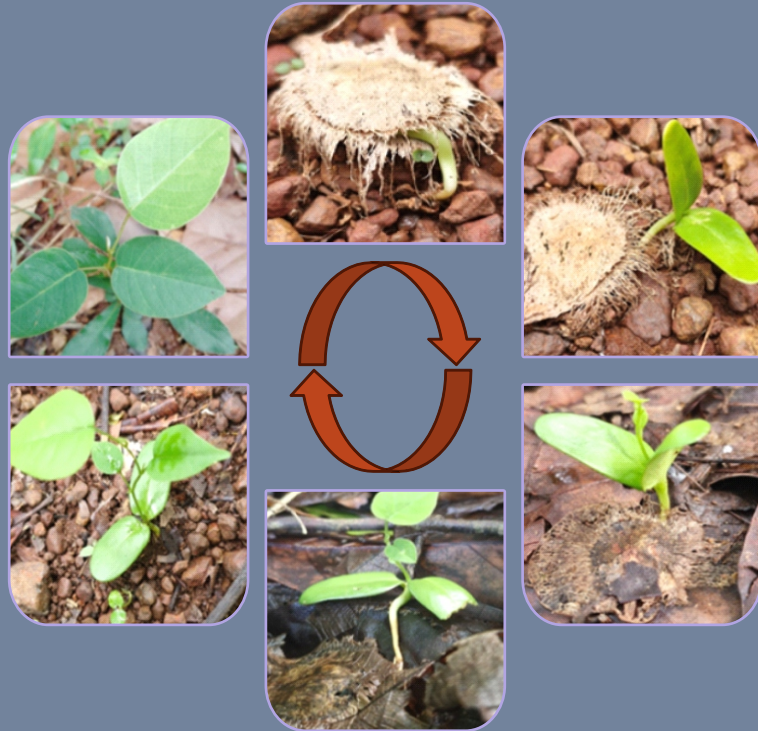
Fruit : Winged fruit

Seed viability : 6 months

Germination perc : 90%

Germination type : Hypogeal

Total seeds : 2100/kg



Samanea samana

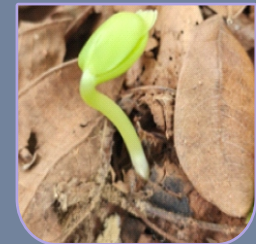
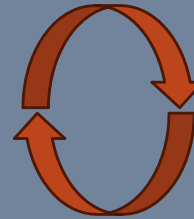
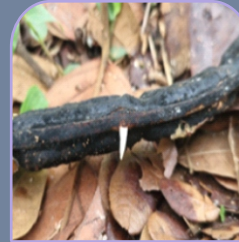
Fruit : Pods with brownish pulp

Seed viability : 12-18 Months

Germination perc : 91.26%

Germination type : Epigeal

Total seeds : 4400-7700/kg



Sapindus emerginatus

Fruit : Leathery
skinned drupe

Seed viability : one year

Germination perc : 67%

Germination type : Epigeal

Total seeds : 2000/kg



Santalum album

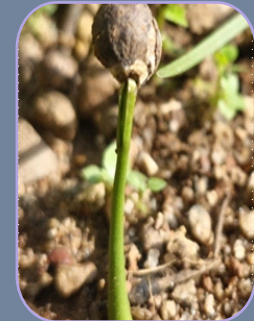
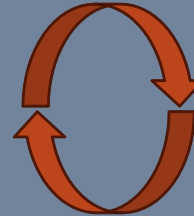
Fruit : Drupe

Seed viability : Up to 2 yrs

Germination perc : 40-60%

Germination type : Epigeal

Total seeds : 6000/kg



Sterculia guttata

Fruit : Follicle of 1-5
black ovoid
seed

Seed viability : Moderately
long lived

Germination perc : 40-90%

Germination type : Hypogeal

Total seeds : 5300-6400
seeds/kg



Strychnos nux-vomica

Fruit : Indehiscent
berry with
discoid seed

Seed viability : Up to 1 yrs

Germination perc : 25%

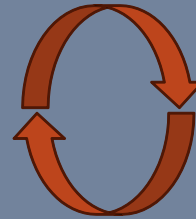
Germination type : Epigeal

Total seeds : 635-650/kg



Schleichera oleosa

Fruit	: Indehiscent drupe
Seed viability	9 months
Germination perc	: 60-80%
Germination type	: Epigeal
Total seeds	: 1500-2200/kg



Swietenia mahagoni

Fruit : Hard capsule
with winged
seed (Sky fruit)

Seed viability : One year

Germination perc : 60-80%

Germination type : Hypogeal

Total seeds : 25000/kg



Syzygium cumini

Fruit : Fleshy drupe

Seed viability : 6 Months

Germination perc : 97%

Germination type : Hypogeal

Total seeds : 896/kg



Tamarindus indica

Fruit : Indehiscent pod with pulp

Seed viability : Orthodox, several year

Germination perc : 95-99%

Germination type : Epigeal

Total seeds : 1800-2600 seeds/kg



Terminalia bellerica

Fruit : Drupe

Seed viability : Up to one year

Germination perc : 65-70%

Germination type : Hypogeal

Total seeds : 400-450/kg



Terminalia tomentosa

Fruit : Samara

Seed viability : 1 year

Germination perc : 30-60%

Germination type : Hypogeal

Total seeds : 1000/kg



Terminalia catappa

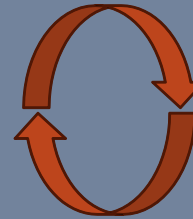
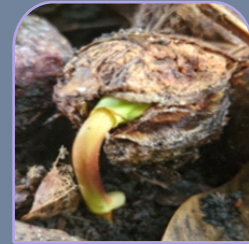
Fruit : Drupe

Seed viability : up to one year

Germination perc : 70-80%

Germination type : Epigeal

Total seeds : 500-860/kg



Vateria indica

Fruit : Capsular and one seeded

Seed viability : up to a month

Germination perc : 95%

Germination type : Hypogeal

Total seeds : Average 42-44/kg

