

Morphological Characteristics of Capsules, Seeds and Seedling Growth Performance of *Aquilaria malaccensis*

Sharda Dubey*, Gaurav Kumar Padwar, Arvind Prajapati

Department of Forestry, Wildlife & Environmental Sciences,
Guru Ghasidas Vishwavidyalaya, Bilaspur, Chhattisgarh, India

*Corresponding author: sdubkv1986@gmail.com

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Abstract An endangered species of *Aquilaria malaccensis* is belonging to family of Thymelaeaceae found in North –East India. Study was carried out to investigate capsule morphology, seed morphology, pre-sowing treatment, germination behavior, moisture content, viability, seedling survival, Seedling growth performance of *Aquilaria malaccensis*. Nondestructive collection were done in natural forest of Assam and detailed study was carried out in the Department of Forestry, wildlife & environmental sciences, Guru Ghasidas University, Bilaspur, Chhattisgarh. Morphological characteristics Capsule of length was 32.57 mm, Width of the Capsule was 17.18 mm, weight of the capsule was (g) 286.62, Thickness of capsule was 13.83 mm, length of seeds was recorded 16.51mm, Width of the seeds was recorded 4.83mm, Number of seeds per Capsule found one or two, Seed weight was recorded 11.91g, Seed viability (%) was recorded 80%, Seed moisture content was recorded 29.87%, Germination percent (GP) in water 73.33% and control 67.33%, Germination value (GV) 5.95, Mean germination time (MGT) 19.50, Seedling vigor index (SVI) 1536.93, Percent survivability (%) of seedling was recorded 75.00%, Plant height (cm) after 12 months recorded 47.23, Collar diameter (mm) 6.72, Volume index (cm.mm²) 2132.83, Sturdiness Quotient 8.58. The differences for capsules and seed parameters were recorded significant (CD=0.05).

Keywords: *Aquilaria malaccensis*, Agarwood, Eagle wood, Germination Percentage, Germination value, mean germination time, Seedlings vigour index and Morphological characteristics

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1. Introduction

An endangered species of *Aquilaria malaccensis* is an economically important native tree species of sub-tropical-tropical rainforests of northeast India. There are 27 *Aquilaria* species distributed worldwide, of which 24 are naturally found in 12 south-east Asian countries i.e. Bangladesh, Bhutan, Cambodia, India, Indonesia, Malaysia, Myanmar, Philippines, Thailand, Vietnam and New Guinea [1]. About six species are reported to occur only in Indonesia and two in China [2]. *Aquilaria malaccensis* Lamk. (Syn: *Aquilaria agallocha* Roxb.), belonging to family Thymelaeaceae, This species is commonly known as Agarwood or Aloe wood or Eagle wood or Gaharu. It is an evergreen tree found growing naturally in the foothills of the North Eastern States of India (Assam, Arunachal Pradesh, Nagaland, Manipur, Mizoram, and Tripura) and West Bengal up to an altitude of 1000 msl [3,4]. Recently, natural populations of the species have been reported existing in pockets in Assam and Arunachal Pradesh [5]. India is the home of three *Aquilaria* species and *Aquilaria*

malaccensis is considered endemic to north-east India [6]. Two species i.e. *A. malaccensis* Lamk. and *A. khasiana*. are found in the evergreen rain forest of north eastern states whereas the third species i.e., *A. macrophylla*. is found in the Nicobar Islands [7]. In India, it is mainly confined to the north eastern states and mostly distributed in plains and foot hills of eastern Himalayan states [8]. Due to high medicinal and perfumery value, the species has great demand in national and international market hence the attempts are now being made to cultivate the species in plantations in India and other places around the world. Currently, the species is mainly surviving in plantations, home gardens and along tea plantations in Assam and its adjoining areas of northeast India and Bangladesh and significantly contributing to the local economy of the region [2]. *Aquilaria* is presently being cultivated on commercial scale mainly in upper Assam region, but even favorable topology, climatic conditions and soil types in Arunachal Pradesh. Information on morphological variations in seed characteristics among the natural populations of a species is useful for tree improvement [9]. A number of studies have been conducted in this respect in India as well as abroad.

2. Materials and Methods

2.1. Study Area

The study of Morphological characteristics of capsules, seeds and seedling growth performance of *Aquilaria malaccensis* was carried out in Bilaspur Chhattisgarh, situated in 22. 12° North and 82. 13° East, soil type of the site is sandy to loam. The average temperature of the area is 29.5°C, annual rainfall is about 58 cm.

The capsules were collected randomly from the natural forest site of Nazaria, Sibsagar, Assam during rainy season in the month of July- August. The climate of Assam is generally humid throughout the year having the annual rainfall 295. Experiments were carried out using mature fresh green capsules (Agar wood fruits called as Capsules). Seeds were planted on the nursery raise bed having a proper mixture of soil: sand: organic manure (2:1:1) ratio at 2-5 cm (plant to plant) x 15-10 cm (row to row) spacing at 2.0- 2.5 cm depth with three replication. Seed germination was recorded daily to a minimum of 28 days or until there was no further germination. The weeding, cleaning and watering of raise bed were done manually when needed. The raised bed were arranged RBD design with three replication. The morphological parameters of

capsules were taken and broken immediately to extract seeds. Then the seeds were sown in the nursery after taking morphological parameters. Observations were recorded with respect to following parameters, Capsule size (mm), Capsule weight (g), Seed size (mm), Number of seeds per Capsule, Seed weight (g), Seed viability (%), Seed moisture content (%), Germination percent (GP), Germination value (GV), Mean germination time (MGT), Seedling vigor index (SVI), Percent survivability (%), Plant height (cm), Collar diameter (mm), Volume index (cm.mm²), Sturdiness Quotient.

3. Results and Discussion

The study of Morphological characteristics of capsules, seeds and seedling growth performance of *Aquilaria malaccensis* Capsules and seed data were recorded [Figure 1](#), Seed germination on daily basis have been furnished, germination value, Mean germination time (days), seedling vigor index in the [Figure 2](#) respectively, before sowing seed two different treatment were performed (i.e. pre-treated water and control). Some picture as given below for Morphological visual appearance of capsules, seeds of *Aquilaria malaccensis*.

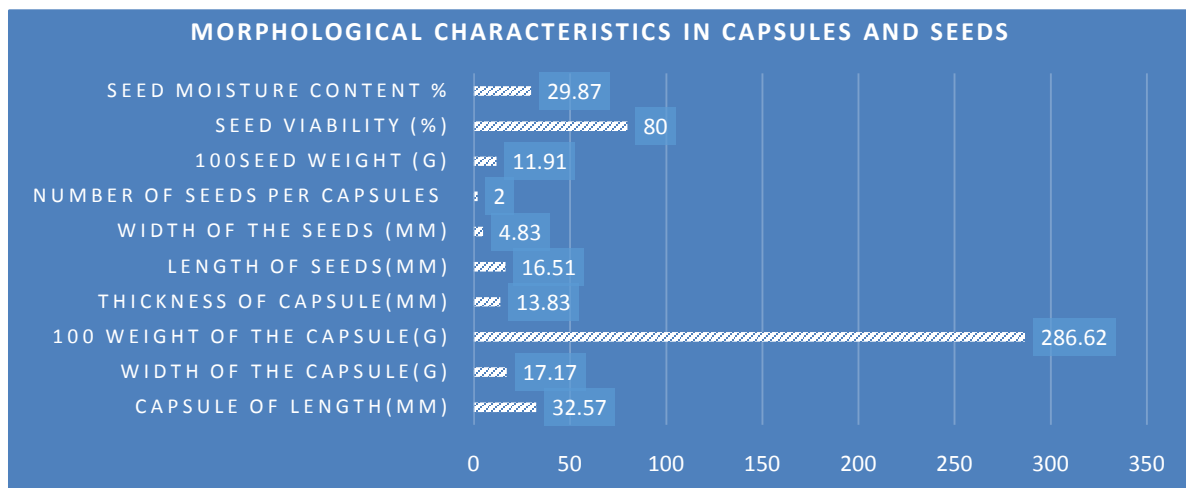


Figure 1. Morphological characteristics in Capsules and seeds

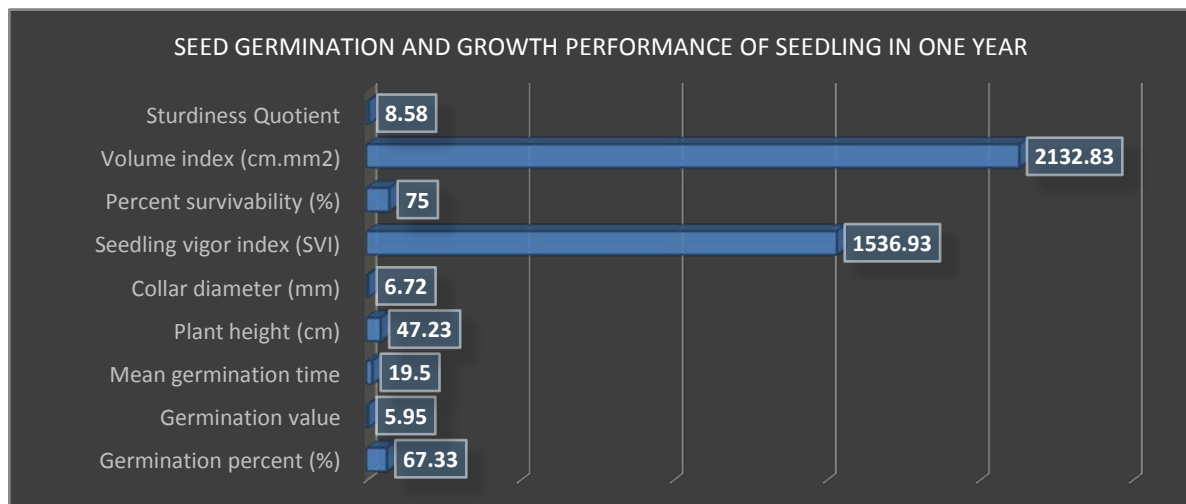


Figure 2. Seed germination and growth performance of seedling in one year

Flower of *Aquilaria malaccensis*Capsules & seed of *Aquilaria malaccensis*Capsules & seed of *Aquilaria malaccensis*Capsules & seed of *Aquilaria malaccensis* on the tree

Data pertaining to the morphological characteristics Capsule of length is 32.57 mm, Width of the Capsule is 17.18 mm, weight of 100 capsules is 286.62 (g), Thickness of capsule is 13.83 mm, length of seeds was recorded 16.51mm, Width of the seeds was recorded 4.83mm, Number of seeds per Capsule found one or two, Seed weight of individual seed observed 0.13 g., Seed weight was recorded 11.91g, Our findings are well in conformity with the findings of [2] who reported the individual seed weight of 0.126 g, seed diameter 4.66 mm; [4]. It is evident that there was much variation in length, width, thickness, weight of capsules and length, width, weight of seed in addition to the number of seeds per capsule among the different seeds may be due to climatic and topographic variation. The differences observed in capsule and seed traits might be due to their genetic makeup in nature as a result of adaption to diverse environmental conditions throughout their range of

distribution The differences for seed parameters were recorded significant ($p=0.05$) statistically at par with each.

Seed viability (%) was recorded 80%, Seed moisture content was recorded 29.87% out of 100 selected seed. It was observed that the moisture content of seed influenced the viability percentage. The variation in viability may be due to the moisture content of the seed. This finding is well agreement with the findings of [10]

Germination percent (GP) in pre sowing treatment of water was recorded 73.33% and control 67.33% , Germination value (GV) 5.95, Mean germination time (MGT) 19.50, fresh seeds of *Aquilaria malaccensis* while [11] found 92% of germination as the seeds possesses recalcitrant behavior; [4] achieved 80% and [12] found 70-80% germination. Seedling vigor index (SVI) 1536.93, Percent survivability (%) 75.00%, Plant height (cm) 47.23, Collar diameter (mm) 6.72, Volume index ($\text{cm} \cdot \text{mm}^2$) 2132.83, Sturdiness Quotient 8.58. The differences for

seed parameters were recorded significant differences ($p=0.05$) statistically at par with each at 12 months growth period.

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