

Seed polymorphism and its effect on germination and growth of *Vateria indica* Linn. an economically important endemic trees of Western Ghats

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Abstract

Present paper describes the occurrence of seed polymorphism in respect of seed size, shape, weight and colour in *Vateria indica*. Three categories of seeds with size difference viz. large oblong shaped and light brown coloured, medium oval sized and brown coloured and small globular shaped and grayish brown were noted. Their tree to tree variation in distribution proportion was found to vary with sites. All sized seeds were tested for their germination and growth. Small globular shaped and grayish brown seeds had maximum percentage of germination and best growth performance as compare to other seeds

Key words: *Vateria indica*, Seed polymorphism, Germination, Growth performance, Seed size, Seed colour

Introduction

Vateria indica Linn. (Family: Dipterocarpaceae) an economically important trees species found in the evergreen forest patches of South India especially of Western Ghats region. The tree is a well known species for making commercial plywood and yields an oleo-resin called white dammar. The resins are used as tonic, carminative and possess expectorant properties against throat troubles, chronic bronchitis, piles, diarrhea, rheumatism, tubercular glands etc., mixed with gingly oil, it is used against gonorrhoea, with ghee and long pepper for the treatment of ulcers etc. (FAO 1985). The silviculture and regeneration of the dipterocarp species are difficult and complicated on the basis of their complexity of structure with varying demands on growth promoters like light. Another aspect of their complexity in maintaining regeneration is the absence of regular good seed year. In *Vateria indica*, prolific seeding occurs in 3-5 years with one to two poor seed years and one to two average seed years between them (Anonymous 1976). Seeds produced by a tree vary in respect of size, shape, colour and weight, even in the samples from the same tree and also from other trees. Seed polymorphism in respect of size and weight and its effect on germination and growth has been reported in *Robinia pseudoacacia* (Thakur and Thakur, 2002), *Grewia optiva* (Chauhan, 1989) etc. Somatic seed polymorphism is of selective advantage to plant to adopt an unpredictable fluctuating environment and also to maintain its population in nature through natural selection. Seed polymorphism in respect of size, shape, weight and colour, occurs within and between trees have not been reported for *Vateria indica*. Hence the present paper discusses the occurrence

of seed polymorphism in respect of the above mentioned characters in *V. indica* trees selected under different locations and impact of seed polymorphism on germination and growth under controlled conditions.

Material and Methods

Trees for the present study were located from Kallar, Kulathupuzha and Palode forest patches of Southern Kerala (Southern region of Western Ghats). These forest patches are situated between 8° 45' & 8° 47' N latitude and 77° 1' & 77° 4' longitude at an elevation of 150 to 700 meters above sea level. The area enjoys a warm humid tropical climate with an average temperature of 25-30 °C, atmosphere humidity of 60-80 %, intensity of sunlight of 2000-20000 lux, soil temperature of 20-22 °C, soil moisture content of 14-21 % and a mean annual precipitation ranging 2500-3000 mm respectively. Normal regeneration of this species is through seeds.

Seed polymorphism and Germination

Mature seeds of *Vateria indica* were collected from the three earmarked phenotypically superior trees from each of the mentioned locations. During seed maturity period, nylon nets were spread above the ground surface to prevent the seeds falling on the ground. Seeds collected manually by gentle shaking of the branches along with natural shedding were used for the study. Collected seeds were kept separately at room temperature (28±2 °C and 65 % RH) for each tree. The seed variations or polymorphism in respect of seed size, shape, weight and colour were observed. Proportion of different size, shape and colours of seeds in seed lots collected from different trees under three locations observed in 50 samples/trees by random sampling method and 100 seed weight (g), seed length (mm) and seed breadth (mm) were noted for all categories of seeds. Seed germination studies were conducted using acid free germination paper (A R Industries, Bangalore, India) and river sand. Germination test was carried out in three replicates of 50 seeds each and kept under ambient laboratory conditions (28±2 °C and 65 % RH). Seeds were watered as and when required. Daily observations on seed germination were recorded

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till germination was constant for 15 consecutive days. Twenty five seedlings of each category of variants were transplanted to polythene bags (10 X 20 cm) containing farm yard manure, forest soil and river sand (1:1:1). Bags were watered on alternate days regularly for 40 days. After 40 days seedlings were fully established and data was collected for shoot and root length, number of leaves per seedlings and fresh & dry shoot and root weight.

Results and Discussion

Vateria indica tree exhibits peculiar type of seed polymorphism in respect of seed size vis a vis seed shape, colour and weight. All the trees produce large oblong shaped and light brown

Table-1: Percentage of polymorphic variations of *Vateria indica* seeds in different locations

Seed morphs	Number of Trees	Locations		
		Kallar	Kulathupuzha	Palode
Large oblong shaped and light brown coloured	3	30±5	90±3	40±6
Medium oval sized and brown coloured	3	65±6	40±2	35±5
Small globular shaped and grayish brown coloured seeds	3	20±5	45±5	80±8

± SE of Mean value

coloured, medium oval sized and brown coloured and small globular shaped and grayish brown coloured seeds. Data in Table-1 revealed that proportion of different polymorphic seeds in the seed lots varies from tree to tree and also varies significantly with different locations. Regarding the collection of seeds from different locations noted that proportions of small globular shaped and grayish brown coloured seeds were less in the seed lots collected from Kallar locations and maximum in Palode area. Seeds collected from different trees of Kulathupuzha location showed maximum proportion of large oblong shaped and light brown coloured seeds. Medium oval sized and brown coloured seeds were maximum at Kallar area. These observations revealed that proportions of seed polymorphism in different seed lots collected from different locations showed significant variations. The result is in agreement with the observations of Moya et al (2017), Aleman et al (2015), Thakur and Thakur (2002), Harper (1977), Harper et al (1970) and Williams & Harper (1965). They reported that seed polymorphism is of selective advantage to plants to adapt an unpredictable fluctuating and unfavourable environment because it permit such species to allocate resources to different seed morphs in direct response to changing environmental conditions. It also maintained

population size of plants in nature through natural selection.

Table-2: Seed Polymorphism and its effect on germination and growth in *Vateria indica* under controlled conditions

Seed characteristics	Seed morphs		
	Large oblong shaped and light brown coloured seeds	Medium oval sized and brown coloured seeds	Small globular shaped and grayish brown coloured seeds
Seed Length (mm)	100±3.0	80±5.0	55±2.0
Seed Breadth (mm)	55±2.0	45±3.0	30±1.2
Seed Weight (g)	20±5.0	12±2.0	8±1.5
Seed Germination (%)	80±5.0	82±3.8	95±3.0
Shoot Length (mm)	120±8.0	110±5.0	150±5.0
Root Length (mm)	80±5.0	75±2.0	90±3.0
No. of Leaves/Seedling	6.0	6.0	8.0
Fresh weight of shoot (g)	11±2.0	9±2.5	8±2.0
Fresh weight of root (g)	8.5±1.5	7.5±0.5	7.0±1.0
Dry weight of shoot (g)	6.2±0.5	4.9±0.4	3.8±0.2
Dry weight of root (g)	3.9±1.5	3.3±0.25	3.1±0.5

± SE of Mean value

Germination and seedling growth studies were conducted with three categories of seeds collected from the locations mentioned above. Germination percentage varied with seed morphology under controlled environmental conditions. Small globular shaped and grayish brown coloured seeds showed maximum percentage of germination (95±3.0), followed by medium oval sized and brown coloured seeds (82±3.8 %) and large oblong shaped and light brown coloured seeds (80±5.0 %). Data in Table-2 showed that all the growth parameters, viz, length of shoot and root, fresh and dry weight of shoot and root and number of leaves showed better performance in the seedlings raised from small globular shaped and grayish brown coloured seeds, which was followed by medium oval sized & brown coloured and large oblong shaped & light brown coloured seeds. The study revealed that the polymorphic seeds collected from different locations exhibits significant variations in their germination and growth behavior under controlled nursery conditions. Similar observations were reported in species of *Lotus* by Bhatt et al in 2016, in *Acacia mellifera* by Fathima and Mai Mamoun (2013), Raina in *Robinia pseudoacacia* (1994) and Pathak et al in *Acacia tortilis* (1980). So comparative studies on germination and seedling behavior of seeds

in different trees and locations helps to reveal the intricacies of seed polymorphism.

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