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Reproductive Biology In White Teak (Gmelina Arborea L.)

Key words : Anthesis, Floral Morphology, Pollen Morphology, White Teak

Gmelina arborea Roxb. popularly known as white teak or kumizhu is a tree which has medicinal and timber value. The plant is used for treatment of various ailments like tuberculosis, gonorrhoea, cough, head ache and ulcer (Chopra *et. al.,* 1956). Its roots are an ingredient of Dasamoola, a herbal preparation and its fruits are used for fever and gastric problems (Ambasta, 1986). Even though, kumizhu is important as a medicinal tree and timber source, the studies on floral biology, breeding systems, pollinators and seed dispersal in its natural geographic regions are limited.

Trees maintained in the Dr. T. V. Viswanathan Memorial Herbal Garden attached to the Department of Plant Breeding and Genetics, College of Horticulture, Vellanikkara were utilized for this study. Vellanikkara is situated in Central Kerala on the Thrissur Palakkad national highway and is located at 10° 31'N latitude and longitude 76° 13'N and at 25 m amsl. The average annual rainfall is 2803mm and the maximum temperature ranges from 32.2 to 37^{0}C and the minimum temperature ranges from 22 to 25^{0}C.

In order to study the time taken for full development of inflorescence from visual observation stage to bud formation, five flowering shoots were tagged in two trees. Time taken for the entire inflorescence to bloom that is, from the opening of the first flower in the inflorescence to the last flower in the same inflorescence was observed.

Floral morphology was studied on fresh flower buds and flowers collected. Hand sections, both L.S and T.S were taken and examined under microscope and description of morphological features like size, colour and number of floral parts, androecium and gynoecium were recorded.

Anthesis time was observed at two hour interval from 7.00 pm to the completion of anthesis on the next day. The peak time of anthesis was recorded. The colour and appearance of anthers were examined with hand lens at one hour interval in fully mature flower buds of each inflorescence to find out the time of anther dehiscence in a flower. The stigmatic surface was also observed for any change in colour or appearance in the same buds, at same interval of time to find out the stigma receptivity.

Pollen morphology was studied using acetolysis method. Then the sculpturing on the exine was examined under the microscope. Fertility of pollen was assessed on the basis of stainability of pollen grains in acetocarmine glycerine mixture. Pollen grains were collected from newly opened flowers and placed on a clean slide and stained with a drop of acetocarmine and kept aside for one hour. All the pollen grains that were well filled and stained were counted as fertile. Two fields each of five slides were observed under microscope and the values expressed as percentage. Pollen diameter was measured using an ocular micrometer, after calibration. In order to study the nature of pollination some inflorescences were kept covered while some were left open. Observations on fruit shape, colour, size, seed colour, shape and seed coat characteristics were recorded.

The Gmelina arborea trees started blooming in January when new flushes sprouted out and continued up to the end of March. Inflorescence is a terminal cyme with an average 12.16 flowers in each inflorescence. Blooming started about 8 days after the appearance of visible buds and lasted one week. Blooming is from the base of inflorescence to tip in an irregular manner.

The flowers are short, stalked, pubescent, large, bisexual, scented and 4.45-5cm long. The calyx is green, persistent, tubate with nectariferous glands and five lobed at tip. The corolla is brownish yellow and has a short tube of girth 1.53 cm with the upper lip formed by two petals and the lower lip by one broad central and two lateral petals. Stamens are four in number and epipetalous with the anterior pair longer and the posterior pair shorter. Anthers dithecous and dehisce by longitudinal slits. The ovary is bicarpellary with four ovules. The style is long and terminated into a short bifid stigma. The stigma lies between anthers of the long and short pair of stamens. The nectar is produced and protected in

Table 1. Floral Characterstics in white teak (*Gmelina arborea* L.)

Particulars	Value
No of flowers in an inflorescence	12.16 ± 0.848
Time taken for inflorescence development(days)	8 ± 0.55
Blooming duration(days)	7 ± 0.953
Flower length(cm)	4.45 ± 0.25
Flower breadth (cm)	1.53 ± 0.056
Length of pollen (µm)	26.88 ± 1.892
Breadth of pollen (µm)	23.96 ± 0.968
Fruit set in open pollination(%)	16.50 ± 5.82
Length of fruit (cm)	3.10 ± 1.5
Breadth of fruit (cm)	9.26 ± 0.111

Table 2. Anthesis time, anther dehiscence and stigma receptivity in white teak (*Gmelina arborea* L.)

Time (hrs)	Anthesis time		Anther dehiscence		Stigma receptivity	
	No. of flowers opened	Anthesis (%)	No. of flowers opened	Anther dehiscence (%)	No. of receptive stigma	Stigma receptivity (%)
7-9pm	0	-	0	-	0	-
9-11pm	0	-	0	-	0	-
11-1am	1	3.33	0	-	0	-
1-3 am	26	86.60	0	-	24	80.00
3-5 am	3	10.00	2	6.66	4	13.33
5-7 am	0	-	5	16.66	2	6.66
7-9 am	0	-	23	76.66	0	-

short corolla tube. Calyx is persistent with fruit. After anthesis corolla tube falls off, but style remains with ovary for one day. Similar reports have been made by Raju and Rao (2006).

Anthesis started from midnight and lasted upto 3.00 am. Stigma becomes receptive during anthesis and the receptivity continues for about 4-5 hours. Anther dehiscenes is between 7.00 am and 9.00 am. Pollen grains are creamy white, oval shaped, tricolpate with smooth exine and cent percent fertility. The mean length and breadth of pollen are 26.88 micrometer and 23.97 micrometer, respectively.

Fruit set absent under artificial selfing while under natural open pollination up to 16.5 per cent fruit set was recorded. Immature fruit fall was common. Birds, honeybees, *Xylocopa*, ants, beetles and small insects were the common pollinators, in concurrence with the reports of Bolstad and Bawa (1982).

Immature fruits are initially brick red, later green and turn yellow when ripe. The fruit is a drupe with smooth leathery shining pericarp, pulp and one strong seed. The average size of the fruit is 3.18 x 9.26 cm. Seeds oval shaped, tapering to one end and the size of seed is 2.04 x 4.32 cm. Seeds hard with rough seed coat, are also reported by Little (1983) and Tewari(1995).

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