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STUDIES ON SEED MORPHOLOGY AND GERMINATION OF BUTEA MONOSPERMA (LAM.) TAUB.

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Butea monosperma (Lam.) Taub. is important plant for natural medicine. Plant Show three type of seeds i.e. large, medium and small based on dimension. Highest dimension in large pods with large seeds (5.1×3.6×0.8 cm). Seeds are reddish-brown to dark brown. Observe shapes are ovate, round, d-form and reniform (kidney shape).The large seed is mostly in reniform shape while medium and small seeds are showing all above shape. Percentage germination is highest in medium seeds and lowest in small seeds. Light reddish-brown seed showed high viability than dark brown.

Keywords: Fabaceae, germination percentage, kidney shape and variation.

Introduction

Butea monosperma (Lam.) Taub. is a legume tree of Fabaceae. It is medicinally important. The plant is well known in indigenous systems of medicine from time immemorial for its various curative effects. Seeds have long been used in medicines as anthelmintic, useful in urinary discharges, piles, skin disease, tumours, and abdominal troubles. The seeds have gained economic importance by becoming a potential source of fatty oils, popularly known as Oodoga oil or Kino tree oil[1] which possess antimicrobial activities[2].

Seed morphology has been useful for the analysis of taxonomic relationships in families such as Fabaceae, Brassicaceae, Capparaceae, Anacardiaceae and Pinaceae[3]. Micromorphological features of seeds have been used as important tools in various scientific studies. Most of the light microscopic features used are concern with the general shape, size rather than details of surface ornamentation[4].

The legume or pods is the standard fruit type of Fabaceae family. Seeds are large and within the pods. The study of the comparative morphology of the seed has been largely increased knowledge in the field of taxonomy. The aim of the present study was to analysis of morphology and germination behavior of seed.

Material and Methods

Fruit of the plant i. e. Pods were collected from the natural habitat of plant i.e. Jamwa Ramgarh (Jaipur) as well as from local market of Jaipur city of Rajasthan (India). Pod and seed characters of the plant were studied by using freshly collected mature seeds. Seeds have been isolated from the pods and cleaned with tap water and dried at room temperature. Seed dimensions measured and measurements like shape, size, colour, weight. Colour and shape of the seeds were determined by the eye observation under the light microscope. The size of the seeds was measured by Vernier calipers. The dimensions were taken at the point of maximum length, width, and thickness in 10-10 samples of randomly selected seeds. Weight of the pods and seeds were taken by electronic weighing balance. Germination percentage found out by seed germination, for this purpose equal number of seeds with different size i.e. small, medium and large were sowing in earthen pots by using garden soil at the same time and watering regularly and then observed of seed germination percentage.

Results and Discussion

Seeds are miniature of the plants. Based on the light microscopic observation, the examined *Butea monosperma* (Lam.) Taub. show

variation in seed characteristics. The length, width, shape and colour etc. are used to describe the seed. Leaves of the plant are trifoliate with 10-15 cm long petioles and stipules linear-lanceolate, obtuse, glabrous above at maturity. The pods of the plant are flat, long, stalked, and thickened at the suture. These are light brown in colour. Each pod contain one seed within the dehiscent apex of the pod that revealed the meaning of monosperma name. The seeds greatly vary in shapes and size (Figure 1 & 2).

Colour of fruit and seed:

Fruit and seed colour was variable. In *Crotolaria* which show dark brown, whitish light brown and black colour seeds[4]. The legume testa in Fabaceae is usually monochrome brown to black, rarely red, cream or white, occasionally dichromate as two distinct colored areas[5]

Young pods were green, velvety with a lot of hairs. Mature pods hanging in position and turn into pale yellow to light brown at maturity. Seeds were reddish-brown to dark brown (Figure 3) which are similar to *Crotolaria* seeds[4].

The shape of fruit and seed :

Seeds of *Trifolium* L. examined and concluded that seed shape, size, sculpture pattern and hilum shape can be used as taxonomic significances within the section *Lotoidea* Crantz[6]. He reports that the shape of seeds was round, ovoid, oblong and reniform and brown to light brown that was similar to *Butea monosperma* (Lam.) Taub and same results found in the same genus *Trifolium* L. seed morphological characters i. e. size, shape, surface and weight of genus Oxytropis DC. have taxonomic value in distinguishing sub-genera section and species[7&8]. Studies on seed morphology of *Tephrosia* showed continuous variation in shape i.e. oblong, oval rectangular and reniform and size i.e. large and small and in testa pattern i. e. foveolar in *T. vagelii* and substrate in *T. rufescens* etc[9].Plant fruits were flat, long, stalk, thickened at the sutures. Stalk 2 mm long. Seed one within the dehiscent apex of the pod. There is a wide variety in shapes ovoid, round, oblong, D-shaped and reniform (Figure 2) similar to *Tephrosia*[9]. The reniform (kidney) shape is the dominant shape. A large number of variability in shape found in medium-size seeds i. e. D-shape, round, oblong and reniform, a large seed was mostly reniform and small was mostly round in shape. The seed was flat symmetrical, bilobed, and raphe equal to antiraphe. The number ofreniform seed is present in the large seed are 7-8 in number in 10 samples, D-shape, oblong and round is 1-2 only, medium seed have 4-5 reniform, 2-3 round, 2-3 oblong and d-form and small seeds have 3-4 reniform, 4-5 round and 1-2 oblong in shape.

The surface pattern of fruit and seed:

Seed morphology is an important tool for seed identification by various ornamentation of the seed surface. Presence of cracked surface was a common feature noted in many of the legumes seeds and seed coat pattern categorized into smooth, cracked and papillate in *Crotolaria, Alysicarpus* and *Indigofera*[4]. The texture of seed surface varies from rugosity (opened, pitted and coarse), foveate and loculate in *Colutea L.*[10]

Fruits were curved, flat, long, smooth, reticulated vein with greyish-white hair. Seed surface was cracked, wrinkled, and reticulate. Testa thin, smooth, waxy and paperaceous or lathery. All type of seeds have the same type of seed surface, no have many variations in surface pattern.

Size of fruit and seed:

Plant fruit and seeds were variable in size. Pod size of plant *Butea monosperma* (Lam.) Taub was 12.5-20 by 2.5-5 cm with stalked, reticulate veined, thickened at the suture[11&12]. The fruit was flat legumes with 12.5-20 by 2.5-5 cm and seeds flat with 25 to 40 mm long, 15 to 52 mm wide and 1.5 to 2 mm thick. Seed was flat, kidney shape, dark reddish-brown, thin and glossy with 25-40×1-3×1.5-2 mm in size-wise[13]. In our study, the pod of plant size vary with 10.5 to 21.5 cm long and 1.5 to 3.5 cm wide.

Seed size varies with 2.1 to 5 cm long and 1.5 to 3.6 cm wide as compared to previous rtudies[11&12]. Regarding to the values of the length and width, the pods were classified into three categories and coded as follow: Large (L: 15.4-21.5 cm; W: 2.5-3.5 cm), medium

(Length: 12.5-15.4 cm; Width: 2-3.5 cm) and small (Length: 10.5-12.5 cm; Width: 1.5-2 cm) (Table 1).

The weight of the pods show variation, the weight of 10-10 pods varies from 38-40.5 gram (large), 20-30 gram (medium) and 15-20 gram (small). Thus the weight of large pods increased two times more as compared to small pods (15 to 40.5 gram) and one times more as compared to medium pods (20 to 40.5 gram). The weight of medium pods increased one times more as compared to small pods (15 to 30 gram).

Seed weight was variable, range 0.90-1.50 g per seed in 100 seeds. The seed size range was 2.1-5.1 cm in length, 1.5-3.6 cm in width and 0.2-0.8 cm in thickness. Based on the length and width of three types of seeds i.e. small, medium and large.

Small seed size was 2.1-3 cm in length, 1.5 to 2.3 cm in width and 0.2 to 0.4 cm in thickness and weight of per seed was 0.95 - 1.20 gram. Medium seed size was 2.1 to 3.5 cm in length, 2 to 2.5 cm in width and 0.2 to 0.6 cm in thickness and weight of per seed was 0.95-1.20 gram. Large seed size were 3.4 to 5.1 cm in length, 2.1 to 3.6 cm in width and 0.4 to 0.8 cm in thickness and weight of per seed was1.20-1.50 gram.

The weight of pod vary in different size that was 1.5 to 2 gram (small), 2.4 to 3.1 gram (medium) and 3.5 to 4 gram (large) per pod respectively. The seeds show variation in size, shape and weight (Table 2, 3 &4).

Most of the seeds were medium size, large seeds were average and small were few in numbers. Medium seeds were dominant in number. The smallest and largest seed dimensions were 2.1×1.5×0.2 cm and 5.1×3.6×0.8 cm respectively. Large seed weight (1.20-1.50 gram per seed) higher than medium and small (0.90-0.95 gram).

Large seeds contain in large pods. These were mostly bright reddish in colour with a smooth surface. Shape variation did not much see in these seeds, mostly seeds reniform in shape and few seeds were round and oblong (Figure 1 and 2). The medium and small seed has much diversity in shape i.e. round, oblong, D-form and reniform (Table 2 and 3).

Seed Germination:

Seed viability and germination play an important role in the plant's life. Germination high in medium seed, average in large seed and low in small seeds. The number of seeds germinates 8 to 10 in large, 13 to 15 in medium and 5 to 8 in small seeds out of 30. Seeds germinated within 7 to 14 days. Germination starts on 7th day.

Dark colour seeds having low viability with 10-15% germination rate and reddish-brown colour having 40-45% germination rate (Table 5). Seed germination rate higher in medium seed and lower in the small seed that was 45 to 50% and 15 to 20%. Reddish-brown seed show higher viability than dark brown seeds. Thus germination percentage higher in reddish-brown and medium seeds. So germination percentage affected by size and colour.

Categories of pods	Weight (gm)	Size(L×W×T)(cm)
Large	3.5-4.0	15.4-21.5×2.5-3.5
Medium	2.1-3.4	12.5-15.4×2-3.5
Small	1.5-2.0	10.5-12.5×1.5-2

Table- 1: Pod dimensions of *Butea monosperma.*

Sr. no.	**Colour**	**Shape**	**Weight (gm)**	**Size (L×W×T) (cm)**
1	Reddish brown	Reniform	2.0	4.7×2.9×0.5
2	Reddish brown	Reniform	2.5	4.3×3.0×0.4
3	Dark brown	Reniform	1.8	4.2×2.2×0.8
4	Dark brown	Reniform	1.5	4.8×3.0×0.5
5	Dark brown	Oblong	1.8	5.1×2.0×0.8
6	Reddish brown	Reniform	2.0	4.6×2.7×0.5
7	Dark brown	D-shape	2.5	5.0×3.6×0.6
8	Dark brown	Reniform	2.8	4.8×3.1×0.8
9	Reddish brown	Reniform	2.4	3.5×2.1×0.5
10	Reddish brown	Round	2.1	4.0×3.2×0.4

Table 2: Large seeds of *Butea monosperma.*

Sr. no.	Colour	Shape	Weight (gm)	Size (L×W×T) (cm)
1	Dark brown	Reniform	1.2	3.4×2.5×0.2
2	Dark brown	Reniform	1.8	3.4×2.4×0.3
3	Dark brown	Reniform	1.5	3.4×2.2×0.3
4	Reddish brown	Reniform	1.6	2.3×2.0×0.2
5	Reddish brown	Oblong	1.5	3.3×2.4×0.4
6	Reddish brown	Oblong	1.6	3.1×2.5×0.5
7	Reddish brown	D-shape	1.6	3.5×2.5×0.5
8	Reddish brown	Oblong	1.6	3.0×2.5×0.5
9	Reddish brown	Round	1.7	3.2×2.1×0.6
10	Reddish brown	Reniform	1.6	2.1×2.1×0.6

Table 3: Medium seed *of Butea monosperma*.

Sr. no.	Colour	Shape	Weight (gm)	Size (L×W×T) (cm)
1	Dark brown	Reniform	0.65	3.0×2.2×0.2
2	Dark brown	Reniform	0.70	2.2×2×0.2
3	Dark brown	Reniform	0.60	2.5×1.5×0.3
4	Reddish brown	Round	0.55	2.1×1.7×0.2
5	Reddish brown	Oblong	0.54	2.9×2×0.3
6	Reddish brown	Oblong	0.64	2.9×2.3×0.3
7	Reddish brown	D-shape	0.64	2.7×1.7×0.4
8	Reddish brown	Oblong	0.71	2.7×2.3×0.4
9	Reddish brown	Round	0.72	2.5×2.3×0.2
10	Reddish brown	Round	0.75	2.5×2.1×0.3

Table 4: Small seed of *Butea monosperma.*

Conclusion

The seed of the plant enclosed in flat and curved pods. Medium seeds were much useful for farmers and forest development due to their higher percentage of germination. Large seed having maximum weight (biomass) so much useful for pharmaceutical industries.

Seed size and colour wise categories	Germination Percentage of Seeds
Small	15-25
Medium	45-50
large	25-35
Dark brown	15-20
Reddish brown	45-50

Table 5: Effect of seed size and colour on germination rate of seeds of *Butea monosperma.*

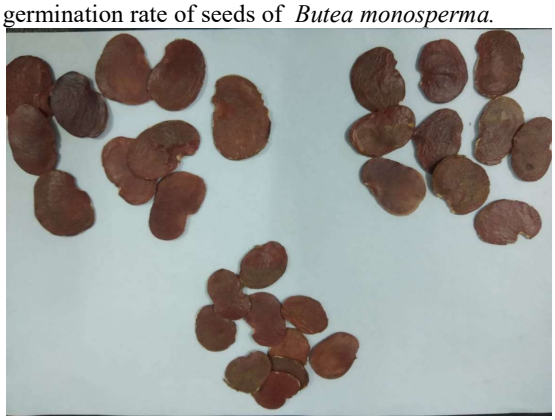

Fig. 1. Seed categories: large, medium and Small of *Butea monosperma.*

Fig. 2. Different shapes of seed of *Butea monosperma.*

Fig. 3. Different colours of seed of *Butea monosperma.*

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