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ANALYSIS OF SPERMODERM PATTERN IN *BUTEA MONOSPERMA* (LAM.) TAUB. AND *PTEROCARPUS MARSUPIUM* ROXB.

KASLIWAL S* AND MOHIL P

Department of Botany, University of Rajasthan, Jaipur - 302004, India

Email id- praveenmohil@gmail.com

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ABSTRACT

Spermoderm patterns are unique and specific for plant species. It is valuable for taxonomic determinations. It was studied by scanning electron microscope (SEM) in *Butea monosperma* (Lam.) Taub and *Pterocarpus marsupium* Roxb. to determine specific features of these species. Morphological characters were examined, includes seed size, shape, colour, testa pattern, surface cell walls and hilum form. Multi-faveolate pattern with parallel ridges found in *Butea monosperma* (Lam.) Taub and faveolated pattern (grooves present between the cells) in *Pterocarpus marsupium* Roxb. Seed colour (reddish and dark brown) and seed coat texture (smooth and lathery) are similar in both plant species. Hilum position is different in both of plant, central to subcentral in *Butea monosperma* (Lam.) Taub. and terminal to subterminal in *Pterocarpus marsupium* Roxb.

Keywords: Scanning Electron Microscope (SEM), faveolated and spermoderm

INTRODUCTION

Seed morphology has long been employed as an important tool. It provides major morphological characters for the various plant species and taxonomic work i. e. identification. Seed characters such as morphological, anatomical and spermoderm patterns etc., used for taxonomic consideration. Most of the light microscopic analysis used is the concern with the general shape, size and colour while the scanning electron microscopy (SEM) helps to detect fine taxonomically significant structure in seed coat patterns which might enable to define species. The SEM provides more accurate information for seed identification, which could be used as a routine technique in the study of the spermoderm morphology.

Fruit of *Butea monosperma* (Lam.) Taub. and *Pterocarpus marsupium* Roxb. is pods,

the plant belongs to Fabaceae. Seeds of *Butea monosperma* are flat and reniform. The seed coat is reddish-brown and two large yellowish cotyledons **(Fageria and Rao, 2015)**. Medicinally seeds are used in inflammation, skin and eye disease, urinary stone, abdominal troubles and tumours **(Somayaji and Hegde, 2016)**.

Pterocarpus marsupium Roxb. seeds are flat and hard. Seeds are used in traditional medicine, especially in the treatment of various disease like hypertension, diabetes, intestinal parasitize, renal and cutaneous disease **(Tiwari *et al*., 2015)**.

We have studied seed surface morphology of the *Butea monosperma* (Lam.) Taub and *Pterocarpus marsupium* Roxb.

MATERIAL AND METHODS

The study constitutes an investigation of seed surface morphological characters of the two species of family Fabaceae. The pods of the plant *Butea monosperma* (Lam.) Taub was collected from the local habitat of Jaipur district (Jamwaramgarh) and the pods of *Pterocarpus marsupium* Roxb. bought from the local market of Jaipur city (Rajasthan). Pods and seeds were stored in an airtight container. Ten fresh seeds of the plant, procured by cleaning and manually separating from the pods, were used for the light and scanning electron microscopic (SEM) studies. Fresh and dry seeds were thoroughly cleaned and washed by tap water. Seed surface sterilized by alcohol to prepared for the SEM technique. The dried seeds were carefully fixed on labelled doubled-sided adhesive tape. Two seeds of each sample were coated with gold. Examination and photography were performed with Nova Nano SEM 450 accelerated by a voltage of 15.00 KV. Ten seeds were used in the morphological description. In the study taxonomical terminology was taken by the **Gunn (1981)** and **Lersten (1981)**.

RESULT

The study of seed surface morphology reveals the following results in shape, size, colour, texture, testa pattern hilum position in *Butea monosperma* (Lam.) Taub. and *Pterocarpus marsupium* Roxb.

The fruit (Pod) of *Butea monosperma* is flat, long, stalked and thick at the sutures. Young pods were green, velvety and fleecy (a lot of hairs). Mature pods turn into pale yellow to light brown at maturity. Pods are monospermic. Seeds were reddish to brown in colour and various shape i.e. round, oblong and reniform **(Figure 1A)**. Seeds were 2.1 to 5.1 cm in length, 1.5 to 3.6 in width and 0.2 to 0.8 in thickness **(Figure 1A)**.

The seed coat was smooth and lathery. The position of hilum was central to subcentral. The epidermal cells are granulated with prominent cracked lines, prominent suture and cell boundaries were obliterated due to presence of waxy white projection **(Figure**

2A, 2B). Cells were penta to hexagonal shape with ridges of various lengths more or less parallel to each other, forming the multi-foveolate pattern **(Figure 2B)**. The multi-foveolate pattern results when grooves surround more than one cell. Each cell has numerous thin and thick fractured lines with short parallel ridges. Crystal-like waxy deposition in the form of tubercles seen in the cells **(Figure 2C)**.

Pterocarpus marsupium Roxb. fruits were samara (hard, orbicular and winged) and seeds enclosed in the fruits, having gone seed per fruit, but two and rarely three seed per fruit observed also. Seeds were reddish-brown to dark brown **(Figure 1B)** and convex shape which enclosed in the brown, flattened winged and indehiscent fruit (Pod). Seeds 1 to1.3 cm long, 0.3 to 0.8 cm wide and 0.2 cm thick **(Figure 1B)**.

The seed coat was smooth. Hilum position was terminal to subterminal. The outer cells surface is in simple foveolated pattern with grooves. In the simple foveolate pattern, the grooves isolate single epidermal cells. The epidermal cells isolated by grooves **(Figure 3A, 3B)**. Thick undulation with wavy outlines appeared in the cells with the presence of less round granular structures, that was papillose and white **(Figure 3C, 3D)**.

Both the plant shows different characters in seed surface morphology.

DISCUSSION

The standard fruit type of Fabaceae is legume. *Butea monosperma* (Lam.) Taub. and *Pterocarpus marsupium* Roxb is an economically important tree. It has varied seed surface morphology. Scanning electron microscopic (SEM) study on seed morphological features of *Butea monosperma* (Lam.) Taub. and *Pterocarpus marsupium* Roxb. shows a great difference in size, shape, testa pattern and hilum form. Seed shape is a good character as compared to size. Regarding seeds of *Butea monosperma* (Lam.) Taub. are reniform (kidney) shape is similar to *Crotolaria* **(Gandhi *et al*., 2011)**. Seeds of *Pterocarpus marsupium* Roxb. convex are similar to *Alysicarpus* and *Indigofera* **(Gandhi *et al*., 2011)**. Seed colour was observed reddish to brown as similar to *Withania coagulans* **(Kumar *et al*., 2020)**.

Spermoderm surface ornamentations are specific for a particular species. It is utilized for taxonomic determinations. The legume seeds show a primary ornament, characterized by the presence or absence of penta or hexagonal cells, a typical sculpture pattern four type- (1) substriate, (2) foveolated (3) papillate and (4) stellate many different combinations of these characters were noticed **(Barthlott, 1981)**. According to **Lesrten (1981)**, the Leguminosae, subfamily Papillionoidae show that nine categories of the testa

pattern in Papillionoidaei. e. levigate, regulate, substriate, simple foveolated, multi-foveolate, lophate, mulilophate and papillose. The multi-foveolate pattern is the most frequent in *Butea monosperma* (Lam.) Taub and the foveolated pattern of seed surface in *Pterocarpus marsupium* Roxb. and it is similar to the genus *Genista* by **Estrelles *et al*. (2006)**.

Table 1: characteristic features of seed

Sr. No.	Plant Species	Seed				Testa Pattern (seed surface morphology)	Hilum	
		Shape	Colour	Size (L×W×T) (cm)	Texture		Position	Colour
1.	***Butea monosperma* (Lam.) Taub.**	**Oblong, round and reniform**	**Reddish brown, dark brown to black**	**2.1-5.1×2.1-3.6×0.2-0.8**	**Smooth and lathery with cracks all over the surface**	**Multi-foveolate pattern with short parallel ridge in epidermal cells, cellspenta to hexagonal shape with wavy outlines**	**Central to subcentral**	**Light brown and pale yellowish**
2.	***Pterocarpus marsupium* Roxb.**	**Convex, flat& long**	**Reddish brown and pale brown**	**1-1.3×0.3-0.8×0.2**	**Smooth and lathery**	**Foveolated (grooves isolate the cells), epidermal cells irregular with undulating outlines**	**Terminal to subterminal**	**Red**

Abbreviation: L= Length, W= Width, T= Thickness and Cm= Centimeter

Figure 1: Seeds (A) *Butea monosperma* (Lam.) Taub. and (B) *Pterocarpus marsupium* Roxb.

Butea monosperma (Lam.) Taub. Seed SEM studies

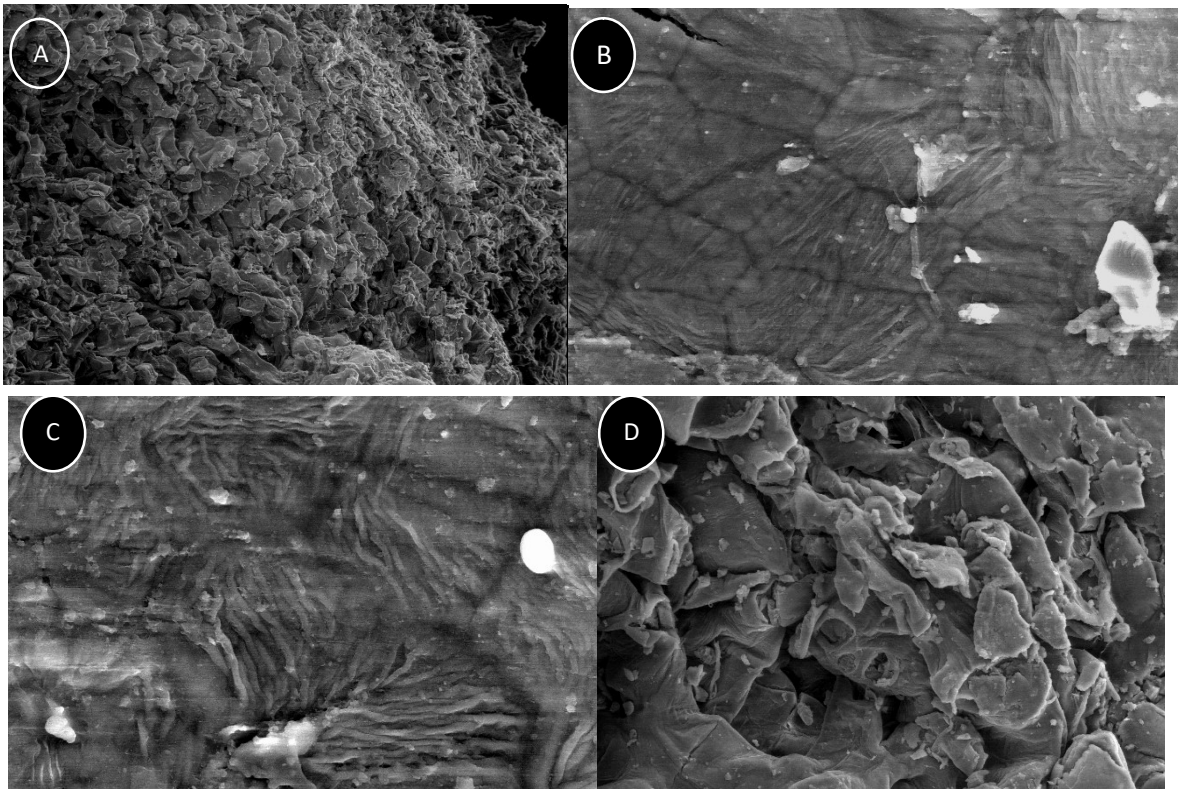

Figure: 2 (A) Seed surface (B) Epidermal cells (C) Cells close up (D) Cell lumen with Cell boundaries

Pterocarpus marsupium Roxb. Seed SEM studies

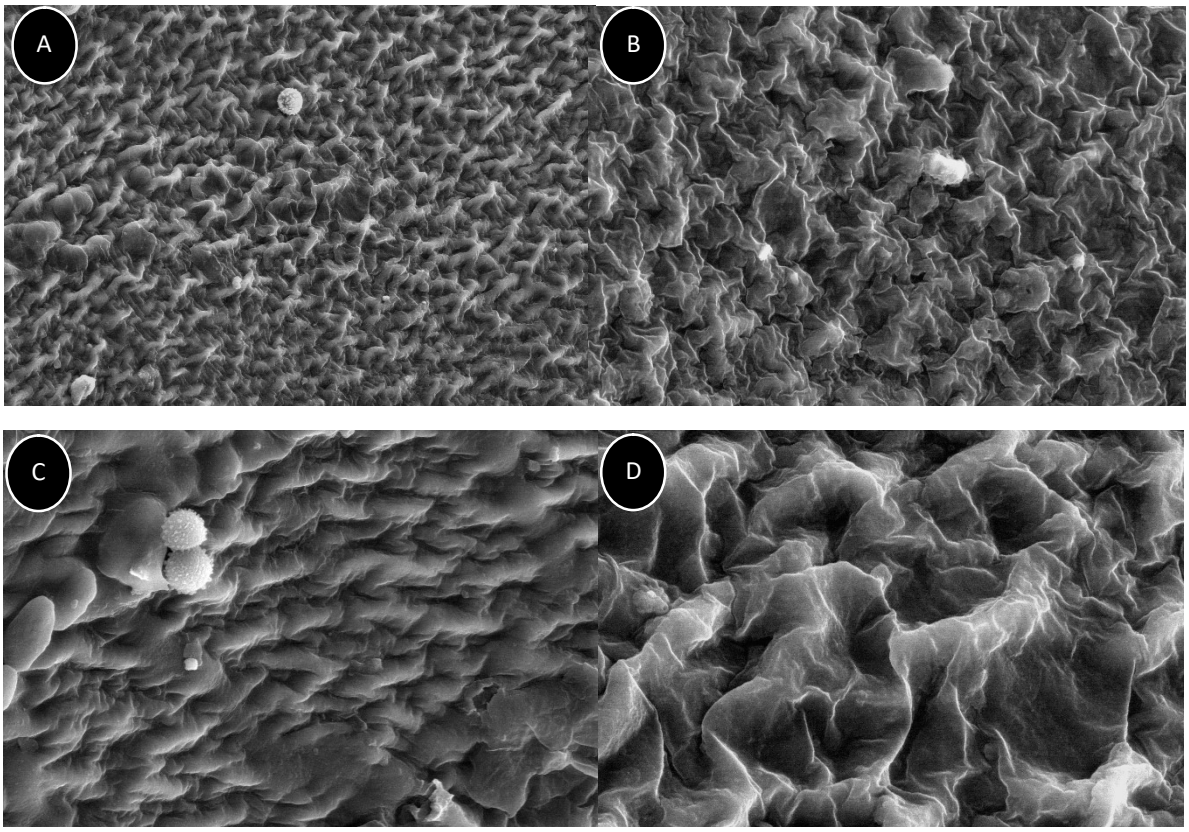

Figure: 3 (A) Seed surface(B) Epidermal cells (C) Cells close up (D) Cell lumen with Cell boundaries

CONCLUSION

There are unique combinations of surface morphological characteristics of seeds. The seeds of both plants show different spermoderm pattern. The two species of the same family i.e. *Butea monosperma* (Lam.) Taub. and *Pterocarpus marsupium* Roxb. have similarity in seed colour and seed coat texture and dissimilar in seed size, shape and spermoderm pattern. This structure reveals identification at a specific level by using seed.

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