

## Anatomy of Mature Seed Coat in Few Members of Family Solanaceae

ItiShriBhati<sup>1</sup>, Shiv Kumar Singh<sup>2</sup>, Rajendra saini<sup>3</sup>, Raaz.K.Maheshwari<sup>4</sup> & Manju Sharma<sup>5</sup>

1. S.S. Jain Subodh P.G. Autonomous College, Jaipur.

2. Kedia Institute of Science and Technology College, Rajawas, Jaipur.

3. S.S. Jain Subodh P.G. Autonomous College, Jaipur.

4. Department of chemistry, SBRM Govt College, Nagaur, Rajasthan.

5. Associate Professor, Department of Botany, U.O.R. Jaipur.

Mail –ID. Shivbotany75@yahoo.com

### ABSTRACT

Anatomy of mature seed coat of seven species of solanaceae family are described. The histological features in all the seven species are showing almost uniform pattern of organization. The mature seed coat in all the species comprised of the epidermis, hypodermis and parenchymatous layers. The epidermis is main mechanical layer and its cell varies in shape, size and nature. The cells of hypodermis is tangentially elongated. The inner zone comprises multilayered parenchymatous zone in which cells are broad and isodiametric to angular and are thick walled in all the species.

**Keywords:** Seed Coat, parenchymatous zone

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### INTRODUCTION

Earlier workers Soueges [1], Netolitzky [5], Dynasagar and Cooper [6], and Saxena like reported the structure of seed coat and Soueges [1] described the structure and development of seed coat in 146 species belonging to 26 genera of the solanaceae including those of *Atropa*, *Datura*, *Scopalia* and *Solanum*. The present study deals with the anatomy of mature seed coat in *Capsicum annuum*, *Datura fastuosa*, *Datura metel*, *Solanum melongena*, *Solanum nigrum*, *Solanum surattense* and *Withania somnifera*.

### MATERIALS AND METHODS

The materials were obtained from widely grown plants of *Datura fastuosa*, *Datura metel*, *Solanum nigrum*, *Solanum surattense* and *Withania somnifera* in botanical garden, University of Rajasthan, Jaipur. *Capsicum annuum* and *Solanum melongena* were obtained from registered horticulture nursery.

The materials were fixed in Formalin-Acetic acid-Alcohol (FAA) consisting of formalin, acetic acid and 70% ethanol in a proportion of 1:1:18 for about 48 hours and preserved in 70% ethyl alcohol till required for further processing. Specimens were washed thoroughly in 70% alcohol, dehydrated through tertiary butyl alcohol (TBA) series and embedded in paraffin. Serial microtome sections were cut at 8 µm -20 µm in thickness. Mature dry seeds were kept in boiled water for 10-20 hours, fixed in Formalin-Acetic acid-Alcohol and stored in 70% ethanol for about six months before free hand sectioning. Free hand sections were stained with safranin- fast green and mounted in Canada balsam.

### RESULTS

Anatomy of mature seed coat was studied in the following seven species belonging to the family solanaceae.

1. *Capsicum annuum*
2. *Daturafastuosa*

3. *Daturametel*
4. *Solanummelongena*
5. *Solanumnigrum*
6. *Solanumsurattense*
7. *Withaniasomnifera*

The histological features in all the seven species showed almost uniform pattern of organization. So, a common description for all the species is given and differences mentioned as and when they come up. The cellular details are described under three different zones.

#### **Zone-I: The Epidermis**

It is made of radially elongated thick walled macrosclerieds. The outer face of this layer is covered with a thin or thick cuticular layer. In *Capsicum annuum* and *Withaniasomnifera* both the anticlinal and periclinal walls are heavily thickened (Figs. 1,16,17). The thickening is more on the periclinal walls than the anticlinal ones. In the former type of walls the inner ones are thicker than the outer ones. At maturity the cuticular layer is broken here and there and the outer faces of the macrosclerieds are grouped due to radial splits at some places. In *Daturafastuosa*, *Daturametel* and *Solanumsurattense* the macrosclerieds cells are oval with broad lumen and scalariform thickening on the radial walls (Figs. 4, 7,12). The outer and inner tangential walls are thicker than the anticlinal walls. Cuticle is in the form of thin layer in *Datura* species and thicker layer in *Solanum surattense*(Figs.4,5,12). These macroscleried cells are broadened near the lateral sides of the seed in all the three species. However, radial elongation at these places is more in *Datura* species than those in *Solanum surattense*.

In *Solanum melongena* and *Solanum nigrum* thickening is more or less like that in *Capsicum*. But here the outer faces of the macrosclerieds are attached to radially elongated mucilaginous string like structures which are attached to a tangential layer on the outer side. In *Solanum surattense* the tangential mucilage layer is broken at places and the radial mucilage threads look like epidermal trichomes (Figs. 12,14).

#### **Zone-II: The hypodermis**

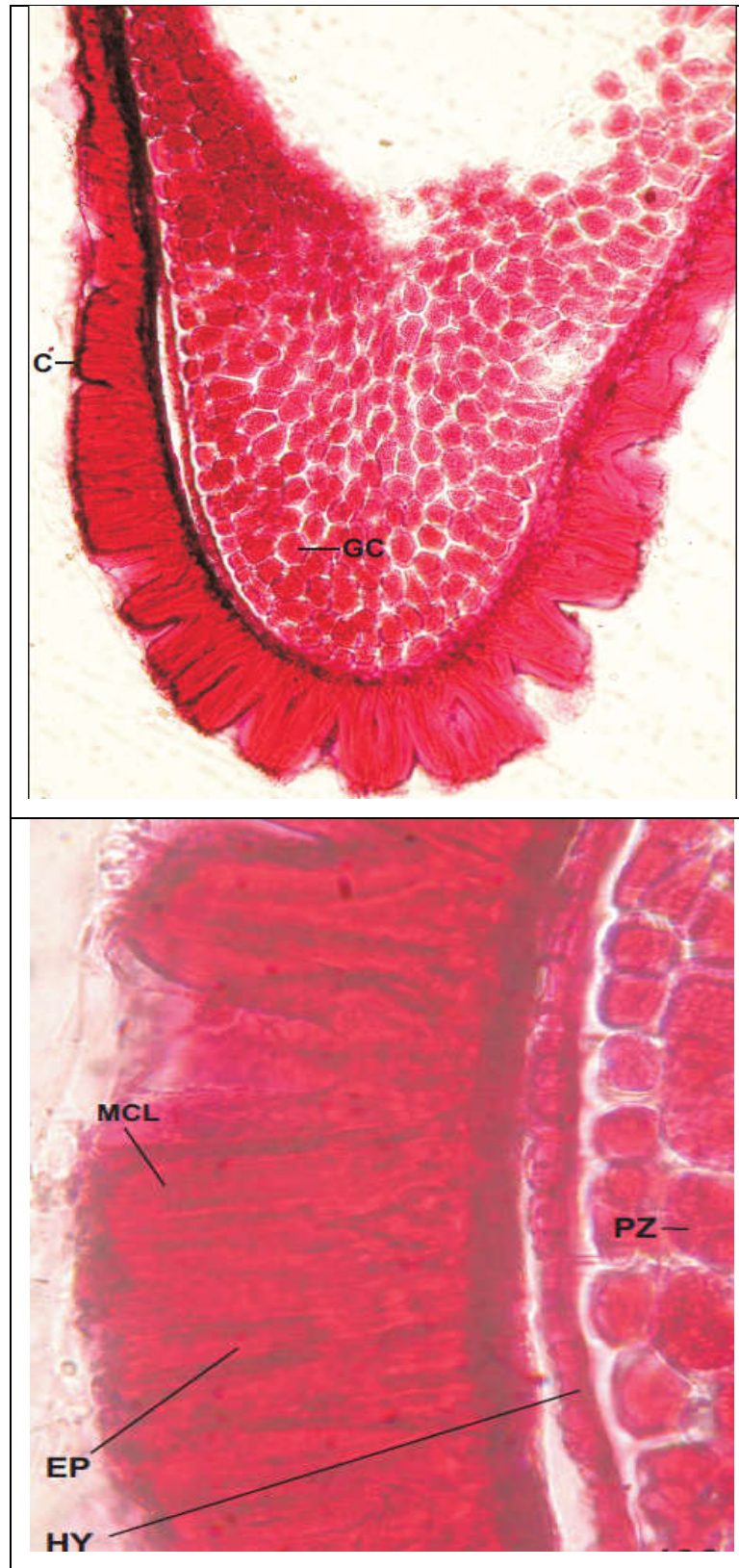
In *Capsicum annuum*, *Solanum melongena*, *Solanum nigrum*, *Solanum surattense* and *Withania somnifera* subjacent to the macroscleried layer the cells are tangentially elongated and constitute the hypodermis. These cells remain thin walled in *Solanum melongena* and become thick walled in remaining four species. In *Solanum nigrum* and *Solanum surattense* the outer tangential walls of these cells are highly thickened (Figs. 12,14). Whereas in *Withania somnifera* both the outer and inner tangential walls are heavily thickened (Figs. 17,18).

#### **zone-III: The Parenchymatous zone**

Inside the hypodermis a multilayered parenchymatous zone represents the third zone of seed coat. The cells are broad and isodiametric to angular and are thick walled in all the species. The thickening material is deposited on all around the cell walls and denser stained. Granular contains are deposited in almost all the cells of this zone in *Capsicum annuum*, *Daturafastuosa*, *Solanumsurattense* and *Withaniasomnifera*(Figs.1,4,5,12,18). In the remaining species only a few cells here and there have granular deposition.

### **DISCUSSION**

The seed coat of *Capsicum annuum*, *Datura fastuosa*, *Solanum melongena*, *Solanum nigrum*, *Solanum surattense* and *Withania somnifera* is built on a common pattern. The structure of seed coat broadly resembles the account reported by earlier workers like Soueges [1], Netolitzky [5], Dnyansagar and Cooper [6] and Saxena [4], but differ in minor details. Saueges [1] described the structure and development of seed coat in 146 species belonging to 26 genera of the Solanaceae including those of *Atropa*, *Datura*, *Nicotiana*, *Scopolia* and *Solanum*. The author recorded the presence of a chalazal cavity in mature ovules which has not been observed in any plant investigated during the present study. Similarly Saxena [4] and Raghuvanshi [8] also did not find the chalazal cavity in the plants investigated by them. Soueges [1] and Raghuvanshi [8] reported persistent middle layers in seed coat of *Capsicum*. The present data failed to support this.

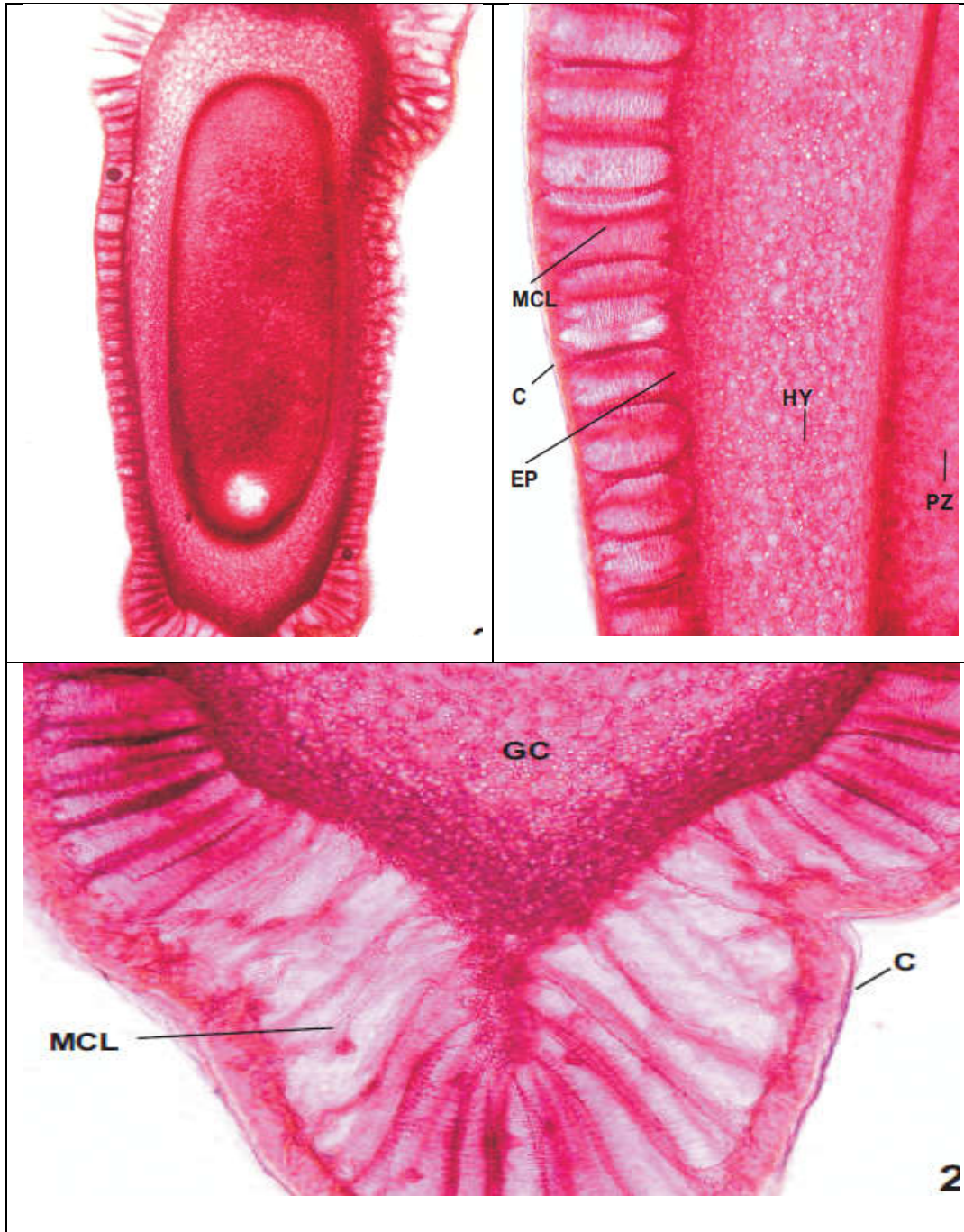


Structure of mature seed coat of *Capsicum annuum*.

Fig. 1: T.S. portion of the mature seed coat X 100.

Fig. 2: Enlarge view of Fig.1 showing different zones X 400.



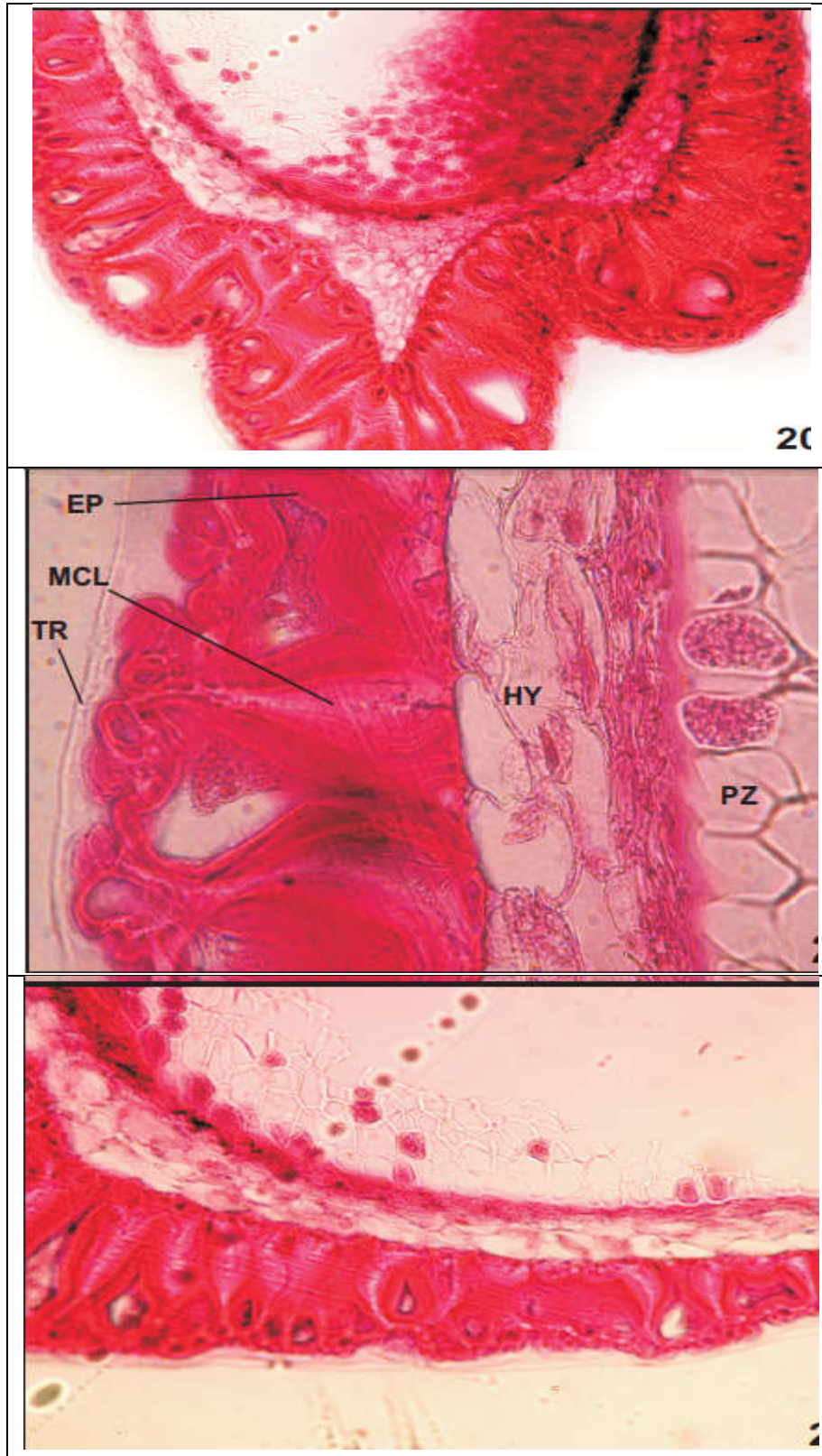


Structure of mature seed coat of *Datura fastuosa*.

Fig.3 :T.S. of mature seed coat X 100.

Fig.4:Enlarge view of lateral side of Fig.3 showing oval shaped macrosclerieds cells X 400.

Fig.5: Enlarge view of lower side of Fig.3X 400

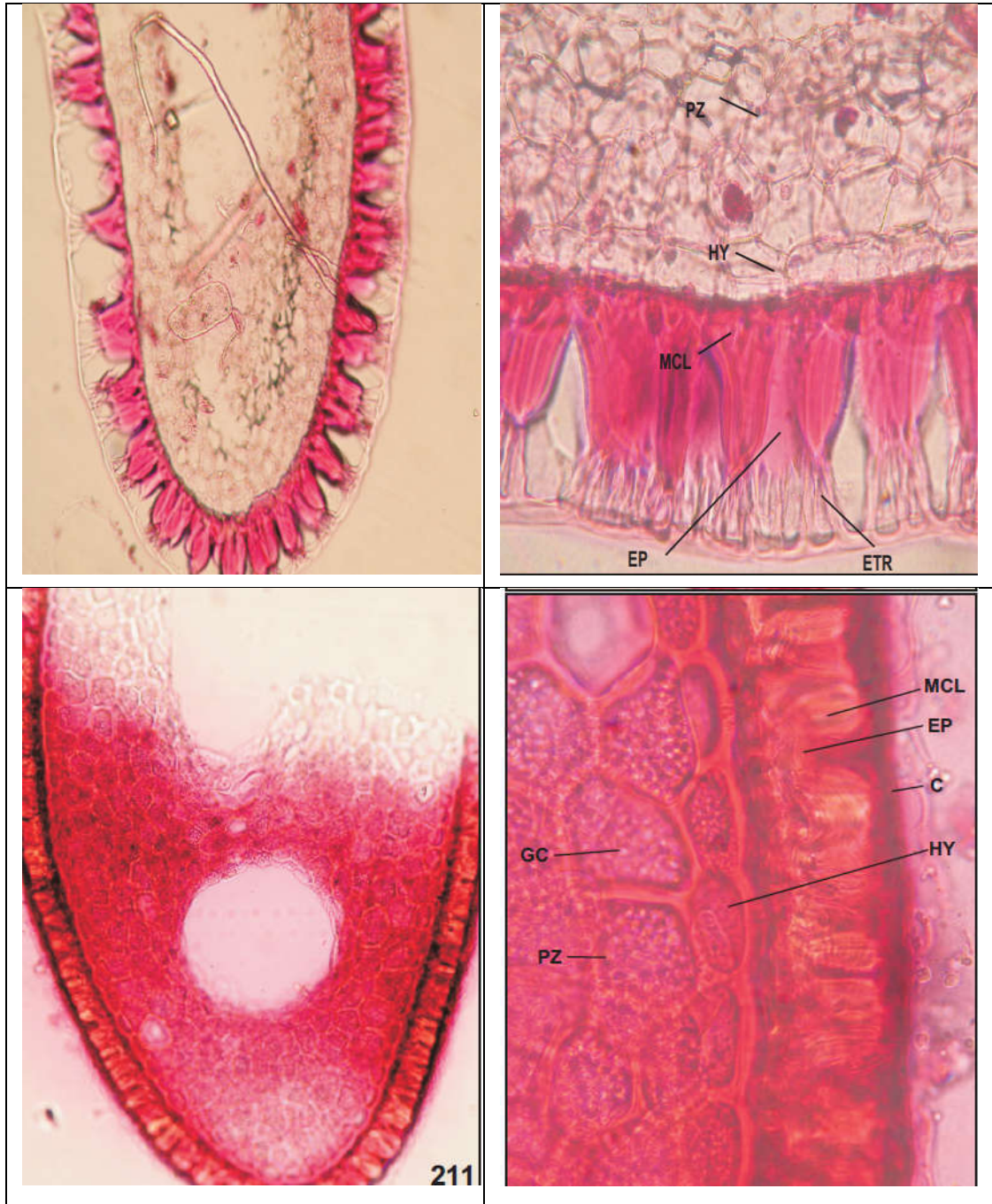


Structure of mature seed coat of *Datura metel*.

Fig. 6:T.S. part of mature seed coat X 400.

Figs.7&8 :Enlarge view of Fig.6 showing oval macrosclerieds cells and string like





**Structure of mature seed coat of *Solanum elongata* & *Solanum surattense***

**Fig.9:** T.S. of mature seed coat X 100.

**Fig.10:** Enlarge view of Fig.9 showing epidermal trichomes and three different zones X 400.

**Fig.11:** T.S. of mature seed coat X 100.

**Fig. 12:** Enlarge view of Fig.11 showing different zones along with thick cuticle X 400.

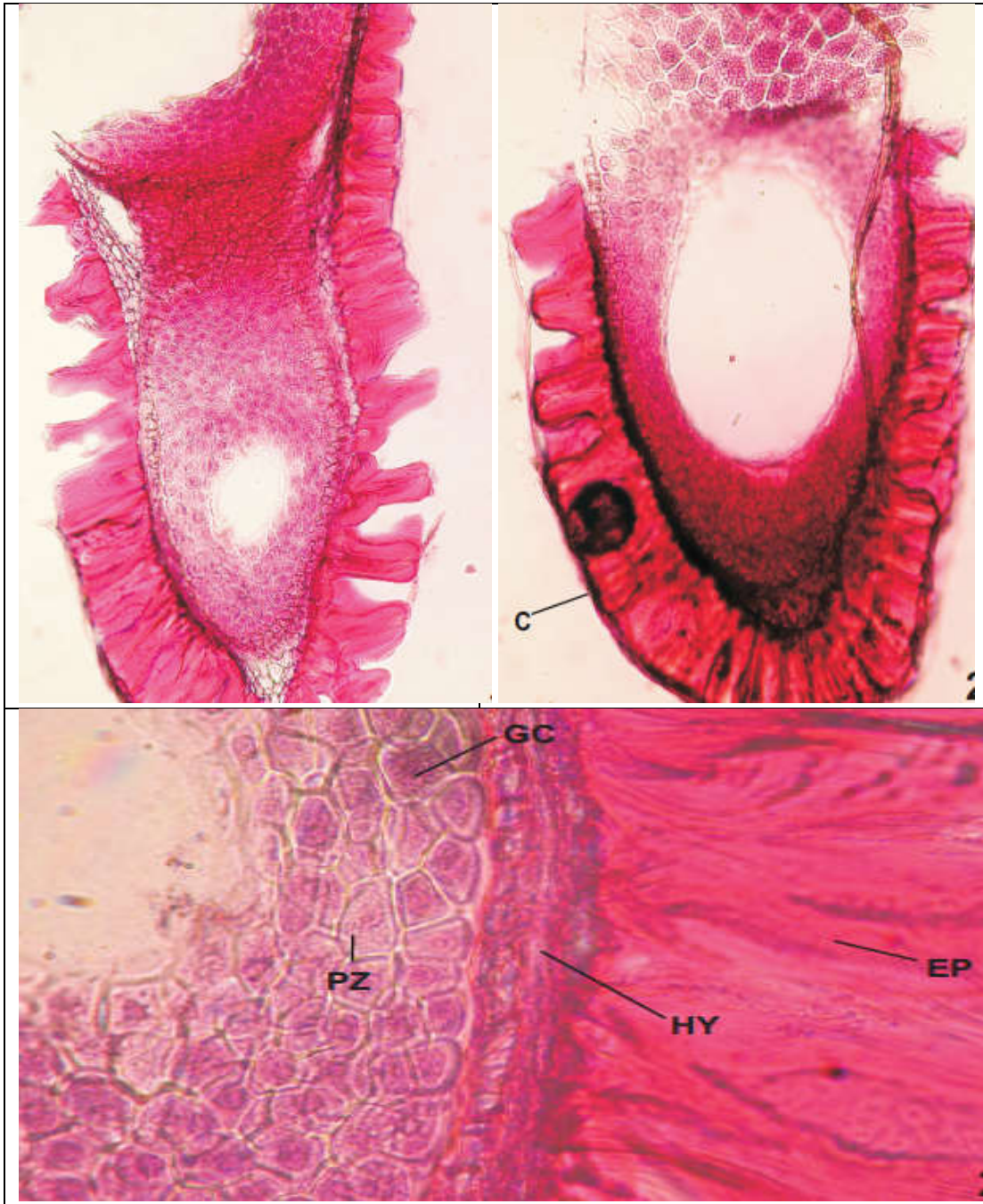


**Structure of mature seed coat of *Solanum nigrum*.**

**Fig.13:**T.S. of mature seed coat X 100.

**Figs.14&15 :** Enlarge view of lateral parts of Fig.13 showing epidermal trichome and three different zones X 400.





**Structure of mature seed coat of *Withaniasomnifera*.**

**Fig. 16:** T.S. of mature seed coat X 100.

**Fig. 17:** T.S. of mature seed coat showing thick cuticle X 100.

**Fig.18 :**Enlarge view of lateral side of Fig.16 showing three different zones X 400.

**ABBREVIATIONS:**

EP	-	Epidermis
GC	-	Granular contents
HY	-	Hypodermis
MCL	-	Macrosclerieds
PZ	-	Parenchymatous zone
C	-	Cuticle
TR	-	Trichome
ETR	-	Epidermal trichome



The mature seed coat in all the species presented here is comprised of the epidermis, hypodermis, and parenchymatous layers. The epidermis is main mechanical layer and its cell vary in shape, size and nature. The cuticle is in the form of a thin layer in *Datura* species and thicker layer in *Solanum surattense*. In *Capsicum annuum* and *Withania somnifera* the walls are heavily thickened. In *Solanum melongena* and *S. nigrum* thickening is more or less like that in *Capsicum*. Similar observations were also reported by Sharma [3] in *Atropa*, *Datura*, *Scopolia* and *Solanum*.

The macroscleried cells are oval with broader lumen in *Datura fastuosa*, *D. metel* and *Solanum surattense*. Earlier Singh and Dathan [2] also found that the epidermal cells are small with a narrow lumen in *Marah fabaceus*. Pandey et al. [7] studied the mature seed coat of *Pongamia pinnata* having layer of macrosclereids followed by multilayered parenchymatous cells.

The mature seed coat showed a tangentially elongated hypodermal cells layer in all the three species of *Capsicum annuum*, *Solanum* and *Withania somnifera* studied here. Presence of a hypodermis subjacent to the palisade layer has also been reported earlier. Singh and Dathan [2] in *Marah macrocarpa*, *M. fabecus* and *M. oreganus* reported sinuate and more or less rounded hypodermal cells respectively. In several leguminous seeds hour-glass or bone shaped hypodermal cells have been reported [2] similarly the thickening behaviour of the hypodermal cell walls also seemed to species specific. In *Luffa acutangula*, *Marah macrocarpa* [2] and majority of legumes with hypodermal layer the cells showed thick walls. In *Capsicum annuum*, *Solanum nigrum*, *S. surattense* and *Withania somnifera* reported here the hypodermal cells become thick walled whereas they remain thin walled in *Solanum melongena*.

In *Withania somnifera* both the outer and inner tangential walls are equally thicker whereas in *Solanum nigrum* and *S. surattense* the outer tangential walls are thicker than the inner ones. Singh and Dathan [2] while reporting seed coat structure in some cucurbitaceae members also found such differential thickening of tangential cell walls in hypodermal layer.

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