

Micromorphological Characters Of Seed Coat Sculpture For Some Species Of *Brassica* L. (Brassicaceae) In North Of Iraq

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ABSTRACT

Seed coat sculpture is a very important character for taxonomic studies. This research aimed to studied seed coats between species for Brassica . The present study included seed coat morphology were studied for six species and three variety belong to the Brassica L. genus in the north of Iraq by Scanning electron microscope (SEM). The SEM photographs showed a difference in the seed coats of Brassica, a seed coat pattern in which six species and three variety belong to it reticulate in all species except two species, rugose in *B.campestris* and undulate – shallow undulate in *B.deflexa*. The present study demonstrated heterogeneous characteristics of outer epidermal cell shape between all species, Irregular cells in three species *B.campestris*, *B.deflexa*, and *B.juncea*, Polygonal cells just in *B.oleraceae* var. *botrytis*, Polygonal-elongated cells in *B.nigra*. anticlinal wall isodiametric –polygonal cells in *B.tournifortii* and *B.oleraceae* var. *capitata*, tetragonal – polygonal cells in *B.rapa* and tetragonal cell just in *B.oleraceae* var. *gongyloide* .

Keywords: Brassicaceae, Seed coat, seed sculpture , Scanning Electron Microscope, Brassica.

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INTRODUCTION

The Brassicaceae or mustard family is also considered one of the large family of flowering plants, as it is widespread all over the world except for the frozen continent as it consists of 39 tribes and about 321-500 genera of 2000-3660 species . In Iraq, it is represented by 80 genera and 90 wild species and 18 cultivated species for food and decoration purposes, spread at most in the temperate and cold regions of the north of Iraq [1]. The mustard family is distinguished by the flowers and fruits as it contains the cruciform corolla, tetradynamous stamens, and the presence of silique and silicle fruits and content septum [2].

The genus *Brassica* L. is considered one of the most widespread in the world and the largest in the family of Brassicaceae. it includes 100-170 species of herbaceous annual, and perennial plants are spreads in Europe, Asia, and North Africa, while in Iraq the genus is represented by more than 18 species, the majority of its species are spread in central and northern Iraq [3]. The species of Brassica have economic significance because of their value as vegetables and oilseeds [4]. The morphological characters of fruits and seeds are used in the identification and classification of the family Brassicaceae. The seed coat sculpture has been used to solve phylogenetic and systematic problems between species and tribes [5] .seed coat structure is considered to be stable characters and not affected by environmental conditions . several studies in the Brassicaceae on the seed coat and its taxonomic significance [6].studied the seed coat of *Brassica* in Iraq by using a light microscope (LM) but the studies about the seeds of the genus *Brassica* by SEM is rarely, therefore, the present study was conducted to present detailed seed coat characteristics of six *Brassica* species (*B.campestris*, *B.deflexa*, *B.juncea*, *B.nigra*, *B.rapa*, and *B.tournifortii*) and three tribes (*B.oleraceae* var. *botrytis*, *B.oleraceae* var.

capitata and *B.oleraceae* var. *gongyloides*) occurring in the north of Iraq.

MATERIALS AND METHODS

Plant samples (seeds) were collected from a different area in the north of Iraq (Mosul, Irbil, Suliamania, and Duhok) from April to July 2019. Plant samples were identified by Iraqi National Herbarium and other herbaria in Baghdad, Mosul University, and the identified samples were kept in the Department of Biology, College of Science, Tikrit University, Iraq.

The seed was fixed in 5% glutaraldehyde buffered with 0.2 mol L⁻¹ phosphate for 5 h at room temperature. the seeds of all species for *Brassica* were dehydrated by graduated ethanol series and followed by mounting on stubs with double-sided adhesive tape. aluminum coating a few nanometers was applied using a coating machine (Q120R, HO.). examined on Quanta 400 Scanning electron microscope (SEM), made in holland.SEM was operated at 25-30 kV with a working distance of 12 mm. high magnification was performed to capture the features of all the specimens. The surface was scanned for all species of *Brassica* [7].

RESULTS

The seed coat for 6 species and three varieties for *Brassica* L. genus belonging to the family Brassicaceae are summarized in table 1 and the image by SEM is represented in Figure 1.

Seed coat sculpture

The studied species were examined by scanning electron microscope showed five different types of seed coat pattern in which six species and three variety belong to it : 1-Reticulate with three subtypes:
a-Regular reticulate seed coat pattern in all species except three species *B.campestris*, *B.deflexa*, *B.juncea*. Show Table 1 figure 1.

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b-Irregular reticulate seed coat pattern in three species *B.campestris*, *B.deflexa*, *B.juncea*.

c-Shallow reticulate in *B.juncea* and *B.oleraceae var. botrytis*.

d-Reticulate -foveate in *B.nigra* and *B.oleraceae var. capitata*.

e-reticulate-ocellate in *B.rapa*, and *B.tournifortii*.

2-Rugose in *B.campestris*.

3.Undulate -shallow undulate in *B.deflexa*, these result were correspond [8,9]

Outer epidermal cell shape

The present study demonstrated heterogeneous characteristics of outer epidermal cell shape between all species belonging to *Brassica* L.genus as shown below:

1.Irregular cells in three species *B.campestris*, *B.deflexa*, and *B.juncea*.

2.Polygonal cells just in *B.oleraceae var. botrytis*.

3.Polygonal-elongated cells in *B.nigra*, these result were correspond [10].

4.Is anticlinal wall isodiametric -polygonal cells in *B.tournifortii* and *B.oleraceae var. capitata*.

5.tetragonal - polygonal cells in *B.rapa* and tetragonal cell just in *B.oleraceae var. gongyloides*. Show Table 1 figure 1.

anticlinal wall

anticlinal wall shape

This research showed a clear discrepancy in the anticlinal wall shape as shown below:

1.Irregular anticlinal wall shape in two species *B.campestris* and *B.deflexa*. these result were not correspond to [11] about anticlinal wall shape .

2.straight - undulate in three species *B.juncea*, *B.rapa*, and *B.oleraceae var. botrytis*.

3.straight in three species *B.nigra*, *B.tournifortii*, and *B.oleraceae var. gongyloides*

4.undulate in *B.oleraceae var. capitata*. Show Table 1 figure 1.

anticlinal wall texture

The current study clarified the texture of the anticlinal wall and it was in the following forms:

1.Smooth in *B.deflexa*, *B.tournifortii*, and *B.oleraceae var. gongyloides*.

2.Striate in *B.juncea* and *B.oleraceae var. botrytis*.

3.Striate - warty in *B.rapa*.

4.Pitted in *B.nigra* and *B.oleraceae var. capitata*.

5.Folded in *B.campestris*.

anticlinal wall thickness

The present study showed the thickness of the anticlinal wall and it was in the following in two forms:

1.Thick anticlinal wall in *B.campestris*, *B.nigra*, *B.rapa*, and *B.tournifortii* and *B.oleraceae var. capitata*.

2. Thin anticlinal wall in *B.deflexa*, *B.juncea*, *B.oleraceae var. botrytis*, and *B.oleraceae var. gongyloides*.

Table 1. seed coat micromorphology in some species of genus *Brassica* L.

Species	Seed coat pattern	Outer epidermal cell shape	Anticlinal wall shape	Anticlinal wall texture	Anticlinal wall thickening	Anticlinal wall level	periclinal wall texture	periclinal wall thickening	periclinal wall level
<i>B.campestris</i>	Rugose	Irregular cells	Irregular	Folded	Thick	Shallow	Striate	Thin	Concave-convex
<i>B.deflexa</i>	Shallow undulate	Irregular cells	Irregular	Smooth	Thin	Shallow	Smooth	Thin	Flat
<i>B.juncea</i>	Shallow reticulate	Irregular cells	Straight - undulate	Striate	Thin	Shallow	Smooth	Thin	Flat-concave
<i>B.nigra</i>	Reticulate - foveate	Polygonal - elongated cells	Straight	Pitted	Thick	Raised	Reticulate	Thick	Concave
<i>B.rapa</i>	Reticulate - ocellate	Tetragonal - polygonal cells	Straight-undulate	Striate-warty	Thick	Raised	Reticulate	Thick	Concave
<i>B.tournifortii</i>	Reticulate - ocellate	Isodiametric - polygonal cells	Straight	Smooth	Thick	Raised	Reticulate	Thick	Concave
<i>B.oleraceae var. botrytis</i>	Shallow reticulate	Polygonal cells	Straight - undulate	Striate	Thin	Shallow	Reticulate	Thick	Flat-concave
<i>B.oleraceae var. capitata</i>	Reticulate - foveate	Isodiametric - polygonal cells	Undulate	Pitted	Thick	Raised	Reticulate	Thick	concave
<i>B.oleraceae var. gongyloides</i>	Shallow reticulate	Tetragonal cells	Straight	Smooth	Thin	Raised	Smooth	Thin	Flat-concave

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anticlinal wall Level

This research showed two levels of the anticlinal wall as shallow in all species except in species *B.nigra*, *B.rapa*, *B.tournifortii*, *B.oleraceae* var. *capitata*, and *B.oleraceae* var. *gongyloides* were raised as table 1 figure 1.

periclinal wall

periclinal wall texture

This study showed periclinal wall texture in species of genus *Brassica* in three types:

- 1.straite in *B.campestris*.
- 2.smooth in *B.deflexa*, *B.juncea*, and *B.oleraceae* var. *gongyloides*.
- 3.reticular in *B.nigra*, *B.rapa*, and *B.tournifortii*, *B.oleraceae* var. *botrytis* and *B.oleraceae* var. *capitata* , as Table 1 figure 1.

periclinal wall thicknes

The research showed periclinal wall thickness as thick in all species except *B.campestris*, *B.deflexa*, *B.juncea*, and *B.oleraceae* var. *gongyloides* show thin of the periclinal wall, as Table 1 figure 1.

periclinal wall level

This study showed periclinal wall level in species of genus *Brassica* as shown below :

- 1.concave in *B.nigra*, *B.rapa*, *B.tournifortii* and *B.oleraceae* var. *capitata*.
- 2.concave-convex in *B.campestris*.
- 3.flat in *B.deflexa*.
- 4.flat-concave in *B.juncea*, *B.oleraceae* var. *botrytis* and *B.oleraceae* var. *gongyloides* , as Table 1 figure 1.

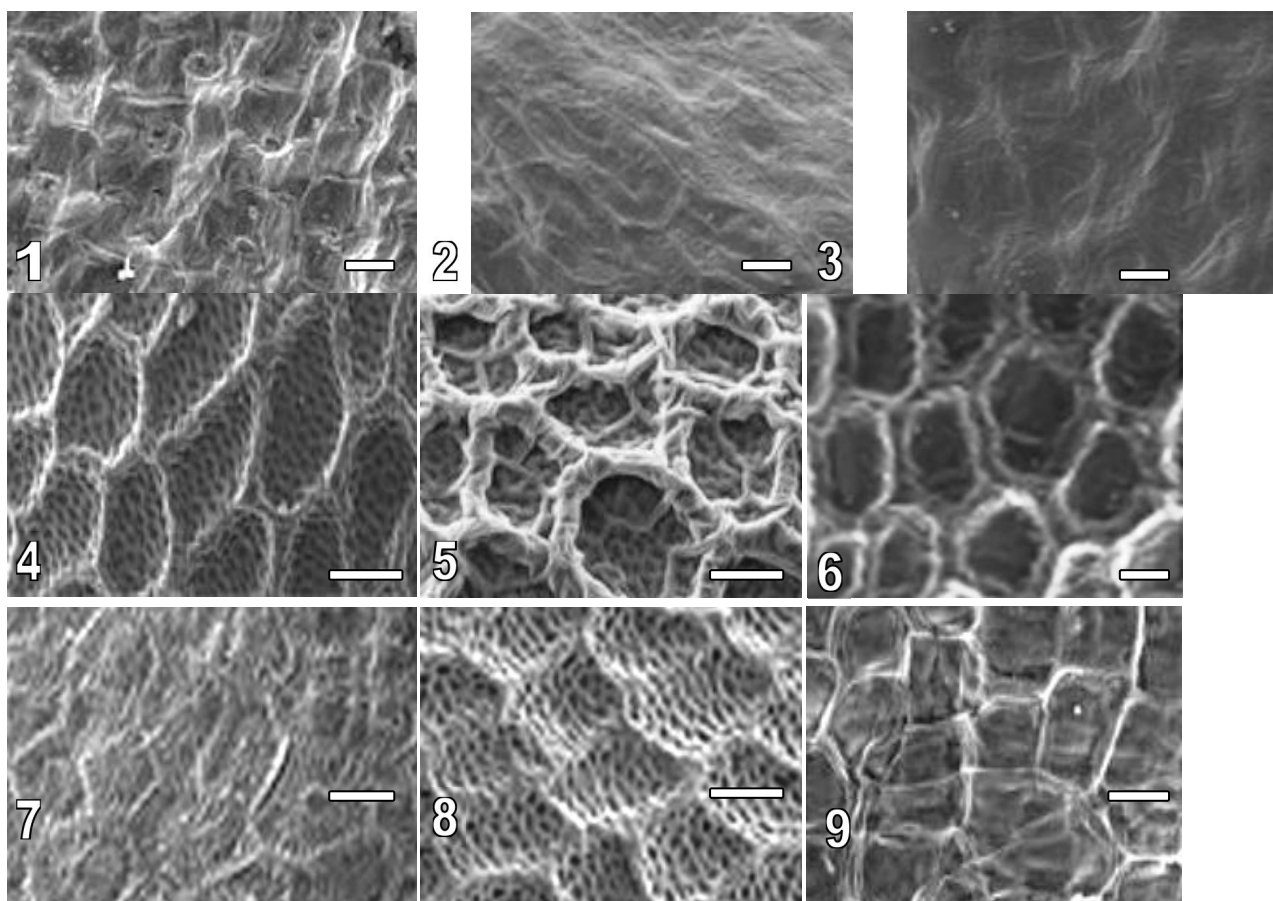


Figure 1. scanning electron microscope micrograph of seed coats in some species and varieties of *Brassica* genus . *B.campestris* 2.*B.deflexa* 3. *B.juncea* 4. *B.nigra* 5. *B.rapa* 6. *B.tournifortii* 7.*B.oleraceae* var. *botrytis* 8. *B.oleraceae* var. *capitata* 9. *B.oleraceae* var.*gongyloides*. X400 Bar = 50µm

DISCUSSION

The genus *Brassica* contains species very similar in more morphological characters [11], and it is difficult to identify them except using the fruits and seeds. In the present study showed clear differences between species belonging to genus *Brassica* L. by used seed coat pattern and outer epidermal cell shape . This study used important characters for differentiaed between all species for identification by use (SEM). several studies in the Brassicaceae on the seed coat and its taxonomic significance [12]. studied the seed coat of *Brassica* in Iraq by using a light microscope (LM) but the studies about the seeds of the genus *Brassica* by SEM are rarely [13].

The seed coat sculpture has been used to solve phylogenetic and systematic problems between species and tribes [14] .seed coat structure is considered to be stable characters[15] and not affected by environmental conditions[16] because the periods of flowering and fruiting very limit [17] , [18].

Conclusion

The seed coat sculpture is a very important character that can be used for identification and differentiates between all species and varieties belong to the *Brassica* genus .most seed coat were reticulate, undulate and rugose . anticlinal and periclinal wall characters are very

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important characters that can be used for differences between species.

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