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The Effect of Brassinolide Application in the Anatomical and Physiological Characteristics of the Vegetative Parts of a Species from the Genous of *Brassciaaleraceacabbage* Cultivated in Iraq

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Abstract

The current study included details of the anatomical characteristics of vegetative parts including the root, stem, leaf in cultivated Iraq for the species *Brassciaaleraceacabbage*, where the study dealt with the stomatal index and the rate of both the length and width of the stomatal complex and the thickness of the periderm, the tissue, cortex, vascular cylinder and pith. The parts were taken and measured after the plant was treated with brassinolide and the treated species with brassinolide and non-treated were measured and the study showed that there was a clear variation in the properties above.

Keywords: Anatomical characteristics, Physiological characteristics, *Brassicaaleraceacabbage.*

Introduction:

Brassica aleracea cabbage belongs to the Brassicaceae family, annual winter plant a short-stem native to Europe that is very similar to ordinary cabbage, its leaves are toothed, lush green, surrounded by inner leaves [1], and it is contain many distribution fibrous roots and its stem is short in the initial growth season carrying a number of competing leaves around the terminal bud to be the head. As for the flowers carried in unlimited long peripheral colors, the flowers are pedicellateyellow-colored, the plant contains folic acid also contains two important elements of sulforaphaneandole and they have an active role in the prevention of cancer, diabetes and heart disease. As confirmed by recent studies that it is a clean to the digestive tract, liver and detoxicity agent as well as its use in gardens for ornamental purposes by coordinating its colors and different forms of the plant in the most beautiful colors[2].

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Brassinolide is a major growth hormone that has a significant effect on the elongation, growth and development of plant tissues, as well as effects on elongation of cell and their division and the differentiation of transfer vessels, which are characterized by vital activity and biologic similarity with auxins and gibberellins, as it stimulates growth in tissues of initial cells [3].

Materials and Methods

The experiment was carried out in the glass house of the Department of Biology, College of Education for Pure Sciences Ibn Al-Haitham, Baghdad University for the growth season 2017-2018 using 7 kg of soil per pot, the soil was taken from the botanical garden and prepared and the weight of the soil above was placed in each pot. The seeds of plant were planted at 1/9/2018 and with 5 seeds per pot watered with water to 50% of the field capacity of the first irrigation and after two weeks of germination the plants were reduced to two plants in each pot with all the agricultural processes of irrigation and removal of the bush.

The standard brassinolide solution was prepared by dissolving 1 gm of the hormone in 1 liter of distilled water to the concentration (1000 $mg.L^{-1}$), then the two concentrations of brassinolide (0, 2) $mg.L^{-1}$ were produced on 10/10/2018 and early in the morning was attended by application of the concentration using a hand spray, two weeks after the first spray at 24/10/2018 the second application was carried out with the same concentration, parts of the treated and untreated with brassinolide species were studied and after reaching the stage of flowering and beginning to be the fruits were picked samples within 2-3 cm of the stem from the middle and cut the leaves 1-2 at the center [4]. The samples were fixed in formalin-acetic-acid F.A.A. solution with 90 ml alcohol at a concentration of 70%, 5% formalin, 5% acetic acid and for 24 hours at laboratory temperature, after which it had impregnated and cleared, and then completed the stages of anatomy by using rotary microtome with thickness 6 to 12 micrometers, the sections are satined with safranin and fast-green based on the method of [5]. The section were studied and photographed under the meijtechne microscope, as studied the stem, leaf of the soft samples of the species under study as stripping off the epidermis of the stem and the leaf by hand, put on a clean glass slide and then added a drop of glycerin, put the cover slide gently and then became ready for examination and the study [6].

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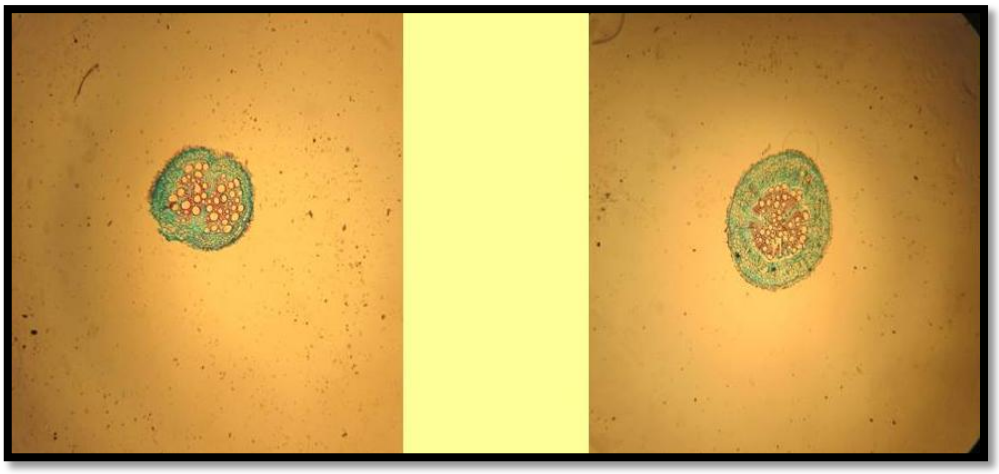
Results and Discussion

Through the plate (1) a difference in the length of the two plants under the study treated and untreated were observed which gives importance to its effect.

Anatomical and physiological characteristics of the roots

All root measurements are mentioned in Table (1) and Plate (1), the study of the sections showed the roots of the two plants under study from the outside to the inside, formed from periderm is made up of cork, combium cork and secondary corterx inward and higher periderm layer is a torn epidermis residue indicating that the plant is in the secondary stages of growth, followed by cortex layer and formed from (2-3) layer of untreated root and (5-6) layer in the treated root of paranchyma cells followed by vascular cylinder of xylem and phelom and the last appeared in a ring of mass cells surround the xylem. The phelom is made of sieve tubes and companion cells separated by fibers and phelom, followed by the tissue of the phelomte xylem tissue appeared in the form of two arms in the untreated root and 3 arms in the treated root, both of which are of vessels and tracheids, and in both separated by fibers and phelomparanchyma, and through the Table (1) that showed a heterogeneity in the tissue of the periderm and the cortex in general and the vascular cylinder in particular, as the tissue of the phelom and xylem is very different this has given importance to the anatomical characteritics in a role on the physiological characteristics by the efficiency of xylem vessels and sieve tubes in transportation and support.



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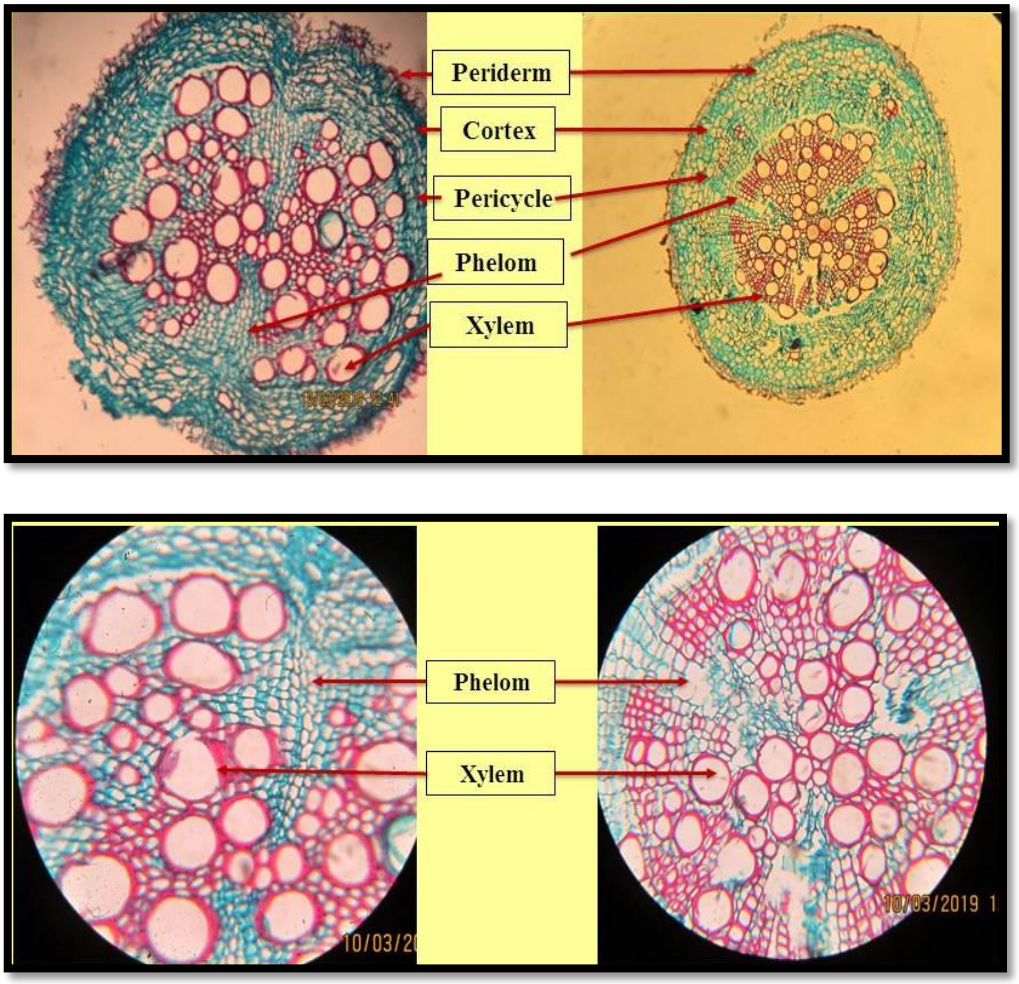

A- Treated B- Untreated

Plate 1: Cross section of root:
A- Treated *Brassica aleracea cabbage* root.
B. Untreated *Brassica aleracea cabbage* root.
10x, 40x, 100x.

Table 1: Anatomical characteritics of the roots of treated and untrated*Brassica aleracea cabbage*species under study measured by micrometer.

Type of plant	Periderm	Cortex	Vascular bundle	Pith	Rows of vessels	Units of xylem in one row	Number of columns of sieve tube	Number of tube unit in on row	Total stem
Untreated plant	**17-20 (18.5)**	**42-57 (49.3)**	**201-203 (202)**	**240-250 (245)**	**(3-7)**	**(2-3)**	**(9-10)**	**(5-6)**	**500-530 (515)**
Treated plant	**21-21.5 (21.5)**	**61-65 (63)**	**210-215 (212.5)**	**252-255 (253.5)**	**(9-1) large**	**(3-5) large**	**(15-18)**	**(7-8)**	**544-556.5 (551.2)**

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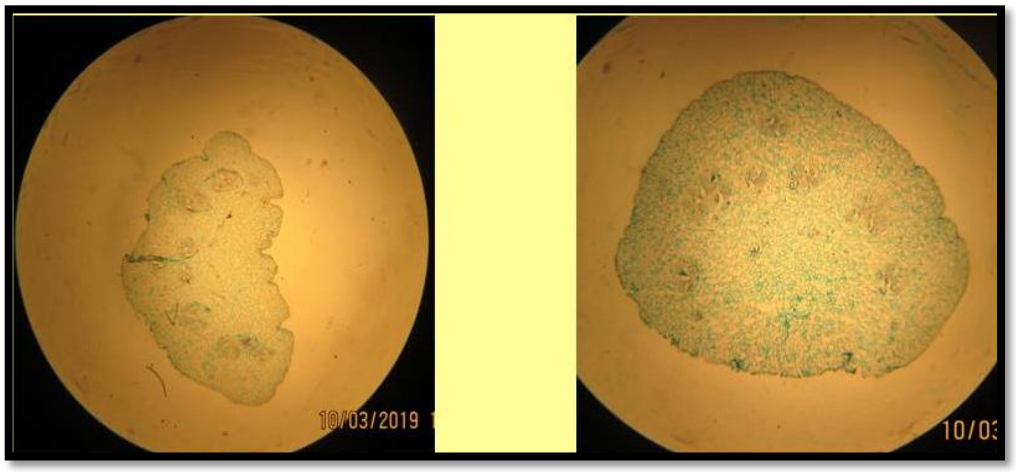
Anatomical and physiological characteritics of the stem

All measurements of the stem are mentioned in Table (2) and Plate (2), the study of the sections of the stems of the two plants under study when studied from the outside and inside, consisted of solid stems and a variation in the shape of the stem was semi-oval with the margine of zigzag in the untreated root and semicircle in the treated root, the stems of the two plants under the study were formed from the periderm what we mentioned above, followed by the tissue of the cortex formed by paranchyma cells and interspersed the cortex with vascular bundle in the form of a ring exchange a large and small bundle and above each vascular fiber withbundle cap fibers [7]. This is consistent with Al-Hadithi and others who said that the vascular bundle is topped by bundle cap fiber, and the vascular bundle is made up of xylem and phelom tissue, both of which form an arc within the vascular bundle, and the phelom is made of sieve tubes and companion cells separated by paranchyma andphelom fiber followed by xylem tissue which is made up of polygonal vessels andtracheids separated by paranchyma and xylem fibers and through Table 2 and the difference in characteriticsshown by them.



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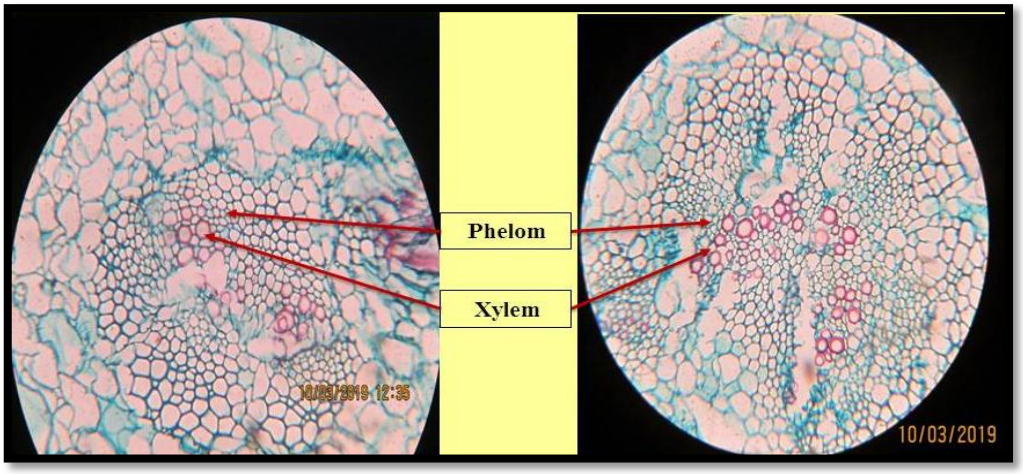

Treated Untreated

Plate 2: Cross section of stem:
A- Treated *Brassica aleracea cabbage* stem.
B. Untreated *Brassica aleracea cabbage* stem.
10x, 40x, 100x.

Table 2: Anatomical characteritics of untreated and treated plant stems s for *Brassica aleracea cabbage*species under study measured by micrometer.

Type of plant	Cuticle	Periderm	Cortex	Vascularcylinder	Pith	Number of vascular bundle	Number of xylem rows	Number of xylem unites in one row	Total stem
Untreated plant	3.5-4 (3.25)	11.25-13 (12.1)	-45 40.5 (42.5)	180-183 (181.5)	-143 140 (141.5)	7-6	2-1	6-5	-385 375.5
Treated plant	5-5.5 (5.05)	13.5-14.5 (14)	-50.5 50 (50.25)	190-195 (192.5)	-151 150 (150.5)	9-8	4-3	4-3	-416.5 408.5 (412.5)

The numbers between the arc represent the rate.

Anatomical and physiological characteritics of leaves

The surface view of the epidermis leaf

Measuring the length and width of the upper and lower surfaces of the two plants under study, illustrated in Table (3) and Plate (3), the results of the study showed that the epidermis leave's simple for the two plants under the study with anisocylic stomata and guard cells kideny shape and the internal tangential wall and external of the epidermis cells was of a straight type, the stomata in the upper surface were less dense than the lower surface of the

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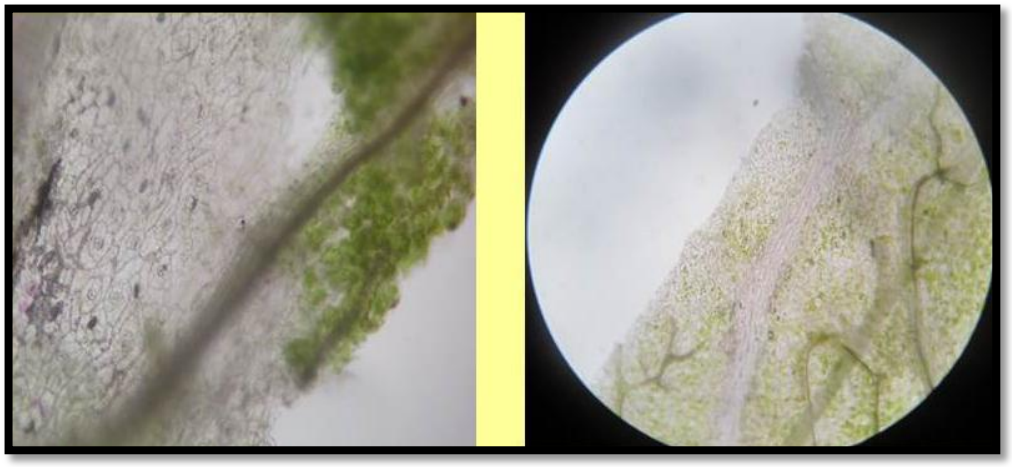
epidermis leave's as well as the stomatal index for both types was calculated as shown in Table (3).



Treated Untreated

Plate 3: Surface veiw of epidermis cells and stomata:
A- Treated *Brassica aleracea cabbage*.
B. Untreated *Brassica aleracea cabbage*.
40x.

Table 3: Measurements of the dimensions of the stomata and the stomatal index to the treated and untreated plants under study measured by micrometer.

Type of plant	Lower surface			Upper surface		
	Stomatal index	Width	Length	Stomatal index	Width	Length
Untreated plant	11	34-37.5 (35.7)	50-52.3 (51)	9	33-36 (34)	41-42 (41.5)
Treated plant	15	35-39 (37)	53-55 (54)	12	35-37 (36)	45-47 (46)

The characteristics of the vertical section of the leaf blade

The measurements for the leaf blade are fixed in Table (4) and Plate (4). The vertical sections of the leaf blade showed their formation of the upper and lower epidermis layers, both of which are made up of a single row of simple quaternary shaped cells interspersed with anisocylic stomata followed by the cortex of the mesophile region formed from spongy and palisade paranchyma cells, while the middle vein area appeared in one central vascular bundle with semi-oval for untreated plant, while with two semi-circular bundle in the treated plant, and several small vascular bundles in which containxylem and phelom elements were fewer than the central vascular bundle.

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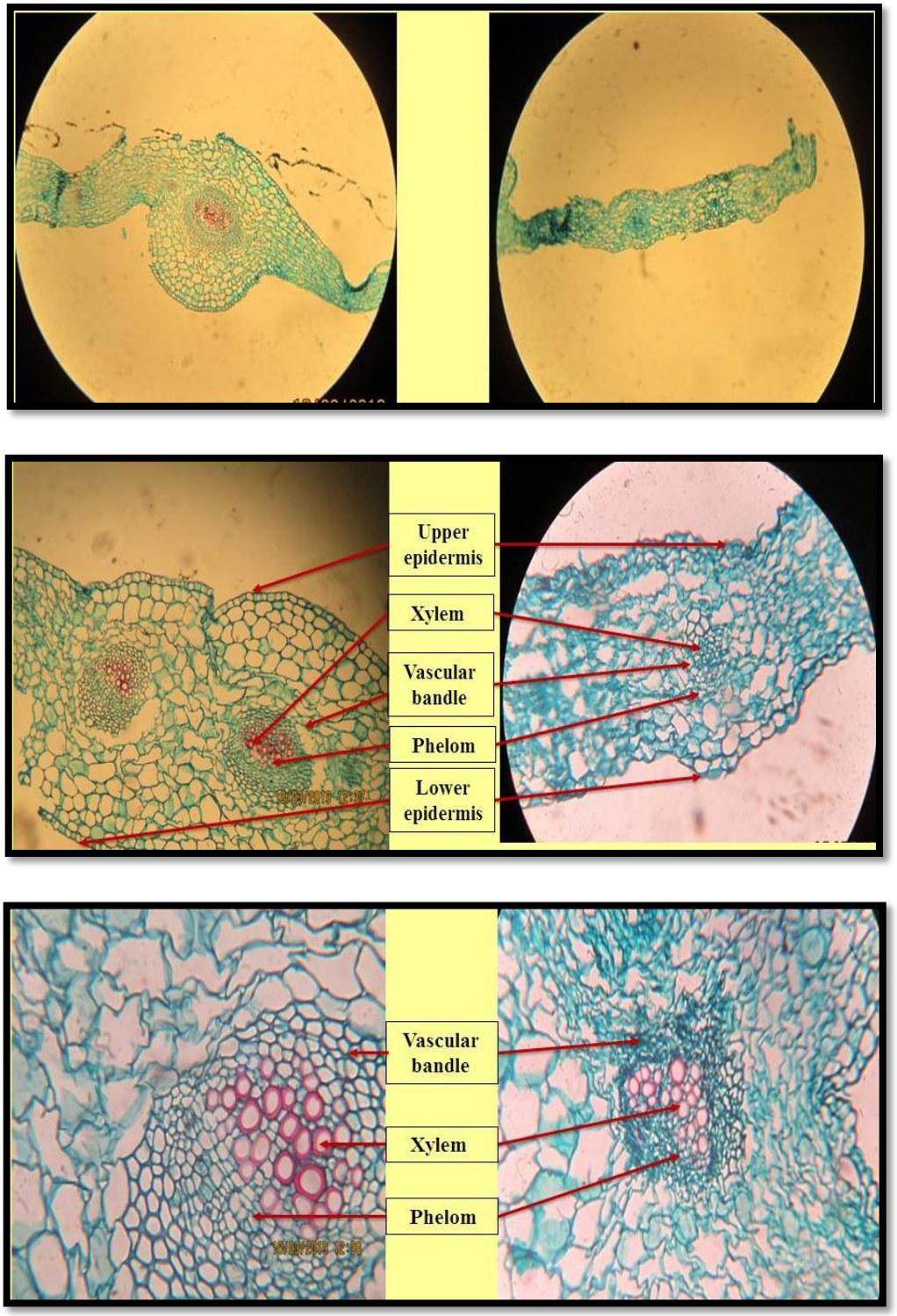

Treated Untreated

Plate 4: Cross section of leaf:
A- Treated *Brassica aleracea cabbage* leaf.
B. Untreated *Brassica aleracea cabbage* leaf.
10x, 40x, 100x.

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Table 4: The dimensions of the leaf blade for *Brassciaalerocea cabbage*under study measured by micrometer (numbers in arc represent the rate).

Type of plant	Cuticle	Thicknses of epidermisupper	Thicknses of epidermislower	Thicknses of mesaphyll	Number of xylem rows in vascular bundle	Number of xylem unites in one row	Thicknses of ??
Untreated plant	-2.25 1.5 (1.8)	12-10 (11)	16-14 (15)	43-40 (41)	9-7	3-2	-65.5 73.25 (69.3)
Treated plant	2-3 (2.5)	16-13 (14.5)	18-17 (17.5)	47-45 (46)	10-8	6-4	78-77 (77.5)

The very obvious anatomical differences in most of the crossed and vertical sections of the plants under study gave the importance of anatomical characteristics and their role and effect on the physilogical characteristics. Brassinolide plays an important role in stimulating plant growth and development, as preliminary studies on its viability have focused on encouraging cell elongation, bending and inflation in the bean plant, and such effects have been termed prasin effectiveness, and are effective in stimulating growth of rich vegetativetissues [8].

The activation of growth by brassinolide is due to the active role in cell elongation and division, as it has been observed that 24-Epibrassinolide has led to an increase in cellular divisions in the paranchyma cells of *Heliathustaberosus* [9].

In a study carried out [10] on the treatment of *Tabebula alba* plant belong to family Bynoniceae by brassinosteroids, there was an increase in the rate of plant hight and the growth of the petiole when the addition of brassinolide and gibberellins, as it was noted that the addition of brassinolide led to the activation of growth, as well as anatomical studies of the leaves have shown changes in the length of spongy and palisade epidermis cells, the thickness of the blade and the leaf petiole.

Homobrassinolide was also application on the sesame plant *Sesamumindicum* with various concentrations (0.25, 0.50, 1.0) mg.L^{-1} and three times of application (30, 45, 60) days as it led to a significant increase in plant height, dry weight, absolute growth rate and increase in chlorophyll content [11].

The study of [12] showed that the treatment of *Coriandrumsativum* plant with concentrations of (0, 0.5, 1.0, 1.5, 2.0) mg.L^{-1} of brassinolide led to an increase in most of the

characteristics studied from plant height, root length, stem diameter, soft weight, dry weight and soft root weight.

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