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The Anatomy of Carotene Biosynthesis in *Beta Vulgaris L., Var. Rubra* Using Scan Electron Microscope

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Abstract—*Beta vulgaris* L., *var. rubra* is plant containing much carotene. Carotene and various kind of carotene are biosynthesis at leaf. It is transported with the stem and stored in the certain places. The aim of this study is to observe the anatomy structure of leaf, stem and bulb/root, containing carotene in Beta vulgaris l., var. rubra. The sample was gained from Cangar, Malang which the old was about 2 months. We analyzed it using scan electron microscope.

Key words— anatomy structure, morfology, Carotene, *Beta vulgaris* L*., var. rubra*.

INTRODUCTION

Like the chlorophyll, carotenoid and ficobilin have ability to absorb the sun light. This pigment group plays an important role to absorb the sun light energy on the area exposed various wavelength rays which cannot coped by chlorophyll pigment, so it becomes recipient of supplement rays. In the first time, the sun light energy is absorbed by various pigment mollecules before it is used in photosynthesis process. We need to observe the transportation mechanism in plant which include, plant anatomy and plant physiology.

Carotenoid is found in the photosynthesis tissues of high level plants, it is consist of chloroplast which containing grana. It spreads in flowers, fruits, and roots. In the leaves of various kinds of green plant, containing various kinds of similar carotene such as β-carotene, violasantine, and lutein, neosantine [1]. Caroten is great group of pigment which is available widely in plants and animals. it is unsoluble in water but it is soluble in fat and organic solvent. There is known 300 carotenoids nowadays in nature. Carotinol or xanthofil is generally alcohol, its colour is yellow. Luteol or lutein and lycopene is available is leaves, its formula is $C_{40}H_{56}(OH)_2$, its colour is yellow. Zeanxanthol $C_{40}H_{54}(OH)_2$ is available in corn is also yellow.

Because of that uniqueness, in this study, we observed the anatomy structure and morphology of Beta vulgaris l. var rubra tissue that containing carotene: leaf, stem and bulb/root using Scan Electron Microscope.

MATELRIALS AND METHOD

We used *Beta vulgaris* L. *var. rubra* which was about 2 months, we were gained it from Cangar, Batu. In this research we used Scan Electron Microscope (SEM) in Central Laboratory of Mathematics and Sciences Faculty, State University of Malang, and we were analyzed and described the result. We also used light microscope to compare it with SEM.

RESULTS AND DISCUSSION

a. The Structure of Root/Bulb

The root has an even more primitive structure than the stem. There is still a single-cell layer of epidermis and a cortical region of ground parenchyma, but the vascular bundles are coalesced into a single solid cylinder. Obtain a prepared slide showing a root cross section. Identify the regions described below.

The root/bulb epidermis is equivalent to that in the stem and leaf, but both cutin and stomata are absent in young portions of the root.

The ground parenchyma is represented by only an outer layer of cortex. This region typically lacks collenchyma. Which a root not need the mechanical support offered by collenchyma.

The vascular tissue is partially coalesced into a solid vascular cylinder. In the cross section we see a circle representing these tissues. The cells again are very elongated and we observe only slices of them. The central portion of tissue comprises the coalesced xylem areas. And that this area is xylem, Near the periphery (edge) of this central disc of vascular tissue we will find discrete (uncoalesced) bundles of phloem. We know that these areas are phloem

Between the vascular tissues and the cortex is a single layer of cells known as the endodermis. This band around the wall is called the Casparian strip. Between the endodermis and the vascular tissues is the pericycle, the origin of branch roots and root bark. This endodermis is critical to active transport and uptake of minerals from the soil water. Aside from mechanical anchorage, selective mineral uptake is the single most important function of the root.

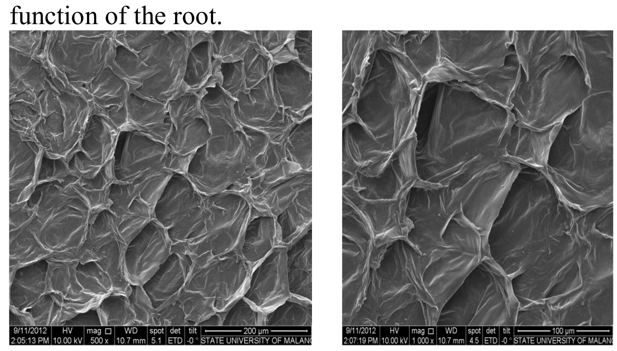

Figure 1. The Structure of Anatomy Root/Bulb Bit Beta vulgaris var. Rubra . L wchich the place store of result fotosynthesis. (a). Fruit/bulb bit with magnifying 550x (b) Fruit /bulb bit with magnifying 1.000x

b. The structure anatomy of Stem

A complex permanent tissue may be classified as a group of more than one type of tissue having a common origin and working together as a unit to perform a function. These tissues are concerned with transportation of water, mineral, nutrients and organic substances. The important complex tissues in vascular plants are xylem, phloem. Xylem is a chief, conducting tissue of vascular plants. It is responsible for conduction of water and inorganic solutes [4]. The main function of phloem is translocation of organic solutes from the leaves to the storage organ and later from the storage organ to the growing part. Sieve tube allow free diffusion of soluble, organic substances across sieve plates due to the presence of large number of sieve pores. consist of two grops a). hydrocarbon carotene which is soluble in ether, petroleum and little bit soluble in sterol. b). xantophyl carotene is alcohol aldehyde and acid which is soluble in sterol, methanol ad petroleum [2].

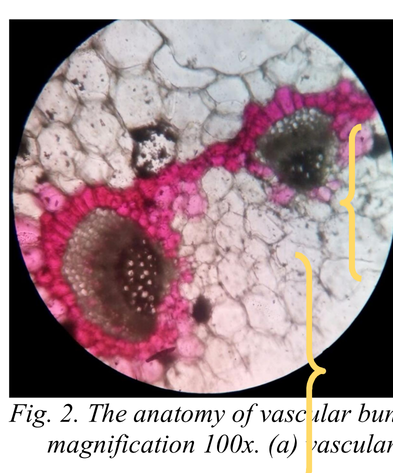

Fig. 2. The anatomy of vascular bundle with magnification 100x. (a) vascular bundle containing

xylems and phloem. The pink cells containing massive carotene.

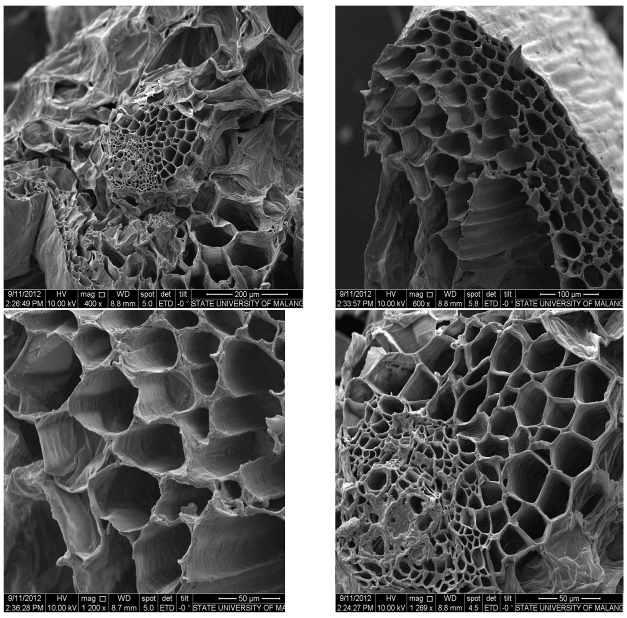

Fig. 3. The anatomy of vascular bundle which the place for transporting the result of photosynthesis. (a) magnification 400x (b) magnification 600x 9 (c) magnification 1.200x (d) magnification 1.269x

Vascular plants have an advanced form of vascular (conductive) tissue consisting of xylem and phloem tissues. These two tissues are arranged in a characteristic pattern that we shall soon examine. These tissues are typically surrounded by a tissue known as ground tissue. Each plant organ is covered by a single layer of cells known as the dermal tissue. The cells of these plant tissues typically have cellulosic walls, true nuclei, numerous chloroplasts, prominent vacuoles, and store starch. Sections of living plant tissues would typically not have any color except yellow or green in the chloroplasts (chlorophyll is a green pigment, carotene is a yellow pigment) or red colors in the vacuole (anthocyanin pigments found typically in flower or fruit tissues).

Carotenoid also arranges main pigment of yellow flowers, certain red, and orange, and small creature/ microorganic. Carotenoid is also found in all animals. Plants and small creatures synthezise their own carotenoid, but carotenoid which available on tissues of high level animals originally come from food sources.

c. The Structure Anatomy of Leaf

Leaves are in almost all instances, an adaptation to increase the amount of sunlight that can be captured for photosynthesis. Leaves certainly evolved more than once, and probably originated as spiny outgrowths to protect early plants from herbivory [5].

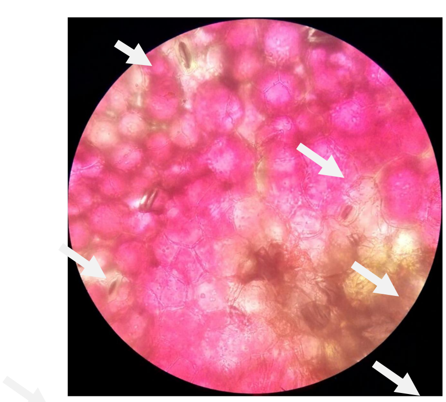

Fig. 4. The Anatomy of upper leaf of Beta vulgaris var. Rubra . L. with magnification 100x. White arrows are showed stomata. The cells with pink color are containing massive carotene.

The epidermis surrounds the inner tissues. The upper epidermis has very few stomata compared to the lower epidermis. is covered with a waxy called cutin which prevents evaporation and water loss. Thus, the only meaningful openings for gas exchange are the stomata surrounded by guard cells. The guard cell pairs work in a special manner involving light, hormones, and ion pumps to fill up with water by osmosis and open the stoma, or to lose water by osmosis and close the stoma.

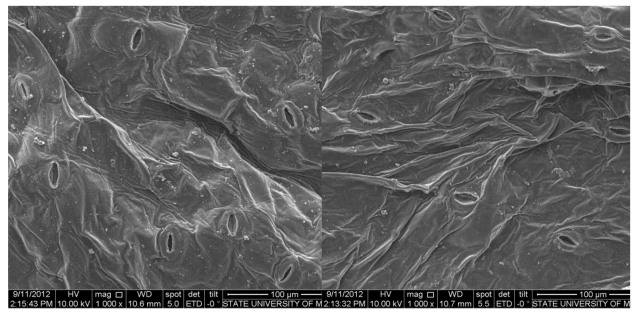

Fig. 5. The anatomy of upper surface of Beta vulgaris var. Rubra leaf. with magnification 1000x.

[6] In order to photosynthesis plants must uptake CO2 from the atmosphere. However, this comes at a price: while stomata are open to allow CO2 to enter, water can evaporate. Water is lost much faster than CO2 is absorbed, so plants need to replace it, and has developed systems to transport water from the moist soil to the site of photosynthesis. Early plants sucked water between the walls of their cells, then evolved the ability to control water loss (and CO2 acquisition) through the use of stomata. Specialized water transport tissues soon evolved in the form of hydroids, tracheids, then secondary xylem, followed by an endodermis and ultimately vessels. The most common carotenoids include lycopene and the vitamin A precursor β-carotene. In plants, the xanthophyll lutein is the most abundant carotenoid and its role in preventing age-related eye disease is currently under investigation. Lutein and the other carotenoid pigments found in mature leaves are often not obvious because of the presence of chlorophyll. However, when chlorophyll is not present, as in young foliage and also dying deciduous foliage (such as autumn leaves), the yellows, reds, and oranges of the carotenoids are predominant. For the same reason, carotenoid colors often predominate in ripe fruit (e.g., oranges, tomatoes, bananas), after being unmasked by the disappearance of chlorophyll [3].

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