Morphological and Anatomical Study of Some Species of Ziziphus L. (Rhamnaceae) Growing in Iraq

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Abstracts: The genus Ziziphus is one of the Family Rhamnaceae and consists of more than 170 species distributed in tropical and subtropical regions. All the species in the genus are of economical and medical importance. This study was conducted to identify the morphologically and anatomically features of the genus in Iraq. The field survey was conducted across the study area where 4 species (Ziziphus jujube, Z. mauritiana, Z. nummularia and Z. spina-christi) were collected and used in the study. The result showed that there is variation in morphological and anatomical features among the species in the stem cross-section and longitudinal section of leaves also the differences appeared in the epidermis of leaves.

Keywords: Ziziphus, Sidr, Jujube, Anatomy, Species.

1. INTRODUCTION

Ziziphus is one of the well-known trees of the environment, and there are large groups of them in Fintas and other places, its homeland in Syria and the countries of the East and its grows in many parts of the world, such as India and many hot dry areas [1]. It's not found in the highlands and the foothills of the mountains and was considered one of the most important trees in hot dry areas with saline soil, and one of the best plants that can withstand such harsh conditions, and it reproduces by seeds or planting the woody seeds of fully ripened fruits, and the seeds can be planted throughout the year and the best time to plant them is in March and April [2].

They have many species of *Ziziphus* like *Ziziphus jujuba*, a branched thorny tree native to India that grows wild and its fruits are small and spherical, and the improved types are larger in size, spherical or oval, and the Algerian city of Annaba, which is famous for its production of this fruit for a long time, and from that, it took its name [3]. Medically, jujube was described as one of the very useful fruits for throat diseases, analgesic, sedative, anti-cough, and beneficial for the chest. In Chinese medicine, jujube is described as a liver tonic [4].

The *Z. mauritiana* or Mauritanian Sidr is a fast-growing and thorny shrub or tree that forms a forest and is found in three Australian states, parts of South Africa, and a number of islands in the Pacific Ocean, and the Indian Ocean, the yellow-orange fruit turns brown and then black at maturity, and It is called the Indian or apple jujube, it is believed that this type originated in the Malaysian Indian region in Southeast Asia, and it has good fruits that children and adults, and the tree considered that relieves sadness and it is one of the famous trees in the desert, the Westerners called it the "apple of the desert", and it is characterized by its enormous ability to live in arid areas and produce its highly nutritious fruits, the tree parts, and its fruits are used in preparing foods, drinks, and therapeutic preparations, the use of Mauritanian buckthorn puree is famous as a medicinal and food preparation [5].

Medically, there is no part of the Mauritanian Sidr tree except that it has proven medicinal properties in skin and intestinal treatments, hair treatment, and other popular medical prescriptions [6].

Z. nummularia they are very small trees, the thorniest of the Sidr species, they are found abundantly in the Arabian Peninsula, 150 miles southwest of Kuwait, it is called the ordinary Sidr, as it is a shrub that reaches a height of 3 meters or more and branches to form a forest, and the plant is commonly found in agricultural fields [7].

This species is native to parts of the Arabian Gulf, especially Qatar, where it is found in natural depressions, it has been proven that these shrubs effectively check wind erosion and help in soil deposition and have proven successful in stabilizing sand dunes in India [8]. Medically, the dried fruit is used medicinally as an astringent in India, and the leaves are used to treat scabies and other skin diseases [9].

The *Z. spina-christi* or Saudi Sidr are fruitful trees or thorny shrubs called the thorny crown, slow-growing, with deep branching roots that can fence well, reaching a height of about 2 to 4 meters, it has no woody seeds in the fruits, but there are two very small seeds, and this type is rare, and it is cultivated well in sandy lands, which indicates the drought tolerance of Sidr trees [10]. Medically, the powder made from charred thorns is used as an antidote to snakebites, and the roots are used to treat headaches when the boiled leaves are applied to various superficial wounds, it also has anthelmintic and anti-diarrheal properties and reduces eye infections, The fruits are used as emollients and astringents, it is also famous for its ability to reduce abscesses and boils, the fruit acts as a sedative [11].

This study aims to compare among the species of Sidr anatomically to confirm the characteristics of each species and to can Discrimination among the tissue and layers also can know the importance of each tissue in the parts of stem, leaves, and epidermis of leaves.

2. MATERIALS AND METHODS

The plants of the genus *Ziziphus* were collected through field trips in different locations in Baghdad governorate, especially the Gherai'at area in the north of Baghdad, Rusafa, surrounded by the Tigris River on three sides, the longitude, and latitude of the area (33.405809096906005N, 44.34702230876791E). We found 4 species cultivated in Iraq (*Ziziphus jujube, Z. mauritiana, Z. nummularia* and *Z. spina-christi*) (Fig. 1). The parts of the plant samples, including the root, stem and leaves, were preserved in the fixative solution of Formalin acetic acid alcohol (FAA), which was prepared according to the [12] method.

The cross-sections of the Sidr plant, including (stems, leaf epidermis, and vertical sections of leaves) were prepared by hand sectioning following by [13] with some modifications according to [14].

First, cutting the preserved parts into small pieces, with a length ranging between (7 - 5) cm, from an area located approximately in the middle of the plant stem. Then put it in sodium hypochlorite at a concentration of 5% to get rid of chlorophyll pigment for 5 minutes.

Then the samples are placed for 15 minutes in a dish containing saffranin dye. It is prepared by dissolving 1g of the dye in 99ml of ethyl alcohol at a concentration of 50%. Then the sections are washed with ethyl alcohol 70% to get rid of the excess dye. The sections are transferred to a slide with cover slide, the prepared slides are examined under the usual KRU¨SS microscope and photographed with the camera installed on the microscope.

3. RESULTS AND DISSECTIONS

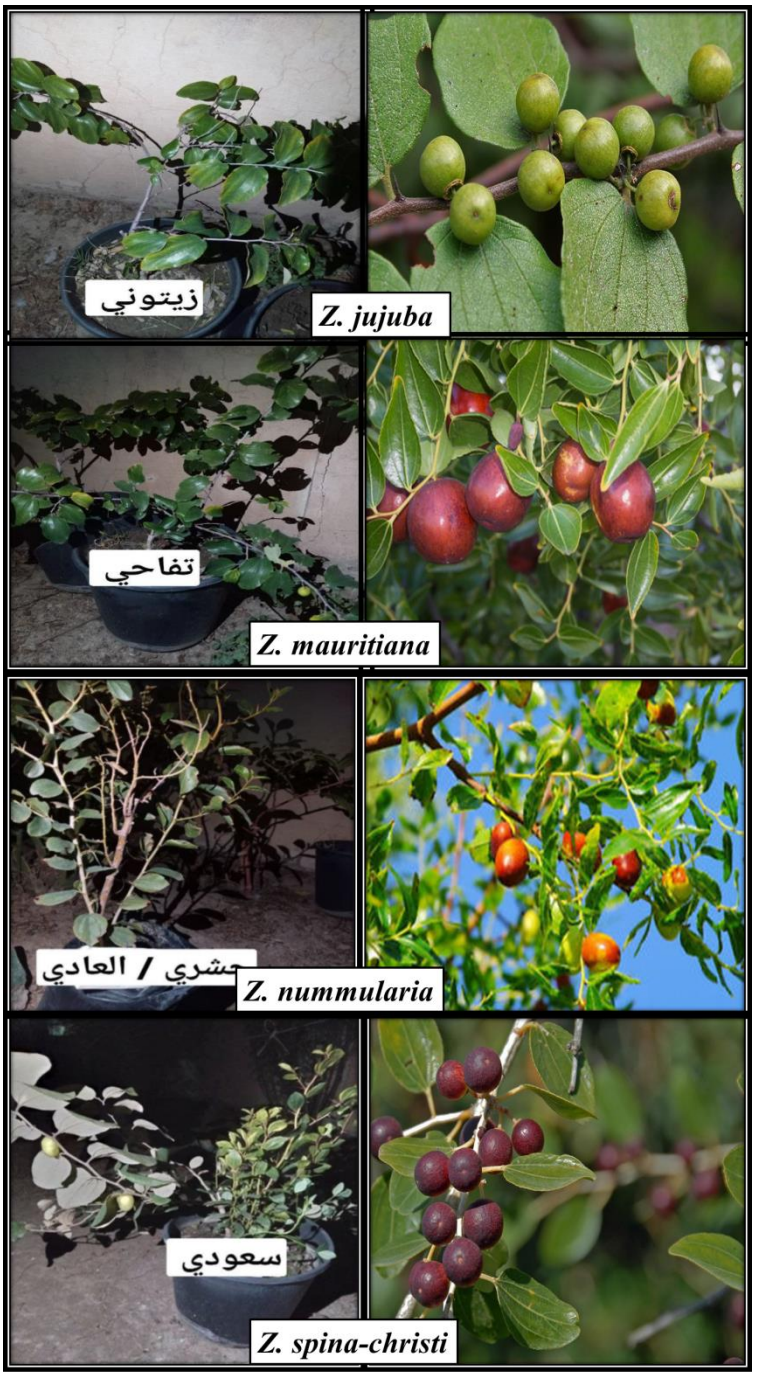

Figure 1: the outline shape of the species studied.

3.1. Cross Section of Stem

The cross-sections of the stem showed a difference between the studied species in the general shape of the stem, as the shape of the stem in the species *Z. lotus* was semi-oval, the species *Z. mauritiana* had a semi-rhombic, also it had an elliptical shape in the species *Z. nummularia*, and in the species *Z. spina-christi* it was circular in shape (Fig.2).

The epidermis is composed of a single row of oval-shaped cells and zigzag in all species, devoid of hairs and other appendages. The cortex in all types is distinguished into two types of tissues, the first tissue, which lies directly under the epidermis, is the collenchyma tissue angular thickening type, it was in the form of two layers in the species *Z. jujuba*, 3-4 layers in the species *Z. mauritiana*, 1-2 layers in the species *Z. nummularia*, and 2-3 layers in the species *Z. spina-christi*. The second of the tissues is the chlorenchyma consists of many cells that have plastids.

In all species, the vascular bundle was connected in the early secondary growth stage. Druces crystals spread in the phloem and xylem, and the arrangement of xylem vessels are ring pours type (Fig. 2). As for the pith region, it was a chlorenchyma tissue of all species, and shown in the *Z. jujuba* pith there were many vacuoles, which are lysigenous intercellular spaces, and in the species, *Z. nummularia,* these vacuoles were specialized intercellular spaces (Fig. 3).

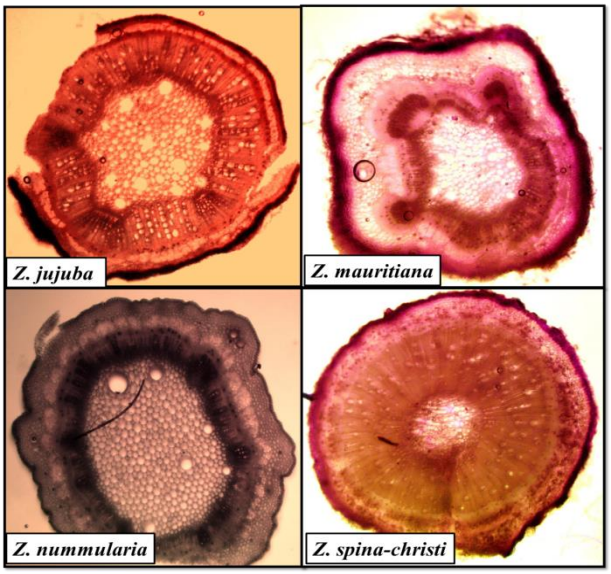

Figure 2: the outline shape of the stems cross-sections in the species studied (4X).

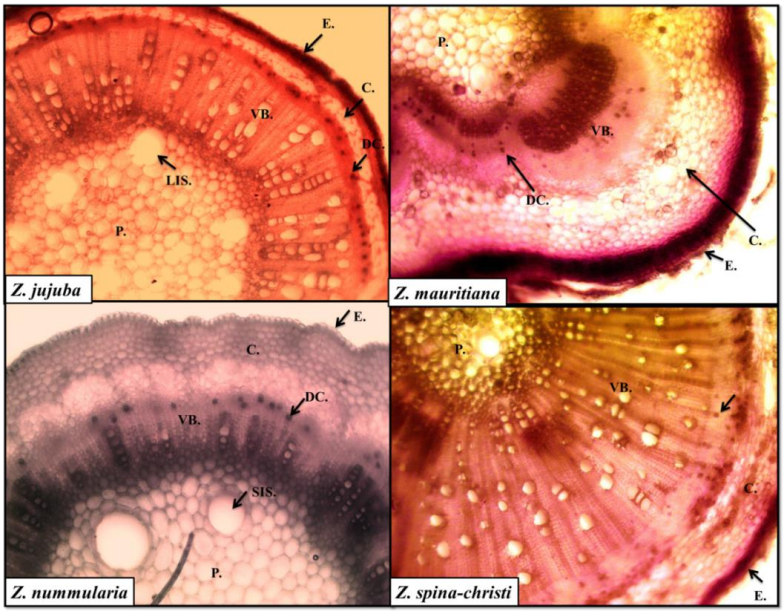

Figure 3: the tissues of the stems cross-sections in the species studied, where E: epidermis, C: cortex, VB: vascular bundle, DC: druces crystals, P: pith, LIS: lysigenous intercellular space, SIS: specialized intercellular space (10X).

3.2. Longitudinal Sections of Leaves

The blade of the leaf in all species consists of the upper and lower uniseriate epidermis. The upper epidermis is covered by cuticles, also the cells of the upper epidermis large ovule shape, and the lower epidermis cells are smaller than the upper cells [15]. The mesophyll consists of palisade layers and spongy layers and showed numerous druces crystals diffuse in the mesophyll (Fig. 4) the cross-section of the midrib region of the leaf showed that the shape like a crescent in all species consists of the epidermis, cortex, and in the central position located the vascular bundle. The vascular bundle central open, collateral, and crescent shape includes xylem with variable size of vessels and phloem (Fig. 5).

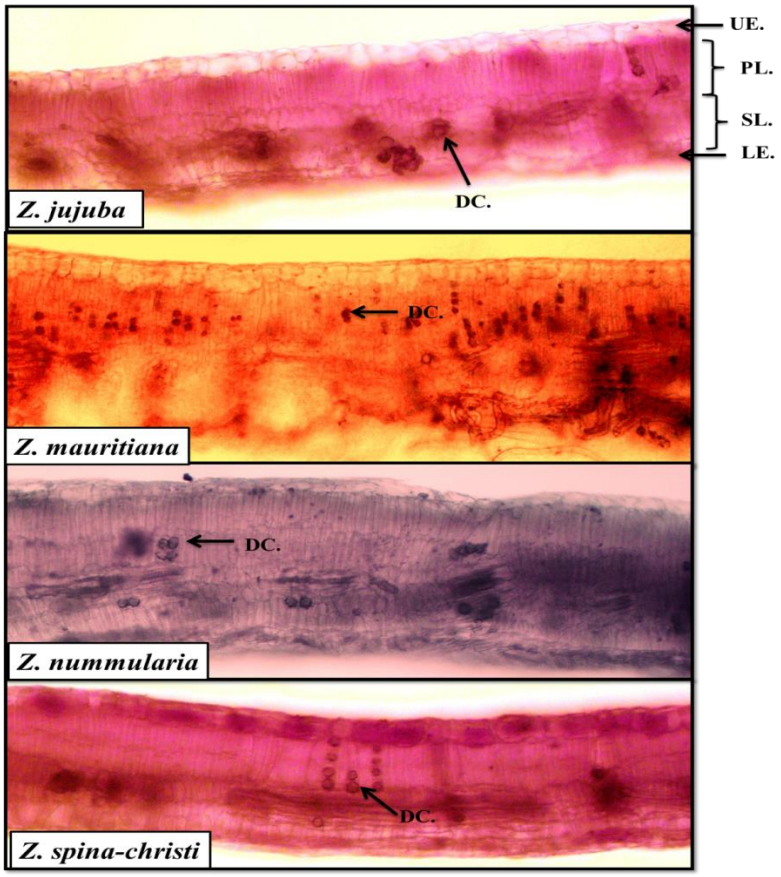

Figure 4: the blade of the leaf in the species studied, where UE: upper epidermis, LE: lower epidermis, PL: palisade layers, SL: spongy layers, DC: druces crystals (10X).

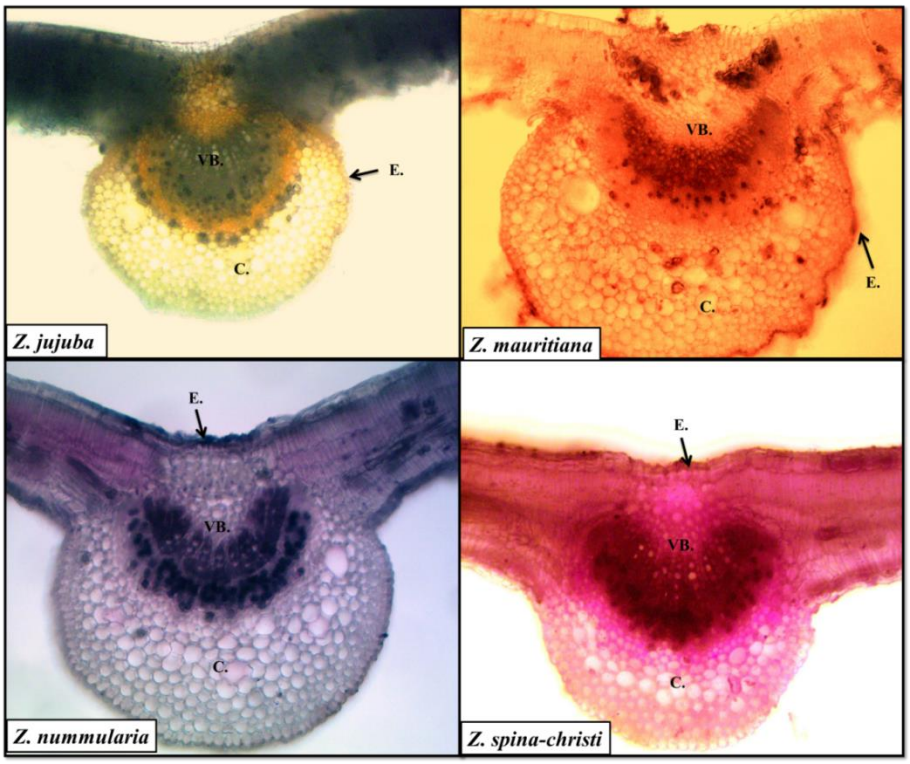

Figure 5: the midrib of the leaf in the species studied, where E: epidermis, C: cortex, VB: vascular bundle (10X).

3.3. Epidermis of Leaves

The epidermis of leaves consists of the upper and lower surface (Fig. 6). The ordinary epidermis cells have straight vertical walls in all the species, and in the lower epidermis were slight sinuous vertical walls in all species except the species *Z. mauritiana* are straight.

The stomata scattered only in the lower epidermis and the upper epidermis free of it. The stomata type was anonmocytic in all species that's means this type free from the subsidiary cells except the species *Ziziphus jujuba* was anisocytic type has three subsidiary cells one of its small and the other two cells largest from it.

The unglandular trichomes are distributed on the lower surfaces of the epidermis, they are unicellular, and uniseriate, found in all species studied except the epidermis of the species *Z. nummularia* do not have trichomes in their epidermis, (Fig. 7) also the druces crystals distribute in the upper and lower epidermis (Fig. 8).

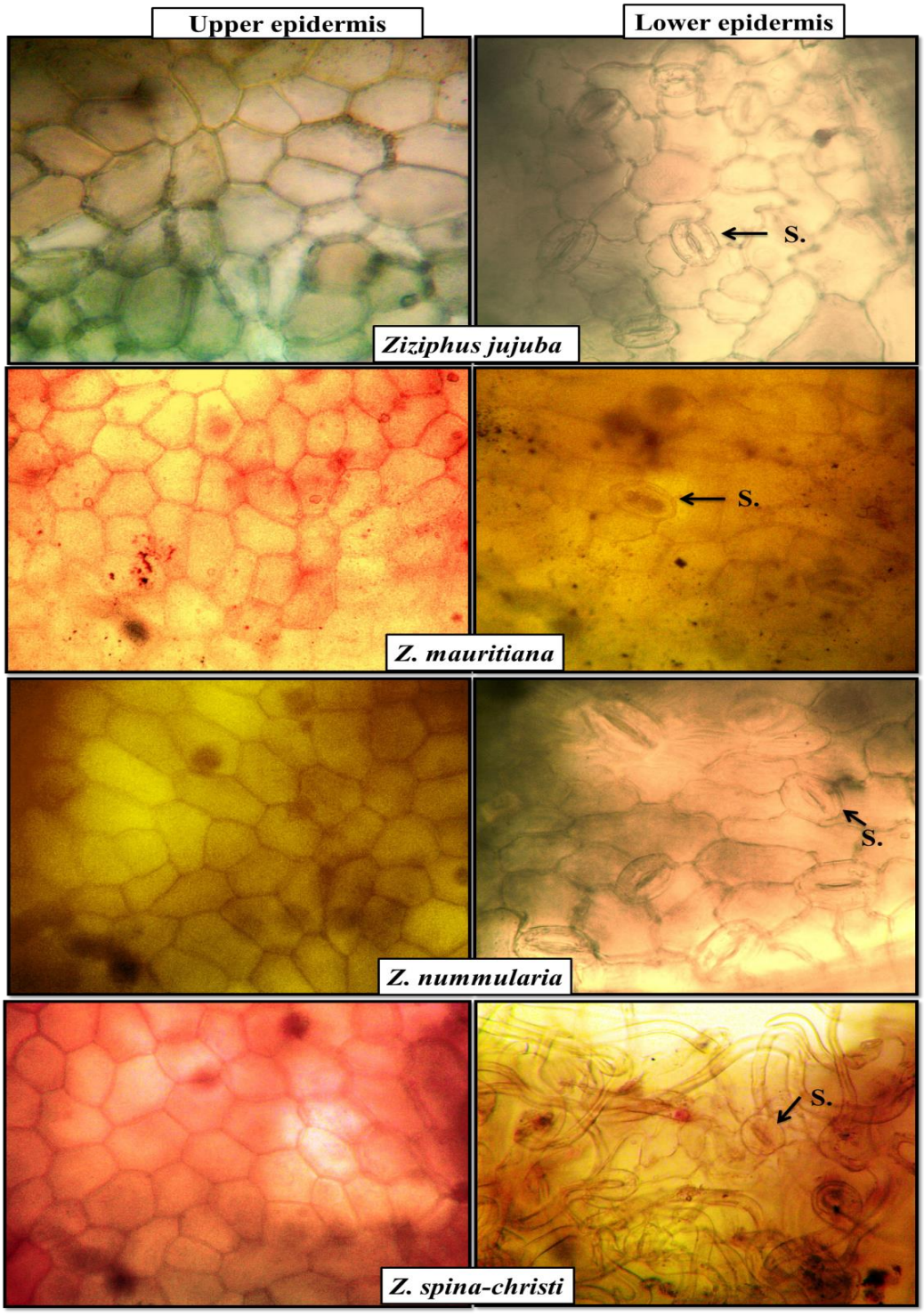

Figure 6: the epidermis of the leaf in the species studied appears the ordinary epidermal cells in the upper and lower, and the stomata complex only in the lower epidermis, where S: stomata, (40X).

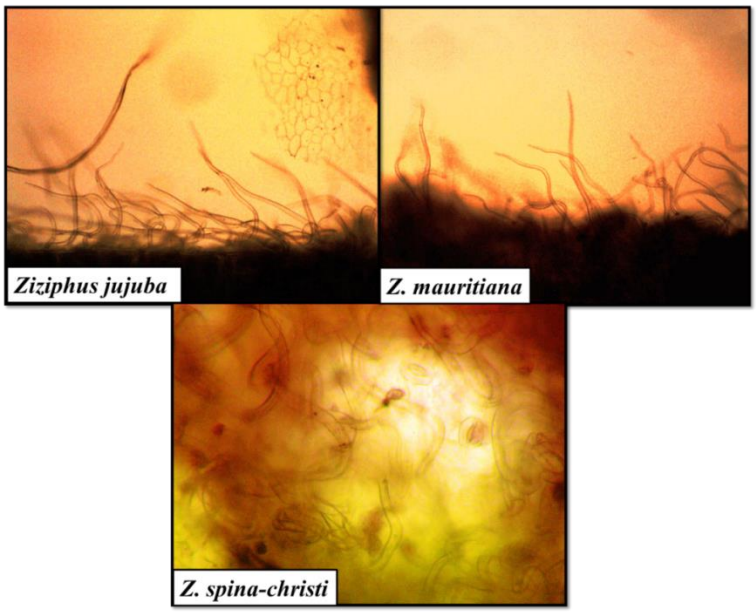

Figure 7: the shape of the trichomes in the epidermis of the leaf in the species studied, (40X).

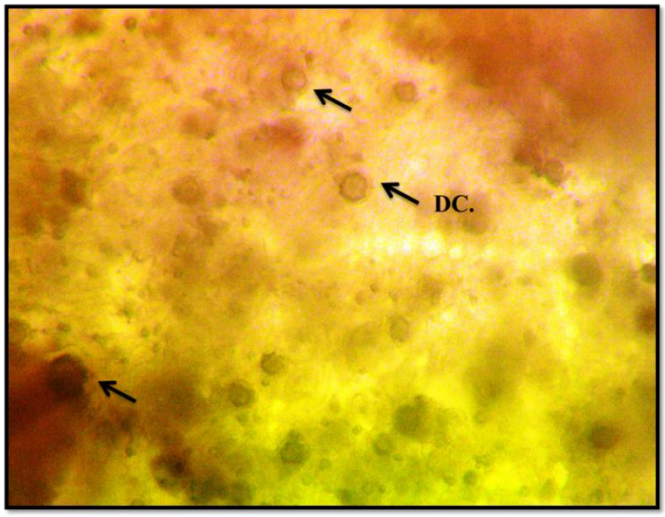

Figure 8: the shape of the druces crystals in the epidermis of the leaf in the species studied, where DC: druces crystals (40X).

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