A Comparative Study of Laticiferous Canals in Five Plant species present in Kurdistan Region-Iraq

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1. INTRODUCTION

Laticifers canals are cells or series of connected cells containing a fluid called latex (plural is latices) and forming systems that permeate various tissues of the plant body (Esau, 1965). The laticiferous canals contain a slurry of many small particles in a sap of unspecified composition. The mostlatex often milky in color and may be yellow, orange, red, brown, greenish or even colorless in different taxa (Fahn, 1979, Mahlberg, 1993). Furthermore, based on some investigators the color may be vary in different parts of a single plant or may be change after the latex has exuded from the plant (Metcalfé and Chalk, 1983).

The combination of suspension with sap is called ‘latex’. Laticifers are suspected and in many cases known they have roles in herbivory and/or disease resistance, and they have some global economic importance such as crucial in the production of both opium and natural rubber (Fahn, 1979, Dussourd and Eisner, 1987, Dussourd and Denno, 1991, Kohno et al., 2004).

Articulated laticifers canals (jointed laticifers or laticifers vesseles) are consist of longitudinal chains of cells in which the walls
separating, the individual cells either remain intact, become perforated or are completely removed. The perforation or resorption of the end walls gives rise to laticifers that are tube-like in form and resemble xylem vessels in origin. Articulated laticifers may arise in both primary and secondary plant bodies. The non-articulated laticiferous canal originate from single cells that through continued growth develop into tube-like structures that often much branched, but typically they undergo no fusions with other similar cells. They are simple in origin, and typically arise in the primary plant body (Esau, 1965).

Among the plants with non-articulated laticifers canals, *Euphorbia* (*Euphorbiaceae* Juss.) is the most studied genus, the fundamental theory of the origin and development of the laticifers canals being established by Mahlberg (1993). The study of morphology, structure and distribution of laticifers canals in *Euphorbiaceae* family mentioned by some researchers such as Esau (1965), Metcalfe and Chalk (1983). The aim of this study are investigated the types and distributed of laticiferous canals in the plant species studied.

2. MATERIALS AND METHODS

2.1. Plant samples

The plant samples were collected from collage of Sciences/Salahaddin University and Khabat plantation in August 2015.

2.2. Plastic Method (Arildite Method)

The glutaraldehyde (2.5%) fixed samples were post-fixed in 1% osmium tetroxide, dehydrate, cleared in acetone and embedded in araldite mixture. Half micrometer thick sections were stained by 1% toludine blue in 1% borax (Ruzin, 1999).

2.3. Paraffin Method

Pieces of samples have been put in FAA (Formalin-Acetic-Acid-Alcohol) solution, prepared as a mixtures of (90ml of 70% alcohol + 5ml of glacial acetic acid + 5ml of formalin). After that the samples have been dehydrated using series concentrations of alcohol (95% for 1hr. and 100%, 100% for 3-4 hrs. after that the samples were placed in xylene for 3-4 hrs. (Twice times). After that the samples were embedded in a mixture of xylene and paraffin (1 xylene + 1 paraffin in 60°C) for 30 min. (Twice times), then transferred to pure paraffin wax and left in it at 60°C for overnight. After that preparation of paraffin blocks were made and sections were prepared with the thickness of 8 µm using the rotary microtome. Then the sections were stained using safranin (1%) and fast green or light green (1%). Finally the sections were mounted by DPX (Dextrin Plastisizer Xylene) (Najmaddin and Mahmood, 2016).

3. RESULTS AND DISCUSSION

The present study pointed out that the laticifers canals in all vegetative organs (petiole, blade and stem) of studied plants (figures 1,2,3,4,5). Laticifers characters were non-articulate, in transvers section are circular in shape, cellulosic thick wall and vary in size and the frequency in the plant tissues and organs. The present laticifers canals were non-branched secretory ducts in the leaf of *Euphorbia sp.* and *Ficus sp.*, while in *Calotropis procera* were branched. The laticifers canals of *Euphorbia sp.* are non-articulated and branched (Metcalfe & Chalk, 1983).While in the leaf of *Euphorbia sp.* generally the laticifers canals were numerous. In the leaf of *Eriobotrya sp.* and *Lactuca indica* the laticifers were more found in spongy layers than palisade layers, especially in *Lactuca indica* were they arranged around the central veins.
Generally laticifers canals in the stem are numerous in the pith and well represented in the cortex, a few laticifers canals may be observed in the secondary vascular tissue and around it. In the stem of *Calotropis procera* the laticifers were numerous in cortex and pith, while in the other plant species such as *Euphorbia sp.*, *Ficus sp.*, *Eriobotrya sp.* and *Lactuca indica* the laticifers canals or cells were very less or not found in the pith. Generally presumed that the laticifers canals or cells penetrate the rays from the pith (Evret, 2006) and able to distinguished from other plants that have laticifers ducts compared with other plants have cells only.

**Figure 1.** Section of *Euphorbia helioscopia*: A. TS of petiole, B. magnification power of A, C. TS of stem, D. LS of stem, E. magnification power of D. Laticifers canals (red arrow), E: epidermis, C: cortex, V: vascular bundles. A,B (plastic method). CDE (paraffin method). A,C,D=10X, B,E= 40X.
Figure 2. Section of Ficus carica: A. TS of stem, B,C. LS of stem, D. TS of petiole. Laticifers canals (red arrow), E: epidermis, C: cortex, V: vascular bundles, trichomes: (small dark arrow). B,D (plastic method), A,C (paraffin method). A,D=10X, B,C= 40X.
Figure 3. Section of *Lactuca indica*: A. TS of midrib, B. magnification power of A, C. TS of stem, D. LS of stem, E. TS of leaf. Laticifers canals (red arrow), E: epidermis, C: cortex, V: vascular bundles, PA: palisade layer, SP: spongy layer. A,B,C,D,E (plastic method). A,C=10X, B,D,E=40X.
Figure 4. Section of *Calotropis procera* (Ashr): A. TS of midrib, B. TS of stem, C,D. LS of stem, E,F. TS of leaf. Laticifers canals (red arrow), E: epidermis, C: cortex, V: vascular bundles, PA: palisade layer, SP: spongy layer. A,B,C (paraffin method). D,E,F (plastic method). A,B,C,D=10X, E,F=40X.
CONCLUSIONS

In all the vegetative organs that investigated in the studied species the laticifers canals or cells are non-articulated, generally being localized in the cortical parenchyma, in pith and rarely in secondary vascular tissues. The walls of laticifers canals are cellulosic that is uniformly thick in the majority of the studied species.

Conflict of Interest
There is no conflict of interest.

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Figure 5. Section of *Eribotryia japonica*: A. TS of stem, B. magnification power of stem (LS), C, TS of magin. Laticifers canals (red arrow), E: epidermis, C: cortex, V: vascular bundles, PA: palisade layer, SP: spongy layer. B,C (paraffin method). A (plastic method). A =10X, B,C= 40X.
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