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COMPARISON BETWEEN ANATOMICAL STRUCTURES AND METALS FROM *CHELIDONIUM MAJUS* L.

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Abstract

Chelidonium majus L., also known as great celandine, from the Papaveraceae family, is a medicinal plant used to treat ulcer, cancer, liver and skin disorders. Different parts of the plant contain alkaloids such as chelidonine, chelerythrine, berberine, sanguinarine. Great celandine is known for its properties like antimicrobial, anti-inflammatory, spasmolytic, analgesic, diuretic and antitussive. This study discusses differences between anatomical structures and characteristic elements, from Chelidonium majus L., harvested in May 2017, from different areas of Bihor County: Borod, Borş, and eight places in Oradea: Oncea, Velenţa, Cantemir Blvd., Caişilor Street, Căpşunilor Street, Apostol Andrei Street, Matei Corvin Street. We determined with X-ray fluorescence spectrometry the metal and sulfur content from ten samples of Chelidonium majus L. harvested from different areas of Oradea and from Bihor county and we observed that these metals are below the toxicity limit set by current standards, so they are not dangerous for the human body.

Key words: *Chelidonium majus* L. , alkaloids, metals, antimicrobial, medicinal plant.

INTRODUCTION

Chelidonium majus L., commonly known as greater celandine is an herbaceous plant easily recognizable by the yellow latex that comes out the moment you break it and in contact with the air turns brown as shown in Fig. 1 and Fig 2.

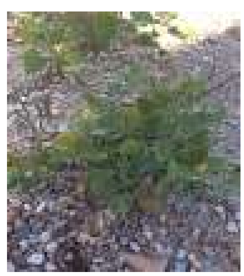

Fig. 1. Vegetable product of *Chelidonium majus*

Fig. 2. Section through the stem of *Chelidonium majus*

Chelidonium majus L. is a plant of the Papaveraceae family, which grows wild in Asia, Central and Southern Europe, the Azores and North America (Gilca M. et al., 2010, Gușiță B. R., Datcu A. D., 2019, Kadan G. et al., 1990, Pantano F. et al., 2017). This plant has been used for a long time in hepatobiliary disorders, gallbladder and digestive dysfunctions, spasms, and in phytotherapy and traditional medicine (Barnes J. et al., 2007). Also, *Chelidonium majus* have diuretic, antitussive, eye-regenerative effect, anti-osteoporotic activity, radioprotection and antispasmodic and relaxant activity (Zielinska S. et al., 2018).

Celandine is very common in shady places, around human settlements, in bushes and up to the mountain region. The plant is rich in isoquinoline alkaloids, which have anti-viral effects (Samatadze T.E. et al., 2020). Also, it is used in the cosmetic industry for treating skin scratches because has antibacterial effects like many other plants, for example *Calendula officinalis* L. (Dejeu I. et al., 2019). The main components are: chelidonine, homochelidonine, chelidonic acid, saponosides, carotenoids, resinous substances, volatile oil, flavonoids, tannins, nicotinic acid and nicotinamide (Habermehl D. et al., 2006, Warowicka A. et al., 2019, Zielinska S. et al., 2020).

Celandine is recommended in the natural therapy of liver diseases, in the healing process of constipation and rheumatism (Freire C.J. et al., 2020, Kumar Singh A. et al., 2020, Nawrot J. et al., 2020) and the yellow milky sap latex is used in skin diseases and warts for the antimicrobial properties (Salome Abarca L.F. et al., 2019, Warowicka A. et al., 2020).

MATERIAL AND METHOD

The microscopic analysis involves the comparative study of anatomical structures and characteristic elements, from several vegetable products of *Chelidonium majus* L., harvested in May 2017, from different areas of Bihor County: Borod, Borș, and eight places in Oradea: Oncea, Velența, Cantemir Blvd., Caișilor Street, Căpșunilor Street, Apostol Andrei Street, Matei Corvin Street.

Stem and leaf cross sections were performed and the pollen grains were morphologically studied, which were subsequently analyzed under the Optika B350 Analysis Microscope.

The identification and differentiation of tissues (mechanical fibers, secretory channels, conducting bundles, etc.) were possible by different staining of cell membrane under the action of chemical dyes: the cellulose membrane was colored red and the lignified one was yellow.

The solutions used in optical microscopy were:

1. Aqueous- ammoniacal solution of Congo red: Congo red 3 g, distilled water 100 ml, ammonium hydroxide conc. 5 ml.
2. Chrysoidin alcoholic solution: 0,1 g chrysoidin, 12 ml 96° ethyl alcohol.

The prepared solutions were kept for 2 days, stirring from time to time. After dissolution, the two solutions were mixed and kept at rest for days. After filtration, the solution was conditioned in a brown bottle. The mixture is known in the literature as the *Genevez reagent*.

The sections were stained for 1-3 minutes and then the excess dye was removed by washing with distilled water.

Determination of the metal and sulfur content of the ten samples of *Chelidonium majus* was performed using GNR TX 2000 X-ray fluorescence spectrometry. That must be carefully selected, handled with care, because modern spectrometers can detect even the fingerprints of the person handling the samples. Circular samples (in the form of discs) with a radius of 5-10 mm can be measured, placed in a support that is inserted into the spectrometer (Antal et al., 2011).

RESULTS AND DISCUSSION

In cross-section, the stems used from various populations of the species *Chelidonium majus* L., have a uniform round-oval contour on the outside.

The epidermis contains one single layer of cells, tightly joined together and with slightly bulging outer walls. Next is the subepidermal parenchyma, in which the first 2-3 layers of cells are collenchyma and contribute to increasing the resistance of these strains. The assimilating parenchyma consists of cells with thin, cellulosic walls, rich in chloroplasts. In this parenchyma are arranged the mixed conducting fascicles. The conducting bundles are made up of liberian tissue located on the outside and woody tissue located towards the central axis of the stem. Central has a medullary gap (Pallag, 2015, Szabo, Pallag, 2007, Szabo, Pallag, 2007, Szabo, 2009).

We observe in Fig. 3-6 that the stems of *Chelidonium majus* L. harvested from Borod and Velența Oradea have a much larger gap, and the number of fascicles and secretory channels are smaller, compared to specimens harvested from Borș and Oncea in Oradea city.

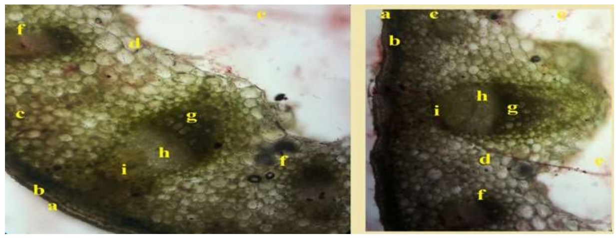

Fig 3: Cross section through the strain of *Chelidonium majus* L. – Borod, 2017 (ob. 10 x): a-epidermis, b-collenchyma, c-subepidermal assimilative parenchyma, d-fundamental parenchyma, e-gap, f-conducting bundle, g- wood, h- free.

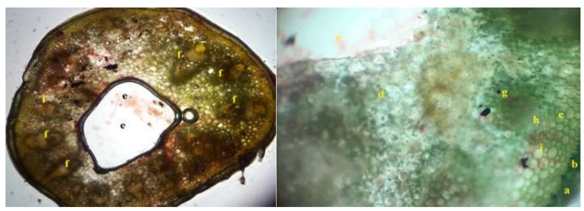

Fig 4. Cross section through the strain of *Chelidonium majus* L. – Borș, 2017 (ob. 10 x): a-epidermis, b-collenchyma, c-subepidermal assimilative parenchyma, d-fundamental parenchyma, e-gap, f-conducting bundle, g- wood, h- free.

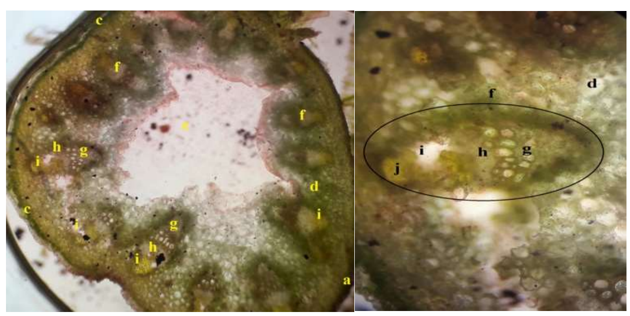

Fig 5. Cross sections through the strain of *Chelidonium majus* L.- Oncea, Oradea, 2017(ob. 10 x): a-epidermis, b-collenchyma, c-subepidermal assimilative parenchyma, d-fundamental parenchyma, e-gap, f-leading beam, g- wood, h- free, i- secretory canal, j- sclerenchyma sheath

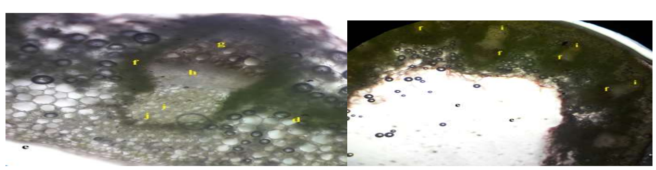

Fig 6. Cross sections through the strain of *Chelidonium majus* L.- Velența, Oradea, 2017(ob. 10 x): d-fundamental parenchyma, e-gap, f-leading beam, g- wood, h- free, i-secretory canal, j- sclerenchyma sheath

The anatomical structure of the leaves from *Chelidonium majus* L. has a bifacial structure, with two epidermises with the mesophile and conducting fascicles inside it. The superior epidermis consists of a single row of cells, closely joined together. The palisadic parenchyma contains 2-3 layers of elongated cells rich in chloroplasts. In addition to the conducting bundles included in the mesophile, we identify here the presence of secretory channels protected by a sclerenchyma sheath. These secretory channels were highlighted on all leaves, regardless of the area of origin (Fig. 7).

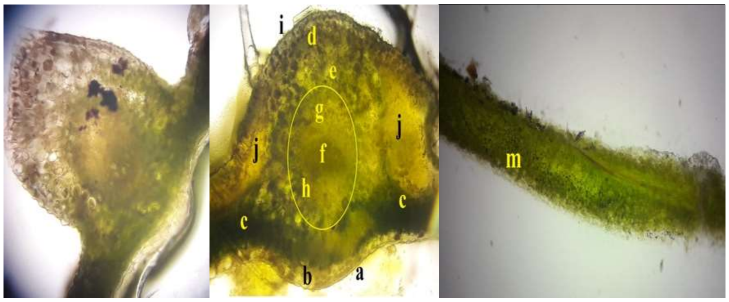

Fig. 7: Cross section through the leaf of *Chelidonium majus* L.
a - superior epidermis, b - stomata, c - palisadic assimilating parenchyma, d - collenchyma, e - conducting beam, f - wood, g - free, h - sclerenchyma sheath, i - lower epidermis, j - secretory canals, m – mesophilic

The morphology of the pollen grain in *Chelidonium majus* L. may differ even within the same genus, in terms of surface structure, shape, size and type of ornamentation.

We analyzed, by optical microscopy, the appearance, color, shape and number of pollen grains, from the stamens of celadrin flowers, *Chelidonium majus* L., harvested from various places, more or less polluted in Bihor County. From the analysis performed, we noticed that the pollen from the 10 mentioned areas is identical in shape and color. However, we also observed that the pollen grains from the Borș area are smaller in size, more abundant and have air sacs on the outside (Fig. 8-9).

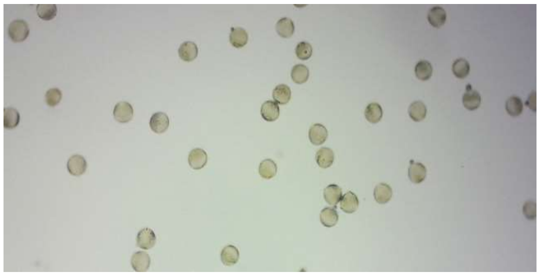

Fig. 8 Pollen grains observed by light microscopy (ob. 10X) in the species *Chelidonium majus* L., origin Borod, Oncea, Velența

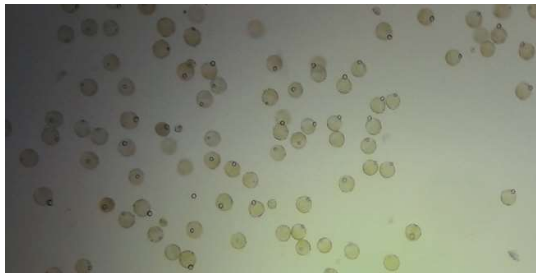

Fig. 9 Pollen grains observed by light microscopy (ob. 10X) in the species *Chelidonium majus* L. origin Borș

The results of the determinations of the elements that are found in very small quantities in the ten samples of *Chelidonium majus* L. harvested from different areas from Oradea and from Bihor county are represented in table 1.

Table 1

Elements determined in small quantities in *Chelidonium majus* L.

Origin of the plant product / Determined element	Pb	Se	As	Hg	Ni	Co	Mn	Cd
Caișilor Street	< 5	< 3	< 3	< 9	< 34	< 27	< 42	< 246
Matei Corvin Street	< 4	< 3	< 3	< 8	< 30	< 44	< 25	< 67
Cantemir Blv.	< 4	< 3	< 3	< 9	< 31	< 23	< 17	< 74
Săvineștilor Street	< 5	< 4	< 4	< 12	< 44	< 31	< 45	< 56
Apostol Andrei Street	< 4	< 2	< 3	< 7	< 24	< 22	< 32	< 61
Căpșunilor Street	< 4	< 2	< 3	< 6	< 22	< 22	< 31	< 44
Velența zone	< 3	< 2	<2	< 5	< 18	< 18	< 25	< 47
Oncea zone	< 3	< 2	< 2	< 6	< 21	< 21	< 32	< 49
Borș	< 3	< 2	< 2	< 6	< 21	< 21	< 33	< 49
Borod	< 4	< 2	< 3	< 7	< 24	< 24	< 61	< 60

The analysis of the results obtained led to the conclusion that although the plant product of *Chelidonium majus* L. is not grown in standardized crops, but is harvested from places where it grows spontaneously, it also contains metals that are harmful to the body's health, but these metals are below the toxicity limit set by current standards, so they are not dangerous.

CONCLUSIONS

The paper provides important and original information that shows the true value of the species *Chelidonium majus* L., harvested from Borod and Velența-Oradea and has a much larger gap in the stems, the number of free-wood bundles and secretory channels is lower, compared to specimens collected from Borș and Oncea-Oradea.

The pollen grains analyzed show that there are morphological differences depending on the origin of the species. Although they are identical in shape and color, it is observed that the pollen grains in the Borș area are smaller in size, more abundant and have air sacs on the outside. This is due to the fact that the Borș and Oncea-Oradea area has higher pollution, compared to the Velența-Oradea area, or Borod, probably due to the noxious substances emitted by the Electro-Thermal Power Plant, located nearby.

The analysis of the content of metals led to the conclusion that in addition to the pharmacological effect of the plant, it is also a source of minerals for the body.

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