

INTERNAL SECRETORY STRUCTURES IN *HYPERICUM PATULUM* – A SELECTION OF OPTIC MICROSCOPY IMAGES

STRUCTURI SECRETOARE INTERNE LA *HYPERICUM PATULUM* - O SELECȚIE DE IMAGINI DE MICROSCOPIE OPTICĂ

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Abstract. *Hypericum patulum* (goldencup Saint John's wort, fam. Hypericaceae) is an exotic shrub, originated from China, widely cultivated in gardens in temperate regions as ornamental, for its large, golden yellow flowers and thick, green, deciduous or persistent foliage. Similar to *Hypericum perforatum* (common St. John's wort), which is a well-known valuable herbal drug, some other *Hypericum* species also have some unusual internal secretory structures that produce and accumulate many bioactive compounds, thought to have evolved as a plant response to herbivore attack. In the present study the optic microscopy images of *Hypericum patulum* leaves, flowers and stem show: black nodules (spheroidal dark glands) which are glands that produce and accumulate a granular red to black colored pigment (hypericin) – they were seen in sepals and stem; pedunculate black nodules (glandular emergences) were seen on the margin of the sepals; secretory cavities (spheroidal pale glands or translucent glands) that are almost spherical or a bit elongated found in leaves and sepals, they have a cavity that is bordered by secretory cells that produce oils that diffuse through the cell wall and accumulates within the cavity, they are considered to produce hyperforin and essential oils; secretory canals with large lumen, that are long, tubular structures found in leaves mixed with translucent glands which have the same structure and origin.

Key words: flowers, *Hypericum patulum*, leaves, optical microscope, secretory structures, stem

Rezumat. *Hypericum patulum* (fam. Hypericaceae) este un arbust exotic, originar din China, foarte cultivat în grădini în zona temperată ca ornamental pentru florile galbene-aurii cu petale mari și frunzele groase, verzi, caduce sau persistente. La fel ca *Hypericum perforatum* (sunătoarea) care este o plantă medicinală valoroasă și foarte cunoscută, și alte specii de *Hypericum* conțin câteva structuri secretoare interne neobișnuite care produc și acumulează numeroși compuși biologic activi, despre care se consideră că au apărut ca răspuns față de atacul speciilor erbivore. În lucrarea de față în imaginile de microscopie optică se pot observa la specia *Hypericum patulum* următoarele structuri secretoare: noduli negri (glande negre de formă

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sferică) care acumulează conținut granular roșu-negricios (hipericină) - s-au observat în sepale și tulpină; noduli negri pedunculari (emergențe globulare) s-au observat pe marginea sepalei; cavități secretoare (buzunare secretoare sau glande translucide), ele sunt aproape sferice sau puțin alungite și s-au observat în mezofil și în sepale, au în centru un spațiu căptușit de celule secretoare care produc uleiuri ce difuzează prin peretele celular și se acumulează în cavitate, la *Hypericum* se consideră că acumulează hiperforină și uleiuri esențiale; canale secretoare cu lumen larg, s-au observat în mezofilul foliar amestecate cu glandele translucide cu care au aceeași structură și origine.

Cuvinte cheie: floare, frunză, *Hypericum patulum*, microscop optic, structuri secretoare, tulpină

INTRODUCTION

The genus *Hypericum* has been associated with traditional medicine, due to the use of the perennial species *Hypericum perforatum* (common St. John's wort) as a medicinal plant for many centuries. *Hypericum perforatum* is the only source for *Hyperici herba* which is included in the European Pharmacopoeia and *Hypericum* products are sold in the EU both as food supplements and as drugs (Linde, 2009, as cited in Nürk, 2011). Numerous investigations of the anatomy, micromorphology, phytochemistry, pharmacology of this species as well as those of other *Hypericum* species can be found in the literature (for example Bottega *et al.*, 1999; Ciccarelli *et al.*, 2001; Crockett, 2010; Curtis and Lersten, 1990; Mahendrakumar *et al.*, 2017; Minarchenko *et al.*, 2021; Nürk and Crockett, 2011; Nürk, 2011; Perrone *et al.*, 2013a, b; Şipoş and Gîtea, 2014; Soelberg *et al.*, 2007; Tekin, 2017; Vieira da Silva *et al.*, 2013).

MATERIAL AND METHOD

Hypericum patulum was obtained in June 2021 from Garden Services S.C. situated within the Agronomie Herăstrău University Campus and was later cultivated in Bucharest (Fig. 1) (*H.p.* identification - dr. Dănăilă-Guidea Silvana Mihaela, Faculty of Biotechnologies, USAMVB). Fresh plant material was analysed at the Laboratory of Biology of the Faculty of Biotechnologies, USAMVB using wet mounts. A Micros Austria optical microscope with ocular micrometer was used, the calibration ratio was 1 µm for objective 100x, 2.5 µm for objective 40x, 10 µm for objective 10x and 20 µm for objective 4x. Microscopic images have been photographed with a Sony Cyber-shot® digital camera (Carl Zeiss Vario-Tessar 5x zoom lens) or with an S-Eye 2.0 microscope digital camera.

RESULTS AND DISCUSSIONS

Microscopic images of *Hypericum patulum* leaves show a random distribution of secretory cavities and canals that give a perforated appearance when held up to the light (fig. 2). Secretory cavities (translucent glands) are also seen in sepals (fig. 3), that also contain numerous protruding marginal glands (pedunculate black nodules) and rare spheroidal dark glands (black nodules) (figs. 4-5). Black nodules were also seen in images of *Hypericum patulum* stem (fig. 6).

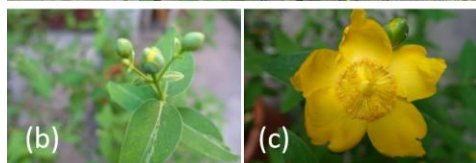


Fig. 1. (a) *Hypericum patulum* plant used in the present study, (b) inflorescence, (c) flower

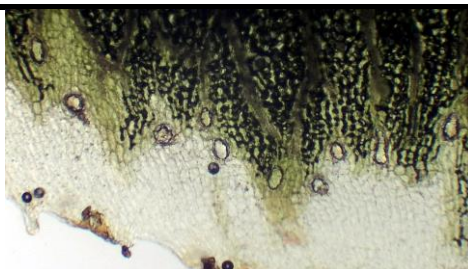


Fig. 3. Several secretory cavities in *Hypericum patulum* sepal



Fig. 4. Protruding marginal glands in *Hypericum patulum* sepal

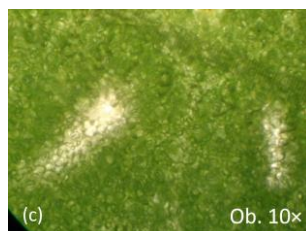
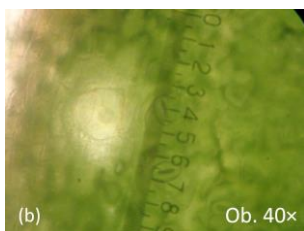


Fig. 2. Secretory cavities and canals in *Hypericum patulum* leaves: (a) random distribution of translucent streaks and dots on the laminar upper surface; (b) spherical secretory cavity; (c) secretory canals



Fig. 5. Black nodule, secretory cavity and protruding marginal glands in *Hypericum patulum* sepal

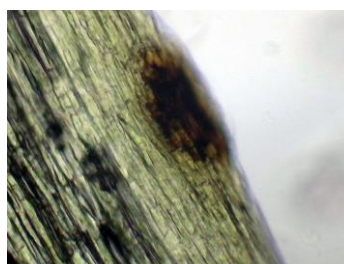


Fig. 6. Black nodule in *Hypericum patulum* stem cortex

CONCLUSIONS

Several secretory structures which are sites of synthesis and accumulation of biologically active substances in *Hypericum* species (translucent glands, secretory canals and dark glands) can be seen in light microscopy images of some *Hypericum patulum* plant parts in the present study.

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