

Subcellular Processes in Plants and Animal Cells

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Microscopy investigation of glandular trichomes of *Satureja horvatii* Šilić (Lamiaceae)

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The essential oils isolated from various *Satureja* species, which belong to the family Lamiaceae, have been shown to possess biological and pharmacological activities, such as antibacterial, antifungal, antiviral, antioxidant [1,2]. *Satureja horvatii* Šilić is an endemic species [3] of the Orjen-Lovćen mountain massif in Montenegro with a high content of the essential oil.

Considering the importance of *Satureja horvatii* Šilić as an endemic plant, and due to the essential oils produced in its glandular trichomes, we carried out micromorphological and ultrastructural analyses of plant's glandular trichomes as a primary secretory organs and have also analysed autofluorescence of their secreted products.

The investigation was carried out using scanning electron (JEOL JSM T 220 15 kV), transmission electron (Philips TEM 208 S.), confocal laser scanning (CLSM 510 Carl Zeiss with Axioskop FS2 mot), and light fluorescence (Leica DM LS with a 13 BLU 450-490 nm filter) microscopy.

A leaf cross-section of *Satureja horvatii* indicated the presence of several different morphological types of glandular and non-glandular trichomes Figure 1. The adaxial and abaxial leaf sides of *Satureja horvatii* were covered by an indumentum containing peltate, capitate and digitiform trichomes, as well as unicellular and multicellular unbranched non-glandular trichomes with wart-like cuticular structures Figure 2. Peltate trichomes distributed on the adaxial and abaxial leaf sides consisted of one basal epidermal cell, a wide stalk cell and a multicellular head consisting of twelve cells. Capitate trichomes, uniformly distributed on both leaf surfaces, were divided into two types according to the shape of the unicellular secretory head. Type I was composed of one basal cell, one stalk cell and spherical unicellular head, while type II was composed of one basal cell, one stalk cell and an ellipsoid unicellular head. Capitate trichomes were more numerous than peltate and digitiform trichomes on the both leaf sides. Digitiform trichomes, which do not show a clear distinction between the apical glandular cell and the subsidiary cells, occurred between the peltate and capitate trichomes with a smaller distribution. Non-glandular trichomes were densely distributed on the adaxial and abaxial leaf sides and on the margins of the leaves. Ultrastructural analyses showed the presence of numerous lipid globules and proliferations of the granular endoplasmatic reticulum in secretory phases of the heads of glandular trichomes. The outer cell wall was covered with a thick cuticle Figure 3.

Strong red autofluorescence of the lipophilic and hydrophilic secreted material was observed with CLSM Figure 4. While intensive light yellow autofluorescence was noticed in peltate trichomes using fluorescence microscope Figure 5.

With the increasing tendency to use volatile oils, our investigation, together with the results of chemical investigations, indicate that *S. horvatii* essential oil could be applied in the pharmaceutical industries.

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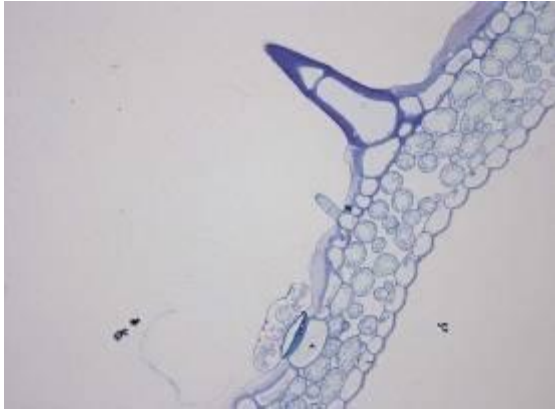


Figure 1. Light micrograph of *Satureja horvatii* leaf 40x.

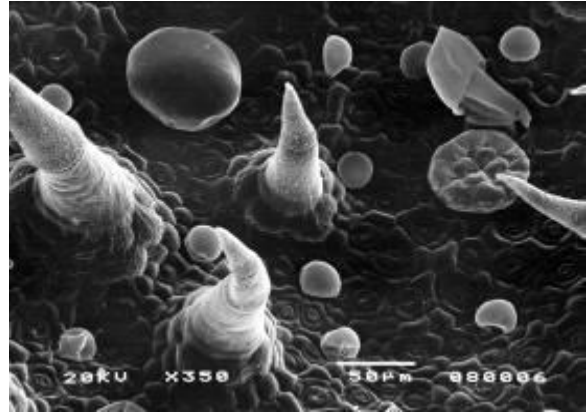


Figure 2. Glandular and non-glandular trichomes on abaxial leaf surface of *Satureja horvatii*. Bar = 50 μm.

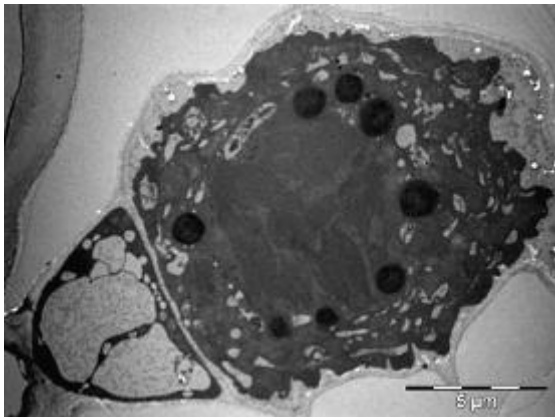


Figure 3. Transmission electron micrographs of glandular trichome of *Satureja horvatii*. Bar = 2 μm.

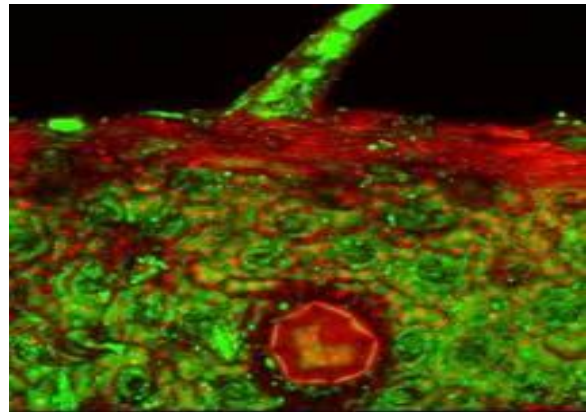


Figure 4. CLSM micrographs of leaf of *Satureja horvatii* 100x.

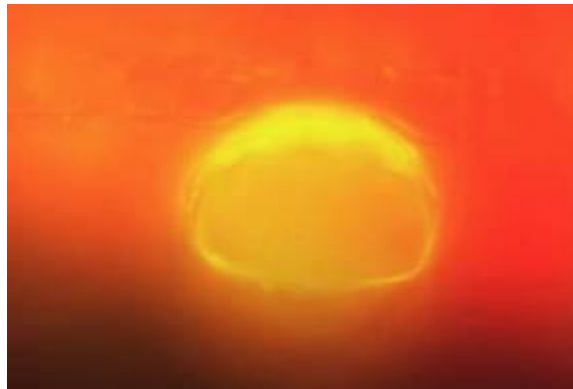


Figure 5. Bright yellow autofluorescence of secreted material in the peltate trichome of *Satureja horvatii* 100x.