

SECRETORY STRUCTURES ON THE FLOWERS OF *HYPERICUM PUBESCENS* AND *H. TOMENTOSUM*

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Hypericum L. (Hypericaceae) is a genus represented by ca. 484 species, shrubs, perennial and annual herbs, growing widely in warm-temperate areas in Europe, West Asia and America [1]. *H. perforatum* (St. John's wort), the most representative member of the genus has been used in folk medicine since Antiquity, and nowadays other *Hypericum* species have been incorporated in traditional medicine systems of several countries around the world. It is now well known that hypericin, pseudohypericin and hyperforin are the main compounds responsible for their therapeutic properties [2]. Although a large number of studies deal with the phytochemical and pharmacological characteristics of *Hypericum* species, the secretory structures that produce the bioactive compounds have only been examined in detail in a few species [3, 4, 5, 6]. Within the framework of a wider project on *Hypericum* glands, we have undertaken cytological studies on the flowers of *H. pubescens* and *H. tomentosum*. Here we describe the structure, development and distribution pattern of the glands present in these two *Hypericum* species.

Flowers at different stages of development were collected from natural populations of *H. pubescens* and *H. tomentosum*, occurring in Portugal. Samples fixed with glutaraldehyde were prepared for scanning electron microscopy or embedding in Leica Historesin® for anatomy, following standard methods.

The flowers of *H. pubescens* and *H. tomentosum* are extremely rich in glands. Three different types of secretory structures (idioblasts, ducts and black nodules) can be found. Tanniferous idioblasts are frequently in the epidermis and in the ground parenchyma of all floral organs and crystal idioblasts containing druses of calcium oxalate are often present in the ovary parenchyma. Two types of ducts are present on the sepals, petals and ovary. Type A ducts have a narrow lumen delimited by four thin-walled secretory cells and occur in association with the phloem. Type B ducts have a larger lumen, are limited by approximately ten secretory epithelial cells surrounded by one sheath of thick-walled cells and are located in the parenchyma. Black nodules, spheroidal clusters of cells surrounded by a sheath of one or two-layers of flatted cells (Fig. 1 A-D) are found at bracts, sepals and petals, along their margins and across the lamina, and between the anther lobes over the connective. In *H. pubescens* the marginal nodules of petals seem dome-like protuberances, whereas on bracts and sepals of *H. tomentosum* they look like

peduncular black nodules (Fig. 1 G-H). Both types of nodules initiate as a small cluster of cells that in the course of development, proliferate, enlarge and become glandular. In late secretory stages the inner cells of the nodules undergo a progressive degradation and an internal cavity seems to arise. Nodules were reported in several *Hypericum* species [3, 4, 5, 6], but peduncular black nodules was only described in *H. elodes* [7]. Detailed anatomical studies of these glands, of their development and secretion process are of utmost relevance to an understanding of the evolutionary origins of secretory structures.

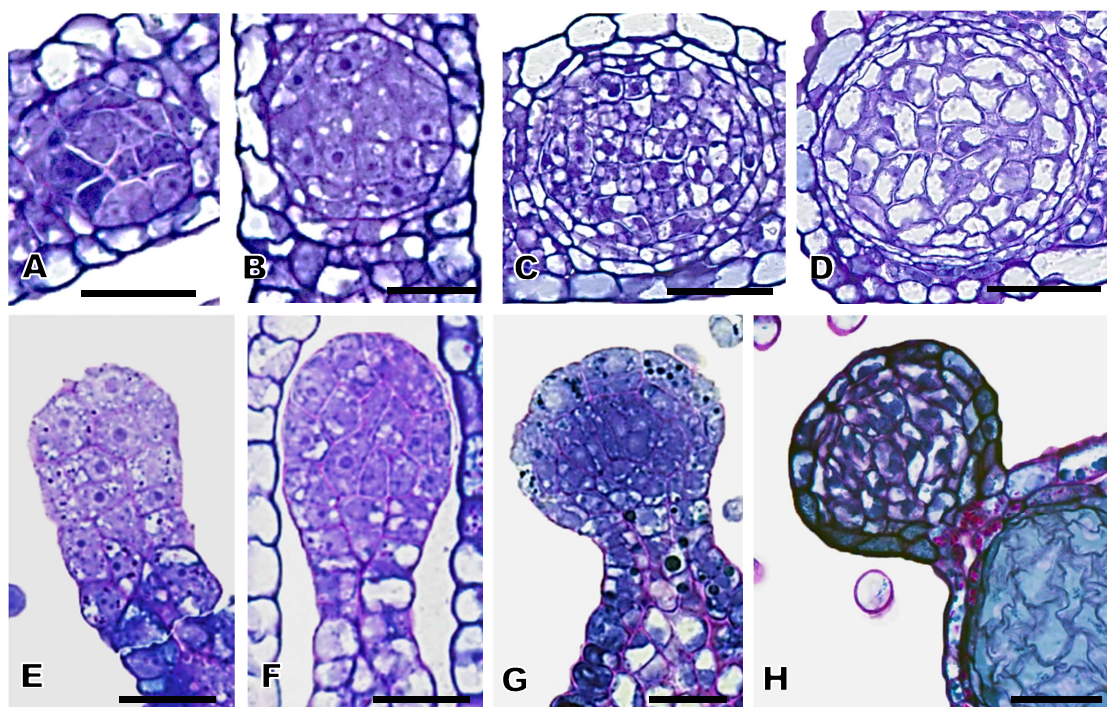


Figure 1. Black nodules in the flowers of *H. tomentosum*. Light micrographs of historesin sections stained with PAS reagent/Toluidine Blue O (A-D and G) and Toluidine Blue O (E, F and H). **A-D**, Black nodules at different ontogenic stages on petal margins. **E-H**, Peduncular black nodules (emergences) on the sepal margins during the course of ontogenesis. Bars = 25 μ m (A, B and E-F); 50 μ m (C, D and H)

References

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