

Nepeta sibthorpii Benth (Lamiaceae): micromorphological analysis of leaves and flowers[☆]

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Abstract

Nepeta sibthorpii Benth (Lamiaceae) is an herbaceous aromatic plant, growing in dry, usually rocky areas of Southern Greece. In this paper, we report the study of micromorphological features of the flowers and leaves of *Nepeta sibthorpii* Benth. The analysis by means of scanning electron microscopy has permitted to characterize both the covering trichomatous garment, abundantly present on the calyx and on the leaves, and the glandular hairs, distributed on the adaxial leaf surface and on the outer surfaces of calyx and corolla, showing also the peculiar features of the epidermal cells, all useful diagnostic elements for the identification of this medicinal plant. © 2001 Éditions scientifiques et médicales Elsevier SAS

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1. Introduction

Nepeta sibthorpii Benth of the Lamiaceae family, is a perennial herb, growing in dry, usually rocky areas of Southern Greece, containing monoterpenes, sesquiterpenes, cyclopentanoid iridoid derivatives and nepetalactones that are structurally similar to valepotriates [1]. The activity of nepetalactone and also of its isomers on the olfactory sense of domestic cats was demonstrated [2]; they function also as insect attractants and repellants [3]. Several *Nepeta* species are still used in the traditional medicine of many countries of the Mediterranean area as diuretic, diaphoretic, antitussive, antispasmodic, anti-asthmatic, febrifuge, emmenagogue and sedative agents [4], and some of these activities were confirmed by several authors [5–7]. Though many chemical-analytical and pharmacological researches with regard to these species are found in literature, the pharmaco-botanical investigations are very few [8]. Therefore, we thought it right to study the micromorphological features of flowers and leaves of

Nepeta sibthorpii Benth and, in particular, the superficial secretory tissues, sites of biogenesis and/or storage of the active principles, to obtain useful diagnostic elements for identification and differentiation of this medicinal plant.

2. Experimental

The leaves and flowers of *Nepeta sibthorpii* Benth were picked during the flowering stage in June 1997 from wild-growing plants on Parnasso mountain (Attica, Greece). Voucher specimens are deposited in the Pharmacology-Biological Department of the University of Messina, Italy.

For observations by scanning electron microscopy, fragments of about 5 mm square of the freshly picked leaves and flowers were fixed by infiltration with 5% glutaraldehyde buffered with 0.1 M Na-cacodylate at pH 7.2 for 12 h, washed with the same buffer, post-fixed in 1% osmium tetroxide in the same buffer at room temperature for 2 h, washed with the same buffer and dehydrated in ethyl alcohol. They were critical-point dried with liquid CO₂ and then coated with gold in a Polaron E5100 SEM Coating Unit. Observations were carried out with a SEM Philips model 500.

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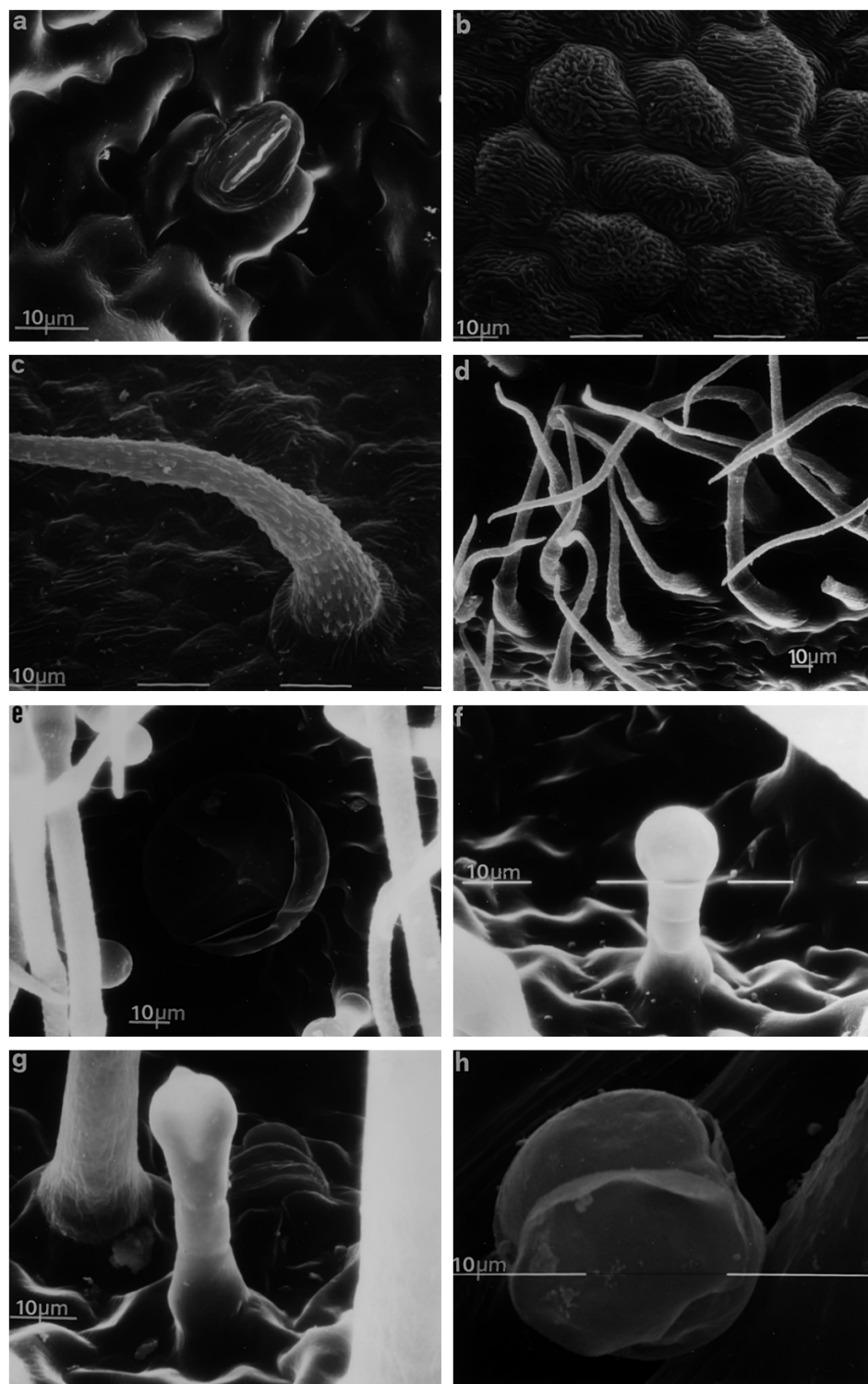


Fig. 1. *Nepeta sibthorpii* Bentham: micrographs (SEM) of flowers and leaves — (a) leaf, upper epidermis; (b) calyx, inner epidermis; (c) calyx, outer epidermis: covering multicellular hairs; (d) corolla, outer epidermis: covering unicellular hairs; (e) corolla, inner epidermis: glandular hairs made up of a short stalk cell and a large globular head; (f) calyx, outer epidermis: glandular hairs made up of a subcylindrical stalk cell and of a sub-spheroidal head connected to the stalk by means of a short collecting cell; (g) corolla, inner epidermis: glandular hairs made up of multicellular, uniseriate stalk and sub-spheroidal head; and (h) leaf, abaxial surface: glandular hairs made up of a subcylindrical stalk cell and bi-cellular head.

3. Results and discussion

Nepeta sibthorpii Benth (Lamiaceae) is a perennial herb with stem erect, ascending, branched, pubescent, with leaves shortly petiolate, ovate-oblong, cordate at the base, rugose, grey-green. The flowers, hermaphrodite, in spike-like erect inflorescences with the lower verticillasters distant, have calyx-teeth, straight, corolla white, two-lipped, upper lip patent, flat, bifid, lower lip three-lobed and stamens didynamous. The fruit is a nutlet, smooth, tuberculate or rugose.

The micromorphological analysis of the leaves showed epidermal cells with sinuous anticlinal walls, with smooth cuticle in the adaxial surface (Fig. 1a) and finely thickened striated cuticle in the abaxial surface. On both leaf surfaces stomata of the caryophyllaceous type are present.

In the calyx, the morphology of the outer epidermal cells presents no differences with regard to leaf epidermal cells, while the inner epidermis analysis shows cells with wavy anticlinal walls, and cuticle with abundant ribbon-like thickenings parallel to the greater cell axis (Fig. 1b). In the corolla, the outer epidermis shows polygonal cells with striated cuticle; cells with undulate anticlinal walls and thickened cuticle covered with numerous ribbon-like waxy thickenings are present in the inner epidermis.

The covering trichomatous garment is constituted of:

- multicellular hairs (Fig. 1c), uniseriate, with pointed terminal cell, strongly cuticularised, are present on both leaf surface and on the outer epidermis of calyx and corolla;
- unicellular hairs (Fig. 1d), with inflated, swollen base, surrounded by sub-spheroidal adjacent subsidiary cells on the outer epidermis of the corolla.

The analysis of secretory tissues shows:

- glandular hairs, characteristic of the Lamiaceae (Fig. 1e), made up of a short stalk cell and a large globular head, which, when the glands are fully developed, is made up of four cells separated by vertical walls; these secretory structures are present on the adaxial leaf surface and on both epidermises of calyx and corolla;
- glandular hairs (Fig. 1f) made up of a subcylindrical stalk cell and of a sub-spheroidal head connected to the stalk by means of a short collecting cell present on all epidermises examined;

- glandular hairs (Fig. 1g) made up of multicellular, uniseriate stalk and sub-spheroidal head that often shows a large subcuticular space, uniformly distributed on all epidermises analysed;
- glandular hairs (Fig. 1h) made up of a subcylindrical stalk cell and bi-cellular head only on abaxial leaf surface.

4. Conclusions

The analysis by means of scanning electron microscopy of the flowers and leaves of *Nepeta sibthorpii* Benth has permitted to characterize the covering trichomatous garment, abundantly present on the calyx and on the leaves, and the glandular hairs, distributed on the leaf adaxial surface and on the outer surface of calyx and corolla, showing also the peculiar features of the epidermal cells, giving useful diagnostic elements for identification of this medicinal plant and of the relative commercial drug samples.

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