Roczniki Akademii Rolniczej w Poznaniu CCCXC

Botanika – Steciana

15, 2011, 49-51

www.up.poznan.pl/steciana

ISSN 1896-1908

NEW DIAGNOSTIC FEATURES OF TAXA WITHIN *LAMIUM* SUBG. *GALEOBDOLON* (LAMIACEAE)

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(Received: March 7, 2011. Accepted: March 14, 2011)

ABSTRACT. Up to five taxa representing *Lamium* subg. *Galeobdolon* were recognised in Europe. Here, we have analysed four following taxa occurring in Poland: *Lamium argentatum*, *L. endtmannii*, *L. galeobdolon* and *L. montanum*. The paper presents new diagnostic features of nutlets, selected with the use of scanning electron microscopy (SEM). Three of the studied taxa are diversified according to micromorphological features of nutlets. Only the nutlets of *L. endtmannii* do not have any distinctive features. It may confirm the previous opinion of Rosenbaumová et al. (2004) that any taxonomic status of *L. endtmannii* is not justified.

KEY WORDS: taxonomy, *Lamium* subg. *Galeobdolon*, Lamiaceae, nutlets, SEM

INTRODUCTION

Five following species representing *Lamium* subg. *Galeobdolon*: *Lamium argentatum* L., *L. endtmannii* G.H. Loos, *L. flavidum* F. Herm., *L. galeobdolon* (L.) L. and *L. montanum* (Pres.) Hoffm. ex Kabath were recognised in Europe (Endtmann 1966, Ball 1972, Garcke 1972, Hess et Al. 1972, Packham 1983, Rosenbaumová et al. 2004, Haeupler and Muer 2007). In Poland, within this subgenus – treated as species *Galeobdolon luteum,* only two subspecies: typical – subsp. *galeobdolon* (= *Lamium galeobdolon)* and mountain – subsp. *montanum* (= *Lamium montanum*) have been recognized until recently (Sychowa 1967). Our recent observations show that also two other species occur in Poland. *Lamium endtmannii* can be found in central parts of the Wielkopolska region (Czarna 2003) while *Lamium argentatum* is planted as covering plant on graves within contemporary cemeteries in different regions of the country.

An extensive research on variation in *Lamium* subg. *Galeobdolon* concerning ploidy levels, morphology and isozymes has been made recently by Rosenbaumová et al. (2004).

The micromorphological features of *Lamium* fruits – the nutlets have not been considered in taxonomical comparison of the described taxa. Hence, the aim of this study was to find out new taxonomic features useful in identification or distinguishing the taxa of *Lamium* subg. *Galeobdolon* on the basis of nutlet observations under a scanning electron microscope (SEM).

MATERIAL AND METHODS

The samples of 30 nutlets of four following species: *Lamium argentatum* L., *L. endtmannii* G.H. Loos, *L. galeobdolon* (L.) L. and *L. montanum* (Pres.) Hoffm. ex Kabath, collected in natural localities and Botanical Garden of Adam Mickiewicz University in Poznań were used in the study. All examinations were carried out on fully developed dry nutlets. The nutlets were not specially prepared, but only cleaned. Four nutlets of each taxa were mounted on aluminum stubs with "Leit-Tabs" and coated with gold in an Agar sputter coater. Electron micrographs were obtained with a LEO 435 VP scanning electron microscope at an accelerating voltage of 15 kV. The terminology describing the nutlet surface followed mainly Barthlott (1981).

RESULTS

A nutlet is a type of fruit characteristic for genus *Lamium*. It is a dry fruit in which a single seed is inseparably linked with pericarp. The nutlets of *Lamium* subg. *Galeobdolon* are trigonous (three-angled) with truncate apex, about 3-4 mm long and have a light coloured elaiosome at their base (Fig. 1) (Wojciechowska 1972, Packham 1983).

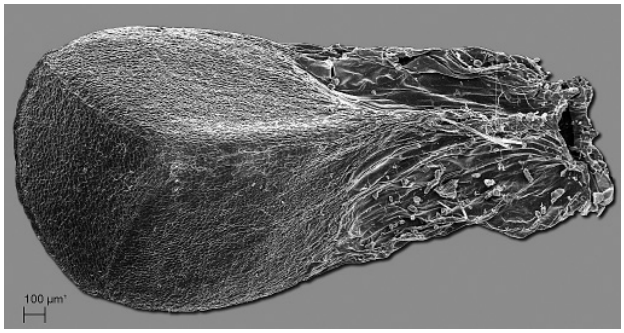

Fig. 1. Shape of nutlet on we example of *Lamium galeobdolon*

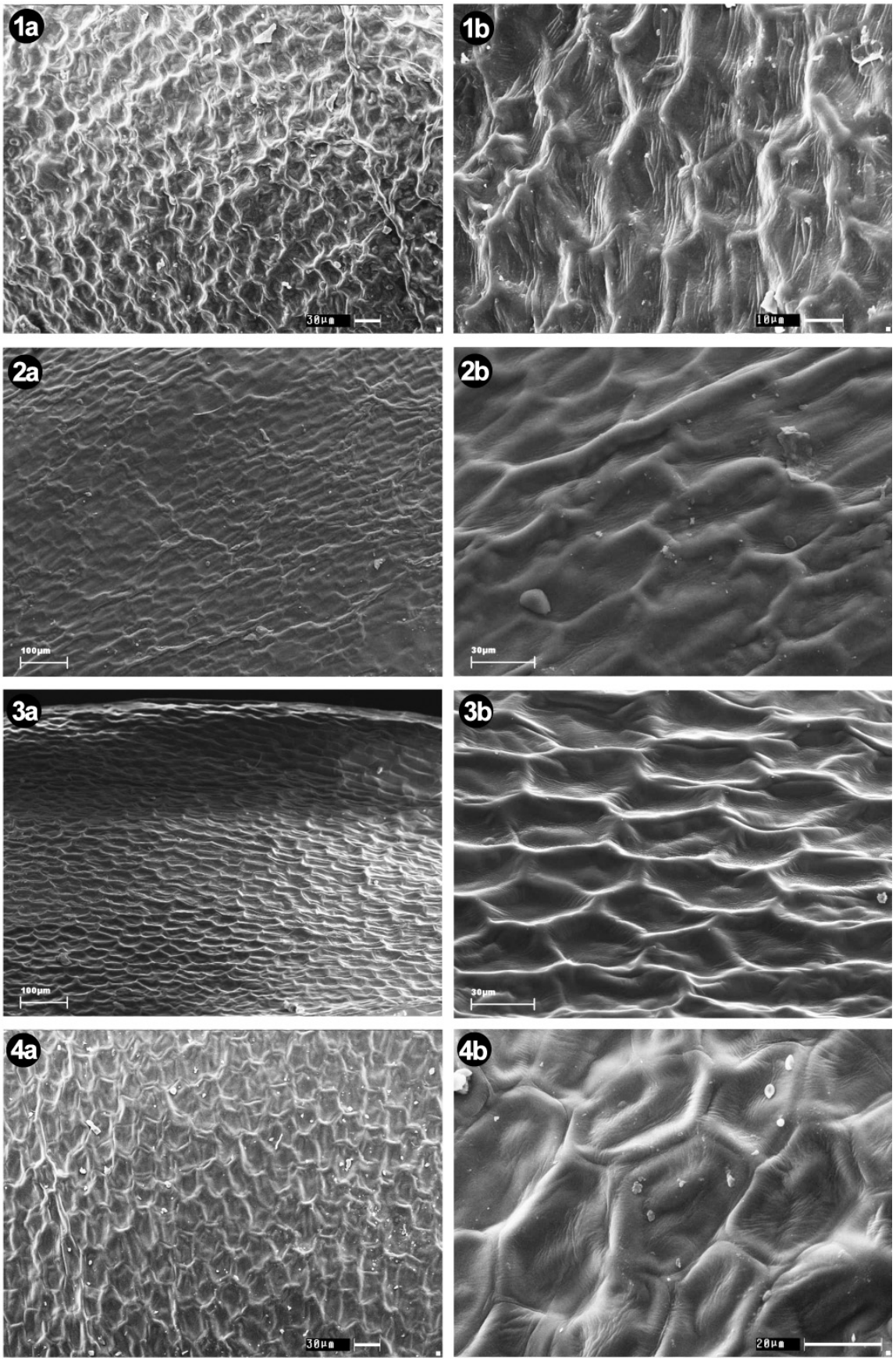

Fig. 2. Ultrastructural comparison of *Lamium* nutlets; exocarp surface details of *L. galeobdolon* (1), *L. argentatum* (2), *L. endtmannii* (3) and *L. montanum* (4)

We have observed the sculpture of nutlet surface of four following species occurring in Poland. The nutlets of all species had reticulate type of sculpture.

Lamium galeobdolon (Fig. 2.1)

The nutlet surface of *L. galeobdolon* showed net-like, distinct cell arrangement. The cells of exocarp were isodiametric – tetragonal, pentagonal or hexagonal, about 20-35 µm in diameter.

The anticlinal walls were raised, ribbed, ribs narrow and distinctly lifted or raised-channelled; straight or slightly undulate. The outer, periclinal, walls were distinctly concave, with distinct, thick cuticular striations running in one direction visible on the bottom of sunk walls.

Lamium argentatum (Fig. 2.2)

The nutlet surface of *L. argentatum* showed net-like but blurred cell arrangement. The epidermal cells of exocarp were elongated, prosenchymatic running parallel to the nutlet axis. The cells were tetragonal, pentagonal or hexagonal, about 35-60 µm long and 20-25 µm wide. The anticlinal walls were raised, ribbed, with ribs wide and smooth; the walls were more or less straight. The outer, periclinal, walls were slightly concave, with very delicate cuticular striations running in one direction visible on sunk walls.

Lamium endtmannii (Fig. 2.3)

The nutlet surface of *L. endtmannii* showed net-like, but distinct cell arrangement. The cells of exocarp were isodiametric to prosenchymatic arranged parallel to the nutlet axis. The cells were pentagonal or hexagonal, about 35-60 µm long and 20-30 µm wide. The anticlinal walls were usually raised, ribbed, ribs narrow and acute; straight or slightly undulate. The outer, periclinal, walls were distinctly concave, with very delicate cuticular striations running in different directions visible on the bottom of sunk walls but also running down from ribbed margins towards cell centre.

Lamium montanum (Fig. 2.4)

The nutlet surface of *L. montanum* showed net-like, distinct cell arrangement. The cells of exocarp were isodiametric – tetragonal, pentagonal or hexagonal, about 20-40 µm in diameter. The anticlinal walls were channelled and straight. The outer, periclinal, walls were concave, with distinct, convex, folded margins and smooth surface with very delicate cuticular striations visible on the bottom of sunk walls but also running down from ribbed margins towards cell centre; striae running in different directions.

DISCUSSION

Our observations showed differentiation in nutlet sculpture features of four examined species. The most distinctive turned out to be the nutlets of *L. montanum*, which epidermal cells had concave anticlinal walls. The remaining species had raised or raised-channelled anticlinal walls. Also the nutlets of *L. argentatum* were easy to distinguished for their blurred, net-like cell arrangement of epidermis made of elongated, prosenchymatic cells. The nutlets of *L. galeobdolon* in turn, can be distinguished on the base of secondary sculpture of outer periclinal walls with distinct, thick cuticular striations running in one direction on the bottom of sunk walls. Only the nutlets of *L. endtmannii* did not have any distinctive features. The shape of epidermal cells was something in between the ones of three other species. The distinct, net-like cell arrangement, as well as the raised or raised-channelled anticlinal walls and distinctly concave walls resembled *L. galeobdolon* nutlets. Microornamentation of outer periclinal walls in turn, referred to *L. montanum* type. The lack of distinctive features of the nutlets may confirm the previous opinion of Rosenbaumová et al. (2004) that any taxonomic status of *L. endtmannii* is not justified.

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For citation: Czarna A., Bednorz L. (2011): New diagnostic features of taxa within *Lamium* subg. *Galeobdolon* (Lamiaceae). Rocz. AR Pozn. 390, Bot. Stec. 15: 49-51.