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Histological studies on small bulb flower crops

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Summary Investigations were done in order to obtain more information on the histological structure of bulbs of *Allium moly*, *Allium sphaerocephalon*, *Muscari armeniacum* and corms of *Crocus sativus*. While starch grain were found in the bulb of *Muscari armeniacum*, fluid nutrient content were shown in *Allium* species. Narrow and fleshy scales were found in the bulbs of *Muscari*. Histological characteristics of *Allium moly* and *Allium sphaerocephalon* showed a closer relationship with corms than with the bulbs. To clarify this question, further investigations are needed (*Bailey*, 1942; *Larson*, 1980).

Key words: histology, bulb, corm

Introduction

Small bulbflowers play an important role among the hardy ornamental perennials (*Priszter*, 1974; *Polunin*, 1971). Thanks to their diverse using possibilities (balconies, flower beds, rockgardens, roofgardens), their importance and popularity are increasing.

Besides the examination of flowering-dynamics and propagation-biology it is important to get a knowledge from the histological structure of their bulbs, too. This question has not been examined in this form yet. The aim of the present study was to try to supply this deficiency.

Material and method

Histological studies of bulbs or corms and the formation of vegetative organs were carried out on the species were as follows: *Allium moly*, *Allium sphaerocephalon*, *Crocus sativus*, *Muscari armeniacum*. In the case of *Allium moly* and *Allium sphaerocephalon*, the histological structure of bulbs was examined and a comparison was made with that of *Allium cepa*. In the case of *Muscari armeniacum*, the development of certain organs was observed. *Crocus sativus* and *Muscari armeniacum* were collected in August, November, March and April, the *Allium* species in March and April. The collected organs were stored in alcohol (40%) until the time of laboratory examinations. The investigations were carried in the laboratory of the Corvinus University of Budapest, Department of Floriculture and Dendrology.

Cross and longitudinal sections were prepared from bulbs and corms with razor blade, 30–60 μm thick cross sections were prepared with the help of a freezing sledge microtome. Cross and longitudinal sections were investigated under light-microscope with a magnification of 32×, 100× and 200×. The cross-section were fixed in 50% glycerine and it necessary, were stained with toluidine-blue. Photos were taken with a digital camera.

Result and discussion

Allium moly L. (*Fig. 1* and *Fig. 2*)

Allium moly does not have a typical bulb. From the outside, it is covered by dryscales but the inside part of the bulb is a uniform tissue-part which is very similar to the construction of corms. Under the one-cell layer of epidermis the broad cortical parenchyma is built from pentagonal or hexagonal cells. There are no starch grains in the parenchyma cells. Nutrient reserves are stored in the form of liquid sugars. The vessels inside the bulb (corm) are rather large and situated relatively close together.

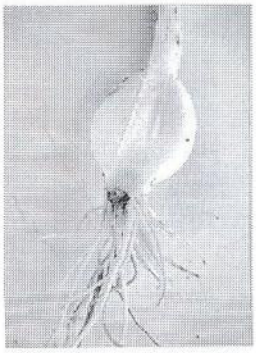

Figure 1 *Allium moly* bulbs in a longitudinal section

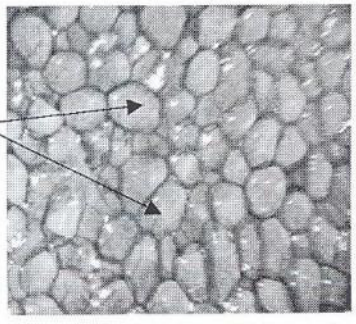

Figure 2 Cross section of *Allium moly* bulb (32× magn.)

Allium sphaerocephalon L. (*Figure 3*)

The bulb of *Allium sphaerocephalon* has a similar construction to that of *Allium moly*. Just like the mentioned species, fleshy-scales are missing here as well. Inside of dry covering scales, the tissue structure shows tuber features which is typical of corms. Under the epidermis of the bulbous part the parenchyma contains liquid nutrients. Its structure is homogenous, only some vessels can be found. *(Figure 4)*

Like the common onion (*Allium cepa*) both investigated species are members of *Alliaceae* family. There is a great difference; however, in their structure. The bulb of *Allium cepa* is composed entirely of fleshy scales covered by narrow-holed epidermis cells with Ca-oxalat crystals (*Sárkány & Szalai*, 1966). Under them, the form of larger sized, thin-walled parenchyma cells can be found with nutrient reserves stored in the form of liquid sugars. The fleshy-scales of *Allium moly* and *Allium sphaerocephalon* form a compact, homogenous tissue, without crystals (MAFF/ADAS, 1984).

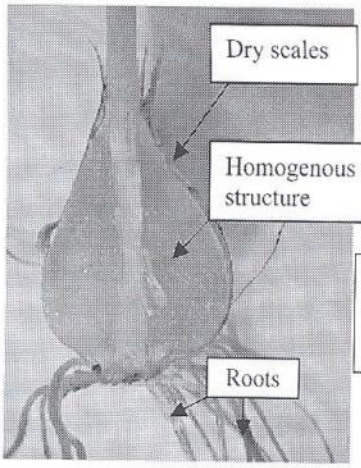

Figure 3 *Allium sphaerocephalon* bulb in longitudinal section March. 2005.

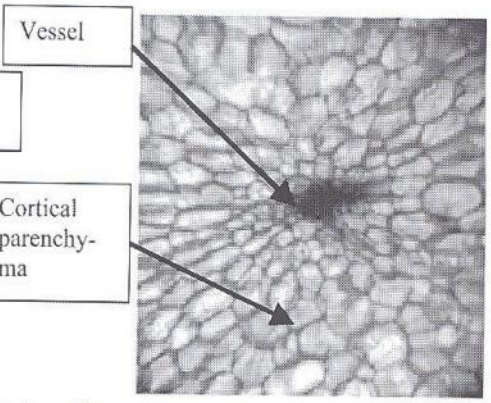

Figure 4 Cross section of *Allium sphaerocephalon* with vessel (100× magn.)

Crocus sativus L.

The corm of *Crocus sativus* is covered with periderm, followed by a homogenous cortical parenchyma with starch grains in the cells. The inside surface of the homogenous cortical parenchyma tissue-part is coated with a one-cell layer of epidermis. The situation of vessels in the parenchyma tissue is longitudinal-diagonal. The histological structure of half-developed and fully-developed corms is the same. Cells are of the same size, there is no division in the meristema or cambial zone.

The corm of *Crocus* is newly initiated every year *(Figure 5)*. Initiation and the formations of the new corm and the organs inside of the corm happens similarly to that of some other genera of the *Iridaceae* family, e.g. *Gladiolus (Figure 5)*.

After flowering the old corm collapses. The developing of the new corm begins with the extending of the sprout base (*Komiszár*, 2003). The contractile root collapses too.

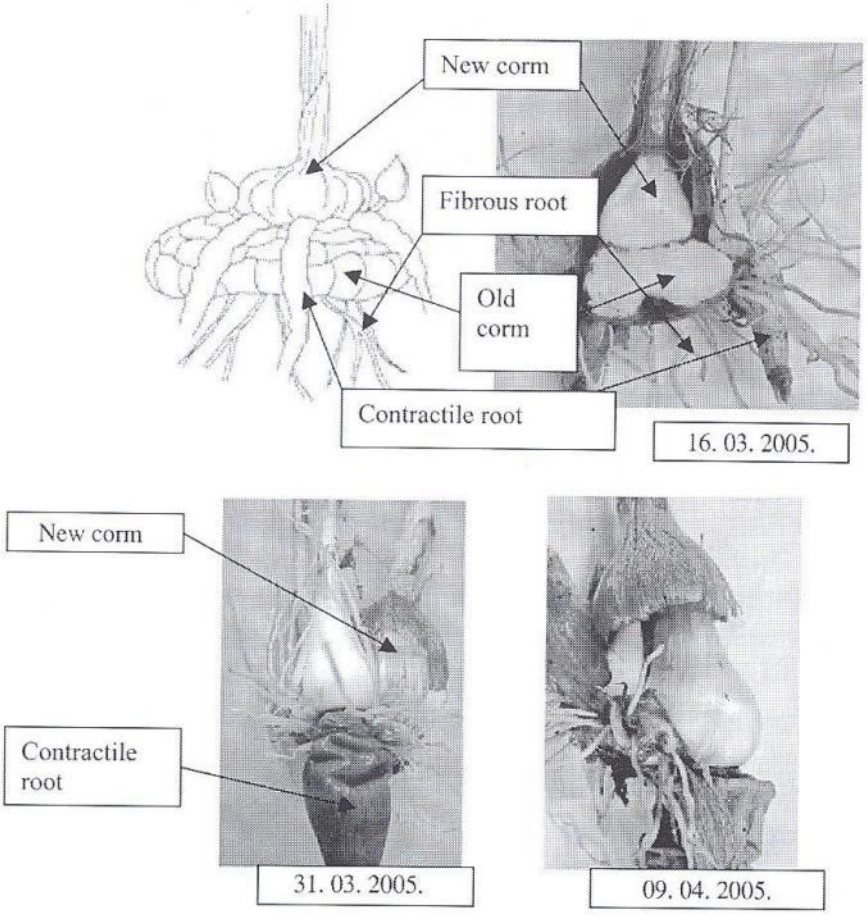

Figure 5 The formation of *Gladiolus* corm (left, top) and the formation of *Crocus sativus* corm (right top and bottom)

Muscari armeniacum Leichtlin ex Baker (*Figure 8*)

The bulb of *Muscari armeniacum* is built up by thin, fleshy-scales of approximately 5–7 layers thickness. The parenchyma between the outer and the inner epidermis of each bud scale is homogenous. There are no vacuolua. Starch is accumulated in greater amounts only in the outer cortical parenchyma. Bulbs of *Muscari armeniacum* are especially rich in starch *(Figure 7)*, crystals can be found in some cells, too. All parts of the plant (bulbs, stems, leaves and inflorescences) contain mucilage.

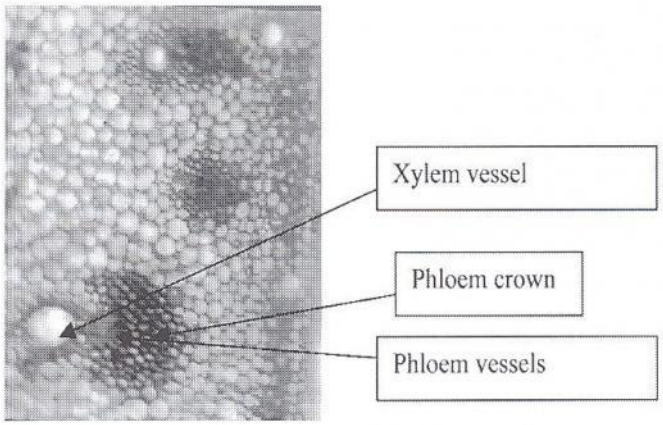

Figure 6 Cross section of *Crocus sativus* bulbs *(100× magn.)*

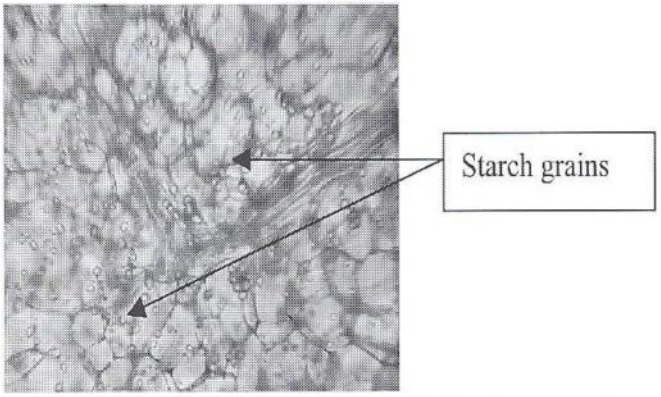

Figure 7 Cross section of *Muscari armeniacum* bulbs with starch grains (32× magn.)

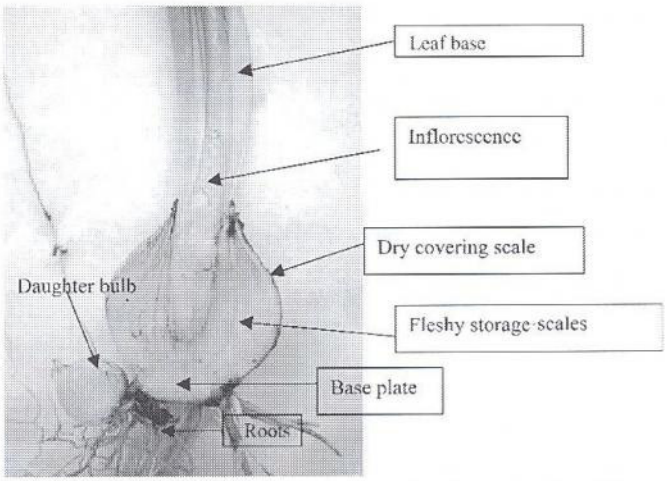

Figure 8 *Muscari armeniacum* bulbs in a longitudinal section (March 2005.)

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