HISTO-ANATOMICAL STUDY ON THE ROOT OF *ONONIS SPINOSA* L.

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Abstract. The medicinal product Ononidis radix derived from the roots of *Ononis spinosa* species. Histo-anatomical studies on the plant roots have been performed. It was found that the root has a secondary structure due to the occurrence of cambium and phellogen.

Keywords: Ononidis radix, histo-anatomical study.

Rezumat. Studiul histo-anatomic al rădăcinii speciei *Ononis spinosa* L. Din rădăcinile plantei *Ononis spinosa* provine produsul vegetal medicinal Ononidis radix. S-au efectuat studii histo-anatomice asupra rădăcinilor acestei plante. S-a constatat că rădăcina prezintă o structură secundară datorată apariţiei cambiului şi felogenului.

Cuvinte cheie: Ononidis radix, studiu histo-anatomic.

INTRODUCTION

The *Ononis spinosa* (LINNAEUS, 1759) species, from Fabaceae family, is known as rabbit bone, sweat (sweating horse), spiny restharrow, restharrow (BORZA, 1968; Flora R.P.R. 1957). It is an undergrowth, enduring, thorny plant, 30–70 cm high. In soil has a rhizome, which continues with a 25–30 cm long root. The aerial stem lignified to the basal part is provided with rigid spines. The lower leaves are trifoliate, with oval leaflets, toothed on the edges, set with glandular hairs on both sides. The top leaves are unifoliate. Pink flowers, usually solitary, are placed at the bottom of bracteiform leaves. The fruits, ovate pods, pubescent, bear 1–2 seeds. Blossoms in June–July (CIULEI et al., 1993; NISTREANU, 2001; TIŢĂ, 2005; Flora R.P.R., 1957).

Ononis spinosa is a Eurasian species, commonly in grasslands, arid grasslands, steppes, sandy places, briers, along watercourses (CIULEI et al., 1993; NISTREANU, 2001; TIŢĂ, 2005; Flora R.P.R., 1957).

Triterpenoid tetracylic saponins (alpha- and beta-onocerin or onokol), isoflavonosides (ononin or formonetin-7-O-glucoside), sterols (beta-sitosterol), volatile oil (trans-anethole, carvone, menthole), glycosidated phenyl-benzyl-ketones (onospin, with aglycone ononetin), tanning substances, organic acids, sugars, and mineral salts have been previously isolated from the medicinal product Ononidis radix, harvested late autumn or early spring, cut into slices and carefully dried (CIULEI et al., 1993; GÂRD et al., 2008; ISTUDOR, 1998; MENCINICOPSCHI et al., 2009; NISTREANU, 2001; ONIGA, 2007; TIŢĂ, 2005).

The extracts from Ononidis radix have diuretic-natriuretic, anti-inflammatory, antibacterial and cholagogue action, due to saponins, isoflavonosides and volatile oil content. Included in the composition of diuretic teas, they are used to treat renal lithiasis in cures of 4–5 days, alternating with 8–10 days intervals, because the diuretic effect decreases in time. For diuretic action, the root should be infused and not decocted or the essential oil will be evaporated. The infusion is also used in the treatment of dropsy, inflammation of the bladder and kidney, rheumatism and skin disorders (CIULEI et al., 1993; GÂRD et al., 2008; ISTUDOR, 1998; MENCINICOPSCHI et al., 2009; NISTREANU, 2001; ONIGA, 2007; TIŢĂ, 2005).

With the exception of two studies (TOMA & DANIŞ, 1972–1973; TOMA & RUGINĂ, 1998), the specialty papers on histo-anatomical structure of *Ononis spinosa* or parts thereof are poor. This fact and the medicinal value of the plant have leaded us to perform this study.

MATERIAL AND METHODS

The vegetal material is represented by the roots of *Ononis spinosa* species, collected from plants in blossom, in a meadow south of the Seaca de Câmp village, Dolj County.

In terms of histo-anatomical study, the material passed through the following steps:

(a) Fixation and preservation in 70% alcohol;

(b) Manually sectioning, using hand microtome and botanical razor, with shock pith as support;

(c) Removal of cell content, with sodium hypochlorite for 20–35 minutes (depending on material), after which the cross sections were washed with distilled and acetic water;

(d) Staining of cross sections with iodine green and alum carmine red: conventional staining for the histo-anatomical studies of plants (ANDREI & PARASCHIVOIU, 2003). Sections were first stained with iodine green (one minute), washed with 90% alcohol, and then stained with alum carmine red (20 minutes) and consecutively washed with distilled water;

(e) Making of permanent preparations: stained sections were mounted on glycerol-gelatine drops, added between the blade and slide;

(f) Valorization of preparations: colour photographs at NOVEX photon microscope (Holland), with Canon A540 digital camera were made. Scale = 100 µm.

The interpretation of microscopic cross sections was performed in the manner of classic authors (LOHRER, 1887; METCALFE & CHALK, 1972; TOMA & DANIȘ, 1972–1973; TOMA & RUGINĂ, 1998; VÉCHOT, 1920).

RESULTS AND DISCUSSIONS

The entire root (Fig. 1) has a secondary structure, which is passed very early, especially due to cambium.

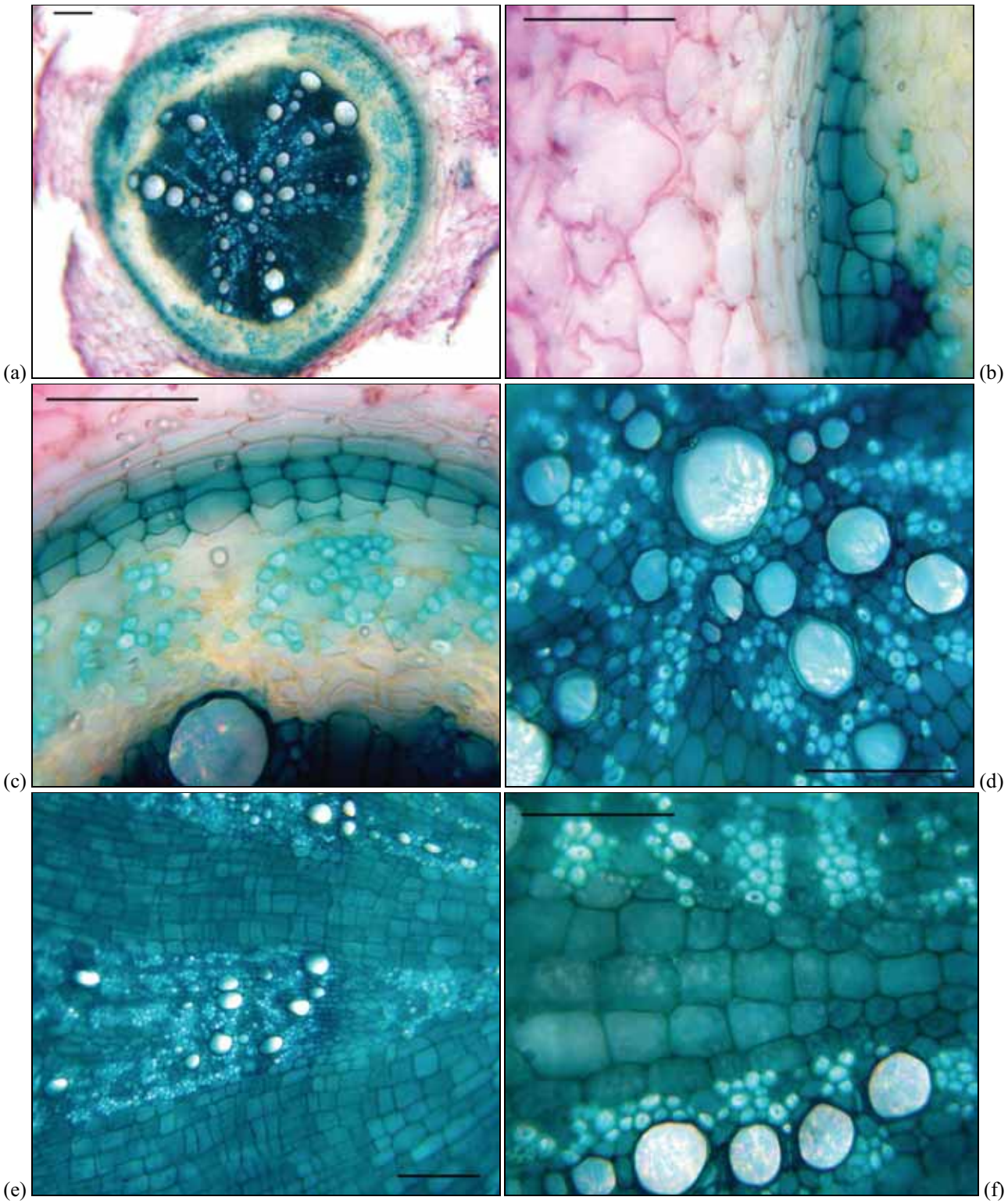

Figure 1. (a–f) Aspects of cross sections at different levels in the root of *Ononis spinosa*.
Figura 1. (a–f) Aspecte ale secțiunilor transversale la diferite niveluri prin rădăcina de *Ononis spinosa*. (original).

In the lower third of the cross section, one may notice the rhizodermis with absorbent hairs exfoliate as well as

In the lower third of the cross section is noted that rhizodermis with absorbent hairs exfoliate as much of the external bark. The rest of cortical parenchyma is of meatus type with very large cells of irregular shape having very thin walls. On account of endodermis and even of pericycle appear a phellogen that formed 2–3 layers of cork near the phloem tissue. The central cylinder comprises an external ring of secondary phloem and a central body of secondary xylem.

The secondary phloem ring includes, in fact, three areas separate by parenchymatous-cellulosic medullary rays; these areas contain few conducting elements (sieve-tubes and annex cells) inwards and numerous phloem fibres (Fig. 1c) separated by phloem parenchyma cells outside. The secondary xylem (Fig. 1d) is represented by several (6) sectors separated by very large parenchymatous-cellulosic medullary rays, which are not found in the root centre (axial area); these sectors include vessels with different diameter, dispersed irregular in the fundamental libriform mass. Both the phloem and libriform fibres have very thick walls (with punctiform lumen), but moderate lignified.

The existence of the three sectors of phloem and of the three pairs of xylem sectors is a proof that the axial cylinder (stele) from the primary structure is triarch.

In the middle third of the cross section appear 3–4 thinner zones (single or bilayer) of cork, separated by parenchyma, so in this case we can speak of building a rhytidoma. Compared with previously analyzed level, the phloem forms a thick ring in which alternates areas of secondary phloem with areas of cellulosic parenchyma; this, together with the lignified parenchyma from the secondary xylem level form a true expansion parenchyma (Fig. 1e, f) under the shape of rays as it approaches to the centre of the root without coming into contact. Both at the phloem and especially at the xylem level, there are more (12) areas of secondary conducting tissue, separated by as many parenchymatous medullary rays of different width. The centre of the root is compact, with several xylem vessels and many libriform fibres.

In the basal third, the cork areas are thicker (with 3–5 cell layers) and the central xylem body is very thick.

In the xylem body, two concentric zones (rings) can be distinguished, which reflects the age of two years of the analyzed root. Both the annual rings of secondary xylem are crossed by numerous medullary rays, parenchymatic-lignified and very large, which not come into contact in the centre of the root. Therefore, the root of this plant is highly parenchymatized, the cells from the medullary rays parenchyma being filled with starch granules.

A comparative analysis of our research results with other researches (TOMA & DANIŞ, 1972–1973; TOMA & RUGINĂ, 1998) find that they are almost identical, and the small structural differences are due to the development phase in which biological material was harvested on.

CONCLUSIONS

Histo-anatomical researches on the roots of *Ononis spinosa* species were carried out.

The root has a secondary structure that is passed early because of cambium and phellogen, the last tissue differentiated on account of endodermis and pericycle.

Outside the root is a top stripped of bark consists of several layers of cork separate by parenchyma.

The phloem is organized as a ring pierced by relatively large parenchymatous medullary rays, which continues on the xylem body.

The xylem body is organized as annual concentric rings penetrated by very large and lignified parenchymatous medullary rays, which not come into contact with centre of the root.

The root is strongly parenchymatous, and the cells of the medullary ray parenchyma are filled with starch granules.

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