Analele ştiinţifice ale Universităţii "Al. I. Cuza" Iaşi
Tomul LII, s. II a. Biologie vegetală, 2006

THE STRUCTURE OF VEGETATIVE ORGANS IN VISCUM ALBUM AND LORANTHUS EUROPAEUS

ASPAZIA ANDRONACHE [*], IRINA TOMA[**], C. TOMA [**]

Abstract: In this paper the results of the histo-anatomical investigations concerning two semiparasitic species from Romanian flora: *Viscum album* and *Loranthus europaeus*, are presented. Authors investigated the structure of the vegetative organs of these two species (the leaf, the stem and the haustoria); some commune or different features of the two species are underlined.

Key words: Viscum, Loranthus, anatomy, vegetative organs

Introduction

In this paper two semiparasitic species from Romanian flora: *Viscum album* L. and *Loranthus europaeus* Jacq. are investigated from anatomical point of view.

The Loranthus genus is predominant tropical and subtropical; it have only one species in Europe (*Loranthus europaeus* Jacq.), parasite on *Quercus,* rarely on *Castanea sativa, Tilia argentea, Fagus sylvatica* or *Betula alba.*

The *Viscum* genus hase more species in Europe, the most frequently being Viscum album L. and *V. laxum* Boiss et Reuter. These species are parasite on trees from *Populus, Salix, Carpinus, Betula, Alnus, Fagus, Castanea, Ulmus, Malus, Crataegus, Prunus, Robinia, Acer, Aesculus, Tilia, Fraxinus, Abies, Pinus* genus etc. (Boulallard, 1990; Gorenflot,1994; Ciocârlan, 2000).

The parasite and semiparasite plants called the botanist's attention from a long time because of their structural peculiarities, their biology and rapid extension of cultured areas invaded by parasitic plants [9, 10]. The vegetative and reproductive organs anatomy was investigated in the last part of the XIX century and in the first part of XX century [5]. Beginnings with 1960 new techniques are utilized in the study of parasitic and semiparasitic plants: electronic microscopy, radioisotopes and analytical procedures in parallel with some observations made on photonic microscope.

In time, the characteristics of the principal ontogenetic phases were underlined, the almost 3000 species was classified, and the combative methods against the most aggressive species were perfected [6]. The Romanian literature is poor in morpho-anatomical studies

[*] National College "E. Hurmuzachi" Rădăuţi, Calea Bucovinei nr. 5, 725400-Suceava, România
[**] "Al. I. Cuza" University, Faculty of Biology, B-dul Carol I no.11, 700506 -Iassy, Romania

of parasitic plants. This is the reason why we take under consideration two semiparasitic plants, underlining the histological features of the leaf, stem and haustoria.

Material and methods

The studied *Viscum* sample was collected from a host plant from *Tilia* genus (*Tilia cordata*) and *Loranthus* from *Quercus pedunculiflora* as host species. The material subjected to analysis has been fixed and preserved in 70% ethylic alcohol, cross-sectioned with a microtome and colored with ruthenium red and blue metilene. The permanent slides obtained have been photographed on a Novex microscope with a Minolta or Canon camera.

Results and discussions

Viscum album

The leaf (fig. 1)

The epidermis in front view is composed from cells with polygonal contour, with right walls. The stomata, from paracytic type, are located in both epidermises. Numerousness crystals of calcium oxalate, from different sizes and simple crystals could be observed trough transparence. On transversal sections, in both epidermises, the cells have external wall thick and strongly cutinized. The mesophyll is differentiated in palisade parenchyma under upper epidermis and spongy parenchyma under lower epidermis. The palisade parenchyma is bi- or try-layered with short and large cells, sometime with waved lateral walls. The spongy parenchyma is multilayered (10-12 layers), the hypodermic tissue having taller cells. Some cells from the mesophyll have simple crystals or ursins of calcium oxalate.

The veins are not prominent; in all of that a vascular bundle of different dimensions could be observed.

The stem

The epidermis has tangential longed cells, with the external wall very thick and completely cutinized; the wall thickness is equal with the cell lumen. Over each external wall, in the middle of the cell, a prominent monticule, half moon or elliptical shaped could be observed. The cortex is moderately collenchymatic; in some cells anticline division walls could be observed. The structure is secondary, resulted from the activity of a cambium. The secondary phloem has a ring shape with parenchymatic and lignified medullar rays; the secondary phloem includes slightly collenchymatic elements: sieve tubes, companion cells and cells of phloem parenchyma, some of the last ones of very large size, containing one ursine of calcium oxalate. At their periphery some thick bundles of sclerenchymatic fibers could be observed.

The secondary xylem includes two annual rings, separated from a thin band of woody parenchyma. In each ring the xylem vessels form radial compact zones, separate from

libriform; they are very thick and lignified walls. Both rings are penetrated by large medullar rays, formed of parenchymatic cells, with moderately thick and lignified walls. In perimedullar area the primary xylem could be observe. It consists from vessels separated by parenchymatic cells. At the internal part of the primary xylem sclerenchyma bundles, similar with that located at the periphery of the phloem could be observed.

The pith is of parenchymatic type, formed by cells with cellulosic walls. Between the pith and the primary xylem some hydrocites are visible.

Haustoria

Primary haustoria of *Viscum album* have the tendency to dichotomic branch out, but, most of the time only a ramification grows more. The tissues of the host plant are affected by the contact with the parasite: they are hypertrophied, many of its cells being destroyed. The penetration and development of the haustoria in host plant tissues is revealed in macroscopic longitudinally section of the parasite and host plant.

The structure and the penetration of haustoria are observed on the microscopic longitudinally sections. The advancement of the primary haustoria doesn't stops at the contact with the xylem vessels of the host plant; the haustoria penetrate many annual rings of growth. At the contact between the parasite and the host we observed some perturbations in the host structure: the presence of necrosated and tanniniferous cells which try to isolate the haustoria; the xylem vessels anomalously arranged at the contact with the haustoria; the parenchymatic cells with intensely-thickened walls (for protection at the contact with the haustoria).

II. *Loranthus europaeus* Jacq.

The leaf (fig. 5)

The epidermis in front view has polygonal shaped cells, with right lateral walls. In the external wall cuticular parallel rows could be observed. . The stomata, from paracytic type, are present in both epidermises. On cross sections the mesophyll appears homogenous, spongy type, with large, isodiametric or slowly elongated cells. Here and there the mesophyll has all cells elongated al disposed perpendicularly on the epidermis, with an aspect of palisade parenchyma. The veins are not prominent; al of them contains only one vascular bundle with different size.

The stem (fig. 6)

In young stem the contour of the cross section is elliptical.

The epidermis has cells slowly elongated tangentially, with a thick and crenellate cuticle. The phellogen produced a thin zone of cork (1-2 layers); the majority of cells are full of tannin. The pheloderm is similar with the external cortical parenchyma. In the central cylinder numerousness vascular bundles of collateral open type, disposed on a ellipsis and separated by medullar rays could be observed.

The pith is parenchymatic, with groups of sclereids, a lot of then containing simple crystals or ursins of calcium oxalate. Sometime (in a lower level of the stem) the epidermis

is exfoliated, the cork thickness rising, the pheloderm are collenchymatic. At the periphery of the vascular bundles sclerenchyma bands with different sizes and shapes are visible.

Conclusions

In the stem, passing from the primary to secondary structure take place early, only based by cambium activity (in Loranthus *europaeus*), or from cambium and phelogen activity (in *Viscum album*).

The mechanical tissue is represented by the collenchymatic pheloderm (*L. europaeus*), periphloemic girdles of sclerenchyma fibers (*L. europaeus, V. album*), groups of cortical sclereids (*L. europaeus*) and xylem fibers (*L. europaeus, V. album*).

The secondary conducting tissues are ring shaped.

In the leaf the epidermic cells has very thick and cutinized external walls. The mesophyll is homogenous, spongy type, not well differentiated.

BIBLIOGRAPHY

1. BOULLARD B.1990 - Guerre et Paix dans la Regne Végétale. Paris: Edit. Ellipses. 114-126
2. CIOCÂRLAN V. 2000 - Flora ilustrată a României. Bucureşti: Edit. Ceres
3. GORENFLOT R. 1994 - Biologie végétale. Plantes supériéures. Paris. Edit.Masson:184-193
4. KUIJT J.1969 - The Biology of Parasitic Flowering Plants. Berkeley Univ.California Press
5. METCALFE C.R., CHALK L, 1972 - Anatomy of the Dicotyledons. 2. Oxford, Clarendon Press. 1184 -1194
6. SALLE G., ABER M. 1986 - Les Phanérogames parasites: Bologie et Stratégies de lutte. Bull. Soc. Bot. De. France, Lettres bot., 133, 3: 235-253
7. TOMA C. 2002 - Strategii evolutive în regnul vegetal. Iaşi. Edit. Univ."Al.I.Cuza"
8. TOMA C., GOSTIN IRINA. 2000 - Histologie vegetală. Iaşi. Edit. Univ."Al.I.Cuza"
9. TRONCHET A., MONTAUT M. 1957 - Sur la structure de la plantule de Gui et la nature de suçoir primaire. Doubs. Bull. Soc. Hist. Nat. 87-95
10. TUBEUF K. 1923. - Monographie der Mistel. Berlin. Edit. Oldenbourg: 250-393

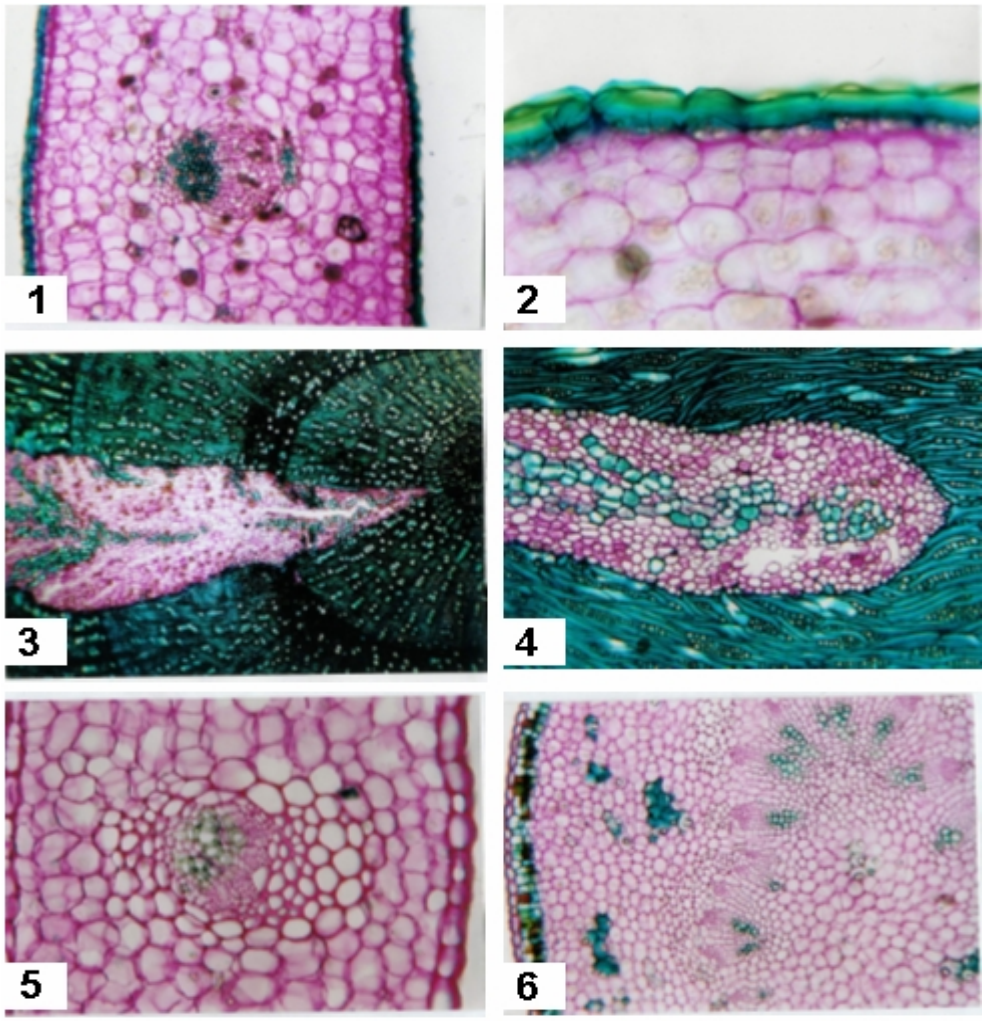

Fig. 1 *Viscum album* – leaf structure Oc.10x,Ob.10 (Orig.); Fig. 2 *Viscum album* – crossection through the stem Oc.10x,Ob.20 (Orig.); Fig. 3 *Viscum album* – haustoria structure Oc.10x,Ob.4 (Orig.); Fig. 4 *Viscum album* – haustoria structure Oc.10x,Ob.10 (Orig.); Fig. 5 *Loranthus europaeus* — leaf structure Oc.10x,Ob.20 (Orig.); Fig. 6 *Loranthus europaeus* – crossection through the stem Oc.10x,Ob.10 (Orig.)