SOME ASPECTS OF *ASPARAGUS BRACHYPHYLLUS* TUCZ. (ASPARAGACEAE) ANATOMY

UNELE ASPECTE ANATOMICE ALE SPECIEI *ASPARAGUS BRACHYPHYLLUS* TUCZ. (ASPARAGACEAE)

RODICA BERCU
Faculty of Natural and Agricultural Sciences, Ovidius University, Constantza

Abstract: *The article comprises the investigation of some vegetative organs (adventitious root, climbing stem and cladodes) anatomy of a popular plant native of East Europe (Ukraine) and South-eastern Europe (Romania), Asparagus brachyphyllus Turcz. The root possesses a typical monocot's primary structure with a great number of vascular bundles, each of them possessing one metaxylem vessel, some protoxylem vessels and phloem elements. The aerial shoot stele consists of numerous vascular poorly developed collateral bundles. The mechanical tissue is absent except the sclerenchymatous pericycle surrounding the shoot stele. The cladode is more or less elliptical in shape, a differentiated mesophyll and with a layer of clorenchymatous cells and a poorly developed vascular bundles vein. The poorly developed vascular system (in the adventitious root, shoots and leaf), the few mechanical elements present in the aerial part and some sclerenchymatous cells in the blade are in accordance with the plant pendant condition. In literature the cladode anatomy is less described whereas those of roots and shoots almost lack. The few mechanical elements, present in the aerial shoots and the poor developed vascular system and the developed cortex are in accordance with the plant prostrate condition.*

Rezumat: *Lucrarea are drept scop descrierea unor caractere anatomice ale organelor vegetative aeriene ale unei cunoscute specii ornamentale, Asparagus brachyphyllus Turcz, originară din zonele Europei de Est (Ucraina) şi Europei de Sud-Est (România). Planta este spectaculoasă prin cladociile sale ramificate. Analiza histo-anatomică a rădăcinii adventive înfăţişează o structură primară, tipică monocotilelor cu multe fascicule vasculare de xilem şi de floem, sărace în elemente vasculare. Stelul lăstarilor aerieni este alcătuit din numeroase fascicule vasculare mici, colateral închise, sărace în elemente vasculare. Ţesutul mecanic este absent, excepţie făcând periciclul pluristratificat sclerenchimatic. Cladodiul, pe secţiune transversală, are o structură heterogenă, iar fasciculele vasculare ale nervurii centrale sunt sărace în elemente vasculare. Atât slaba reprezentare a ţesutului mecanic în structura lăstarilor, cât şi slaba dezvoltare a sistemului vascular sunt caractere specifice naturii pendente a acestei plante.*

Key words*: anatomy, adventitious root, cladode, vascular bundles, Asparagus brachyphyllus*
Cuvinte cheie**:** *anatomie, rădăcină adventivă, cladodiu, fascicule vasculare, Asparagus brachyphyllus*

INTRODUCTION

Asparagus brachyphyllus Turcz. (fam. Asparagaceae), native to temperate zones of Asia, East Europe (Ukraine) and South-eastern Europe (Romania) is a perennial and dioecious herb (GOLUBEV, 1996; SHELYAG-SOSONKO, 1996). It grows on the littoral strip, steppe and salinic lands closed to the sea coast. Roots are tuberous, subcylindric and flashy. The prostrate stems are climbing, 20-100 cm; branches striate-ridged, usually cartilaginous and denticulate. Cladodes are grouped in fascicles of 4-10. They are modification of the stem in which a branch of single internode is flattened and becomes leaf-like. The proper leaf is reduced to a scale in the axil of which develops a group of linear, narrow, acicular structure. They are slightly flattened, irregularly grooved, usually cartilaginous and denticulate (BOONEY-SOVETTS & SATTLER, 1986, WATSON & DALLVITZ, 1992/2006).

MATERIAL AND METHODS

The plant was collected form Hagieni Forest near by Mangalia town. Small pieces of the adventitious root, climbing stem and cladode were fixed in FAA (formalin:glaciar acetic acid:alcohol 5:5:70). The sampled were obtained by the classical methods used in vegetal histology (BERCU & JIANU 2003). Histological observations and micrographs were performed with a BIOROM –T bright field microscope, equipped with a TOPICA 6001A video camera. The microphotographs were obtained from the video camera through a computer.

RESULTS AND DISCUSSION

Cross sections of *Asparagus brachyphyllus* adventitious root exhibits an external rhizodermis with hairs and passing cells. The rhizodermis consists of one layer of cells. Bellow the rhizodermis such as many monocots' is the external cortex with slightly suberized cells (cutis) (BAVARU & BERCU, 2002; TOMA & RUGINA, 1998). The inner cortex is formed of parenchymatous cells which bear small intercellular spaces in between them (Fig. 1, B). Internally, the many-celled endodermis encloses the stele. The stele contains the vascular system, surrounded by a one-layered pericycle (Fig. 1). The vascular system is represented by 23 xylem and phloem bundles in a radial and alternative arrangement. Xylem consists of one metaxylem vessels (towards the centre), 7-8 protoxylem vessels, and xylem parenchyma. Phloem elements are located between the xylem strings. In between the vascular bundles are the pith rays derived from the pith parenchyma (Fig. 2).

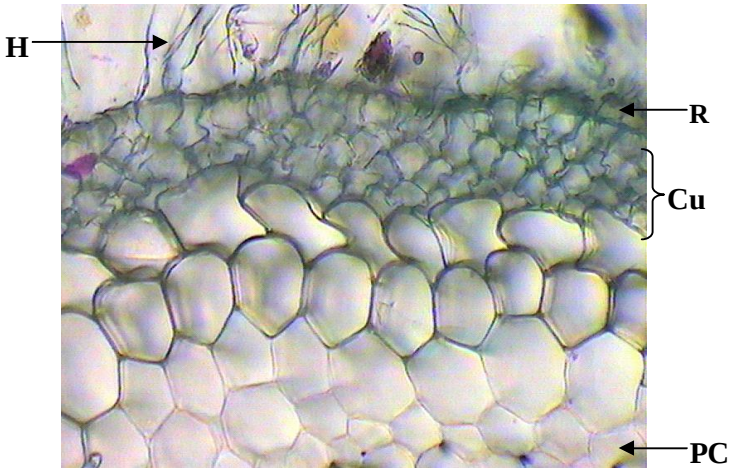

Fig. 1. Portion of the adventitious root with rhizodermis and cortex:
Cu- cutis, H- hairs, R- rhizodermis, PC- parenchymatous cortex (orig.).

The climbing stem in cross section exhibits a circular outline with 8 evidently ridges. The epidermal cells are arranged in a row and covered by a thick cuticle. The epidermal cells are larger in the ridges zone. In between the ridges the epidermal continuity is interrupted by upper stomata (Fig. 3).

Bellow the epidermis is a chlorenchymatous hypodermis (2, 3 layers of cells), followed by a parenchimatous region. Remarkable is the many-celled sclerenchimatous pericycle generating vascular bundles (Fig. 4, A, B). The stele vascular bundles are close and

collateral, aleatory spread into the basal tissue impressing atactostelic feature to the centre cylinder (Fig. 4, C) (FAHN, 1990).

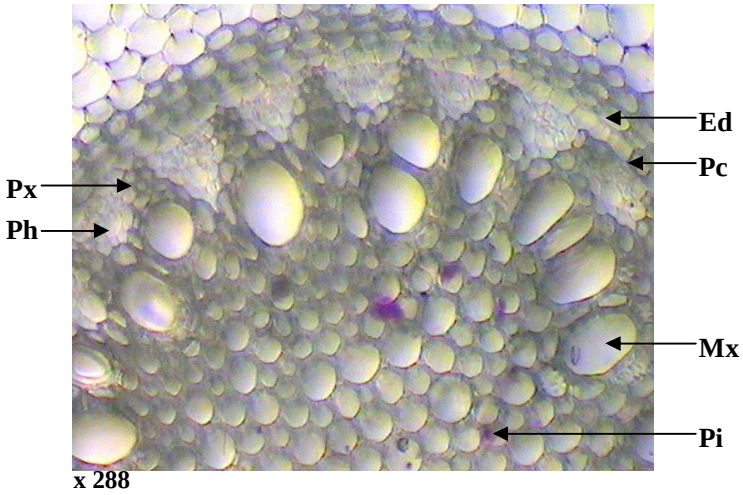

Fig. 2. Portion of the adventitious root stele:
Ed- endodermis, Mx- metaxylem, Pc- pericycle, Ph- phloem, Pi- pith, Px- protoxylem (orig.).

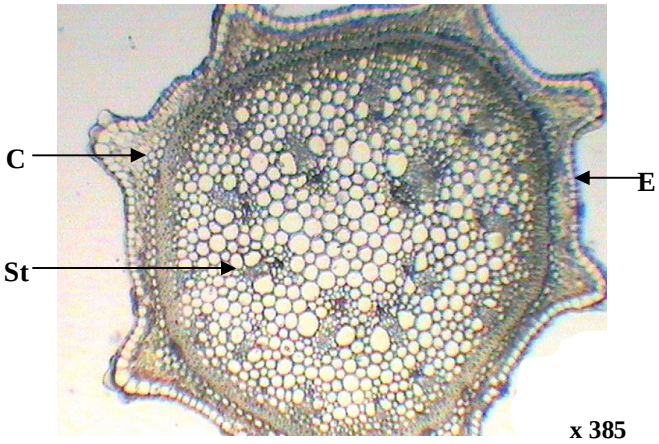

Fig. 3. Cross section of the climbing stem: E- epidermis, C- cortex, St- stele (orig.).

Each vascular bundle is poorly developed formed by few xylem and phloem elements unprotected by bundle sheaths. The central part of the stem is occupied by the parenchimatous pith (Fig. 4, C).

A transection of the cladode reveals the following structure. Epidermis is formed of one layer of thick-walled, barrel-shaped cells. The epidermal cells are covered by cuticle. The epidermis continuity is broken by stomata

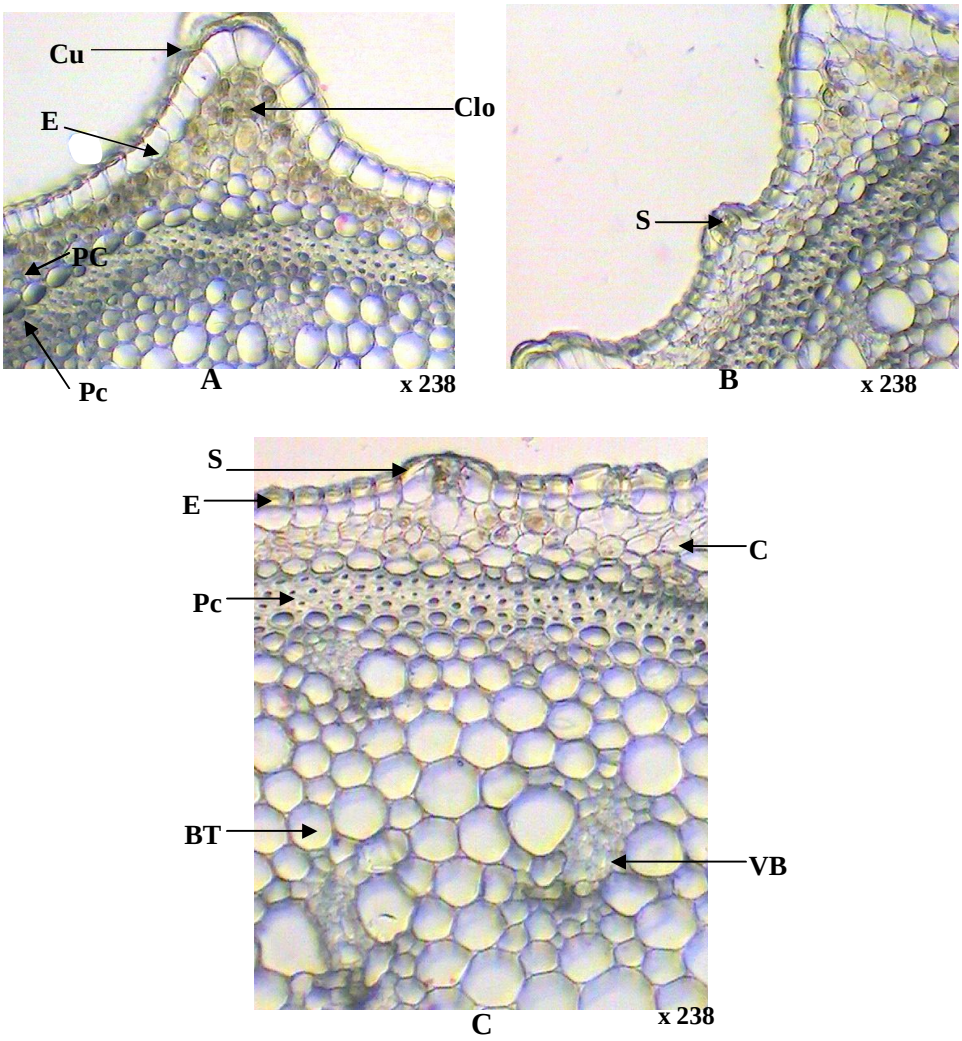

Fig. 4. Cross sections of the climbing stem with. Portions with epidermis and cortex (A, B). Portion of the stele (C): BT- basic tissue, C- cortex, Clo- chlorenchyma, Cu- cuticle, E- epidermis, Pc- pericycle, PC- parenchymatous cortex, S- stoma, VB- vascular bundle (orig.).

The mesophyll is differentiated into a chlorenchymatous zone just bellow the epidermis. It is formed of small columnar cells containing chloroplasts. The chlorenchymatous cells are loosely arranged all around the cladode. The spongy region lies internal the chlorenchyma zone. It is formed of parenchymatous cells containing chloroplasts (BATANOUNY, 1992). The cells are loosely arranged enclosing intercellular spaces (Fig. 5).

The vascular system is represented by two vascular bundles situated in the centre and surrounded by a compact mass of parenchymatous cells. The vascular elements are phloem and xylem. Phloem is present on the upper side whereas xylem is present towards the inner side (Fig. 5).

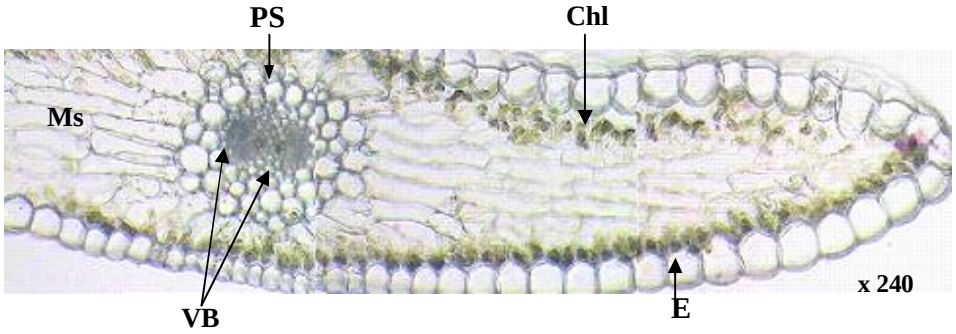

Fig. 5. Cross section of the cladode:
Chl- chloroplast, E- epidermis, Ms- mesophyll, PS- parenchymatous sheath, VB- vascular bundle (orig.).

CONCLUSIONS

The root possesses a primary The cladode of *Asparagus brachyphyllus* shows the following xerophytic traits. Epidermis is covered externally by a thick cuticle. The palisade and spongy cells contain abundant chloroplasts, indicating that in the absence of the normal leaves, the photosynthetic function has been taken up by cladode. Stomata are few in number as a cheek against transpiration.

LITERATURE

1. BATANOUNY, K.,H., *Plant Anatomy*. University Press, Cairo, 1992.
2. BAVARU, A., BERCU, R., *Morfologia şi anatomia plantelor*, Ed. Ex Ponto, Constanţa, 2002.
3. BERCU, R., JIANU, D.L., *Practicum de Morfologia şi anatomia plantelor*, Ovidius" University Press, Constanţa, 2003.
4. BOONEY-SOVETTS, C., SATTLER, R., *Phylloclade development in the Asparagaceae: An example of homoeosis"*, Bot. J. Linn. Soc. 94/1986, pg. 327-371.
5. FAHN, A., *Plant Anatomy*, (4th ed.), Pergamon Press, Elmford, New York, 1990.
6. GOLUBEV, V.N., 1996, *Biologicheskaya flora Kryma* (Biological Flora of the Crimea), Yalta, GNBS.
7. NYÁRÁDY, E.I. (Editor-in Chief), *Flora României*, Vol. XI, Ed. Acad. Române, 1966.
8. SHELYAG-SOSONKO Y.R. (ed.), , Chervona Knyga Ukrayiny, (The Red Data Book of Ukraine). Kyiv: Ukrayins'ka Entzyklopediya, 1996.
9. TOMA, C., RUGINA, R., *Anatomia plantelor medicinale*, Ed. Academiei Române, Bucuresti, 1998.
10. WATSON, L., & DALLWITZ, M.J. (onwards), *The families of flowering plants: descriptions, illustrations, identification, and information retrieval*, 1992, Version: 29th, 2006.