ANATOMICAL ASPECTS OF THE VEGETATIVE ORGANS OF SOME SYNANTHROPIC PLANT SPECIES

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Abstract. To highlight certain anatomical characteristics of the vegetative organs of synanthropic plants there were performed superficial sections and cross-sections through the root, stem and leaf of the plant species frequently found within the analysed area around Pitesti, Mioveni and Maracineni. *Conyza canadensis* (L.) CRONQ. has been selected owing to the following reasons: this species is widespread over the analysed areas; *Conyza canadensis* (L.) CRONQ. is a species which was brought to Europe in 1655, being thus, seen as belonging to the neophyte category (that is plants introduced in Europe after 1500) or adventitious plant category (CIOCÂRLAN, 2009); the species has never been analysed from a structural point of view. The registered anatomic data together with the physiological and ecological ones plead for labelling these species as type C_4 plants.

Keywords: *Conyza canadensis* (L.) CRONQ., *Conyza* type leaf trichomes, anatomy of vegetative organs.

Rezumat. Aspecte anatomice ale organelor vegetative la unele specii de plante sinantrope. Pentru evidenţierea unor particularităţi anatomice ale organelor vegetative la plantele sinantrope au fost efectuate secţiuni transversale şi tangenţiale prin rădăcină, tulpină şi frunză la specii de plante mai frecvent întâlnite în zonele cercetate din Piteşti, Mioveni şi Mărăcineni. Specia *Conyza canadensis* (L.) CRONQ. a fost aleasă din următoarele motive: este foarte răspândită în zonele cercetate; este o specie ajunsă în Europa în 1655, fiind considerată neofită (plantă introdusă în Europa după 1500) sau adventivă (CIOCÂRLAN, 2009); specia nu a mai fost analizată din punct de vedere structural. Datele de anatomie obţinute, corelate cu cele de fiziologie şi ecologie, pledează pentru încadrarea acestei specii la plantele de tip C_4.

Cuvinte cheie: *Conyza canadensis* (L.) CRONQ., peri de tip *Conyza*, anatomia organelor vegetative.

INTRODUCTION

Conyza canadensis (L.) CRONQ., 1943, is widespread over almost all plain units, in rural areas and at the edge of the woods, in the outskirts, along less circulated rural roads and so on (ROŞESCU, 2009). This plant is acclimated to excess light exposure and high temperatures.

MATERIAL AND METHODS

To highlight certain anatomical characteristics of the vegetative organs, there were performed superficial sections and cross-sections through the root, stem and leaf of *Conyza canadensis* (L.) CRONQ. The samples were prepared for microscopic analysis by cutting the biologic material in the pith of elder (*Sambucus nigra*) with a blade (razor). There were performed cross sections through the root, stem and leaf and superficial sections in the leaf (concerning in stripping the epidermis), the superior and inferior epidermis being analysed subsequently.

Brightening and colouring the sections were undergone according to the method presented in ANDREI & PARASCHIVOIU (2003) (treating with Javel water, colouring with Congo red and iodine green, assembling in glycerine). The microscopic samples were examined and photographed using a microscope type DOCUVAL. The displayed photographs and schemes, representing sections through the vegetative organs of *Conyza canadensis* (L.) CRONQ. are genuine.

RESULTS AND DISCUSSIONS

Cross section through the root

The section we presented had been performed through a conducting root with a secondary structure. Observing this section it is easy to notice different degrees of exfoliating in the case of rhizodermis, a 3-4-layered periderm made of parenchyma cells, a central well developed diarh cylinder having a well-represented xylem (Fig. 1).

Cross section through the stem

The section performed through the stem emphasizes the fact that this vegetative organ is involved in the process of photosynthesis, both the epidermis and the cortex being rich in chloroplasts. Studying the cross section it is easy to see that the stem seems furrowed, the ridges of the furrows being strengthened by packs of sclerenchyma cells, which are elongated by parenchyma cells that surround the poles of both the xylem and phloem at their superior end (Figs. 2; 3). Between two ridges, there are smaller packs consisting of palisade cells and between two larger furrows, there are double or triple packs of palisade cells. The palisade cells are ranged in 3-5(6) lines between two large furrows and in less than 5 lines between two smaller furrows.

In longitudinal sections the ridges appear as light-coloured bands, wider (large ridges) or narrower (small ridges). The spaces between the ridges appear as dark-coloured bands due to the packs of palisade cells (Figs. 4; 5).

In superficial sections, the epidermis of the stem is covered by a layer which appears as a series of longitudinal ridges (Fig. 6) and presents rare stomata.

Cross section through the leaf

In cross section, at the midrib level, it is easy to recognize two bundles of under-epidermis sclerenchyma, at the two poles of the vascular tissue (xylem and phloem). It is easy, as well, to see the bottom of a trichome, which goes from the epidermis exactly above the superior sclerenchyma pole (Figs. 7; 8).

What customizes this structure is the ground tissue. This is made of 2/3 layers of palisade cells situated just under the upper epidermis, cells that are rich in chloroplasts. Then, it comes an intermediary tissue, made of 2-3 layers of cells containing less chloroplasts and again 2/3 layers of palisade cells at right angles on the lower epidermis. Such structure is specific to ecvifacial leafs.

The palisade parenchyma technically surrounds the spongy parenchyma, being interrupted only at the midribs level, where the midribs are covered by sheaths (type Kranz structure, crown) (Fig. 9). This structure corresponds to the organization of a xeromorphe leaf, as in the case of *Atriplex* sp. (ESAU, 1960). From the point of view of the way of CO_2 photosynthetic assimilation, the structure of the leaf of *Conyza canadensis* (L.) CRONQ., ranges as type C_4.

In the palisade mesophyll of the leaf, from place to place, one can see secretory cavities, limited by parenchyma cells, where etheric oil is accumulated (Fig. 10).

Both epidermises are interrupted by type anisocytic stomata (Fig. 11) and specific pluricellular trichomes. Stomata open when exposed to light. The trichomes on the upper epidermis, which are better developed, are specialized at the level of the packs of sclerenchyma. Analyzing figure 12, it is easy to notice the fact that the trichomes are surrounded by a thick cuticula, which prolongs on their entire surface, in the shape of some obvious ridges. The cells of the trichomes convey by perforated walls.

Trichomes

A special structure specific to this plant, to be seen on both leaves and stems, is the trichomes. There are registered two types of trichomes:

- pluricellular trichomes, filiform, very long, made of uniform cells;
- shorter pluricellular trichomes, made of heteromorphous cells.

We assume that the first mentioned type of trichome, thin and uniform, perform the role of merging the second type (Fig. 13).

The second type of trichomes can be described as: pluricellular, stronger, with a pluricellular base, their cell walls are thick and are covered by an obvious cuticula, which has multiple protective functions among which we can mention: humidity adjustment at the organ surface, defence against different aggressions in the external environment, (TOMA, 1975-1977; TOMA & NIŢĂ, 1985, 1995). The trichomes are living entities, made of cells with individual nucleus, which grow in length from the bottom to the top. These cells have perforated cell walls, at which level plasmodesma cells can be noticed. The plasmodesma cells perform the role of connecting structurally and physiologically the trichome cells (type Conyza trichome) (ANDREI & PREDAN, 2007; TOMA & ANGHEL, 1985) (Figs. 14; 15).

Within a certain period of the year, these trichomes are uprooted. Their active part is at the bottom formed by 3-4 cells (Figs. 16-18). The top of the majority of the trichomes curve when it comes in touch with the others resulting in a protective cloth (Fig. 19).

Conyza type trichome play a double role: of protection and of nutrition or of absorbing water from the atmosphere. During their first period of life, the trichomes play a protection role against the herbivorous animals, due to their rigidity, while during the second period of life a major part of the trichomes die, except for 3-4 cells at the bottom which stay alive and ensure nutrition. The death of these cells is preceded by the issue of some intercellular cells filled with tannin.

CONCLUSIONS

As a result of the research, we can conclude as follows:

- the root of *Conyza canadensis* (L.) CRONQ displays a central diarch cylinder, a cortex with parenchyma cells and an exfoliated rhizodermis;
- the stem is furrowed, with ridges reinforced by packs of sclerenchyma; between the ridges there are packs of palisade cells;
- the leaf is ecvifacial, it has palisade tissue under both epidermis, the palisade tissue surrounding the spongy tissue; at the poles of the xylem-phloem bundle, there are packs of sclerenchyma and the midrib is covered by nutritive sheaths (type Kranz structure);
- epidermis displays two types of pluricellular trichomes, some are filiform, very long, made of uniform cells, the others are shorter pluricellular trichomes, made of heteromorph cells - Conyza type trichome, whose tops can curve or tear, resulting into an assimilating stump. Conyza type trichome play a double role: of protection and of nutrition.

From a physiological point of view, such a structure of the leaf (with almost all the cells of the mesophyll involved in the process of photosynthesis) and of the stem (the presence of the palisade cells) leads to the conclusion that the photosynthesis processes are more intense comparing to other heliophile-xerophile plants. From an ecological point of view, the analysed species grow in both permanent light and high temperatures conditions. Such conditions are to be found in rural areas and in the outskirts. Anatomic data, connected with the physiological and ecological ones, plead for ranging this species among C_4 type plants. It is undoubtedly obvious that only a biochemical study of the photosynthesis products can decide without any doubt on this labelling.

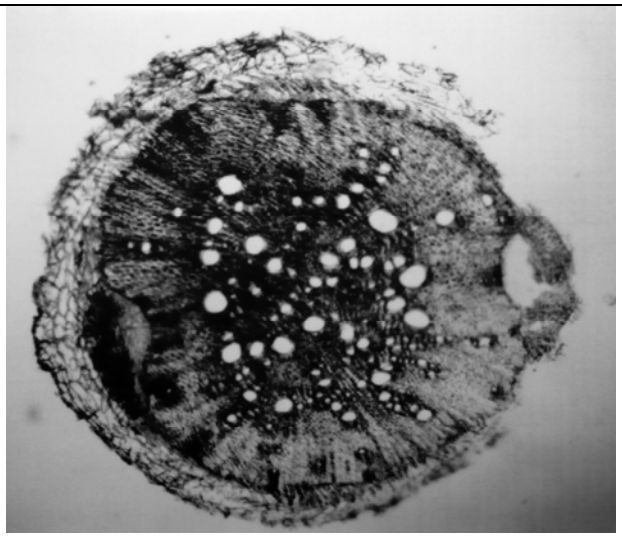

Figure 1. Cross section through the root of *Conyza canadensis* (L.) CRONQ. (Oc. 10×; Ob. 40 + ampl.). / Figura 1. Secţiune transversală prin rădăcină la *Conyza canadensis* (L.) CRONQ. (Oc. 10×; Ob. 40 + ampl.) (original).

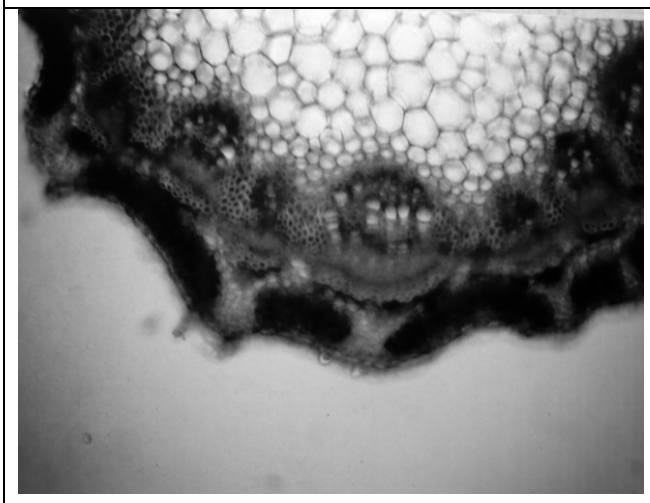

Figure 2. Cross section through the stem of *Conyza canadensis* (L.) CRONQ. (Oc. 10×; Ob. 40 + ampl.). / Figura 2. Secţiune transversală prin tulpina de *Conyza canadensis* (L.) CRONQ. (Oc. 10×; Ob. 40 + ampl.) (original).

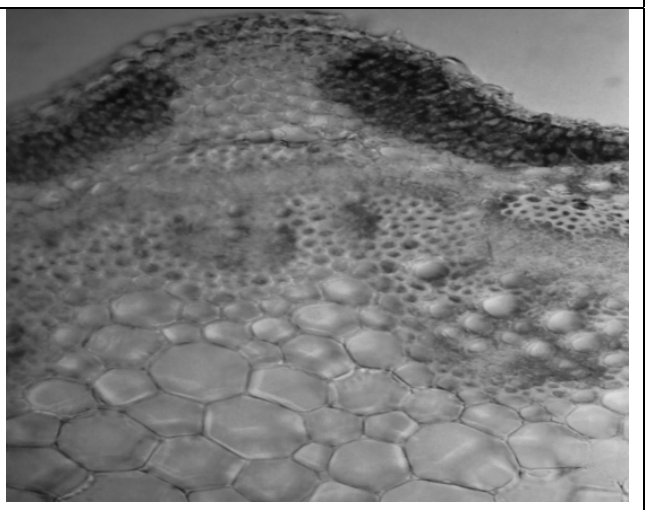

Figure 3. Sclerenchyma Packs in the stem of *Conyza canadensis* (L.) CRONQ. (Oc. 10×; Ob. 40 + ampl.). / Figura 3. Pachete de sclerenchim din tulpina de *Conyza canadensis* (L.) CRONQ. (Oc. 10×; Ob. 40 + ampl.) (original).

Figure 4. Longitudinal section through the stem of *Conyza canadensis* (L.) CRONQ. (Oc. 10×; Ob. 40). / Figura 4. Secţiune longitudinală prin tulpina de *Conyza canadensis* (L.) CRONQ. (Oc. 10×; Ob. 40) (original).

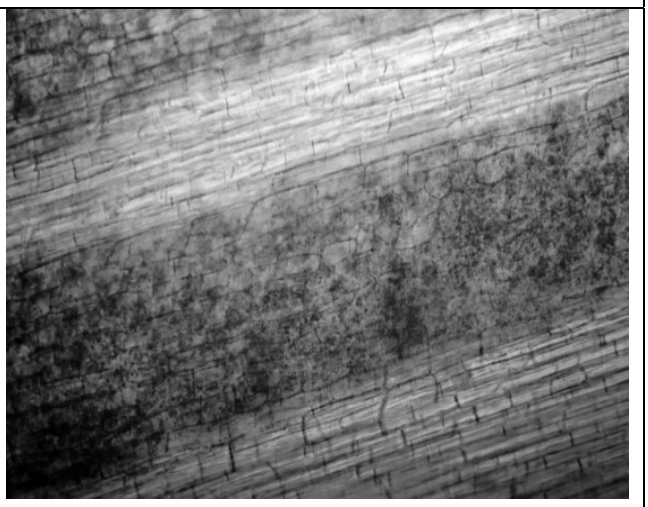

Figure 5. Longitudinal section through the stem of *Conyza canadensis* (L.) CRONQ. Ridges and the areas between (Oc. 10×; Ob. 40 + ampl.). / Figura 5. Secţiune longitudinală prin tulpina de *Conyza canadensis* (L.) CRONQ. Coaste şi zone intercostale (Oc. 10×; Ob. 40 + ampl.) (original).

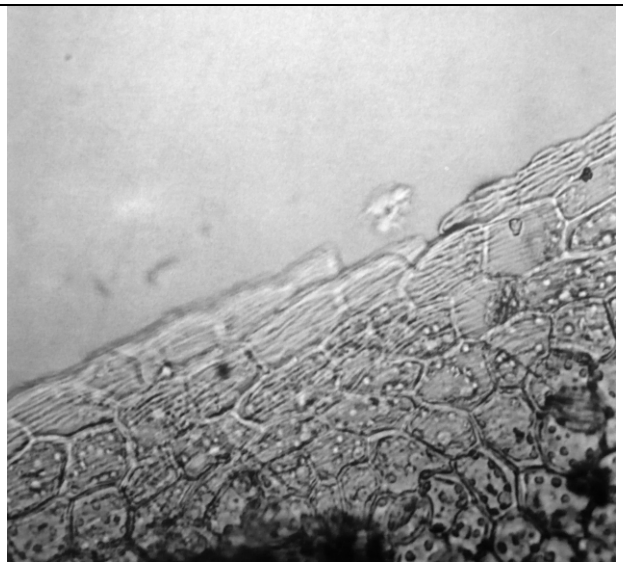

Figure 6. Superficial sections through the stem of *Conyza canadensis* (L.) CRONQ. The epidermis of the stem (Oc. 10×; Ob. 40 + ampl.). / Figura 6. Secțiune tangențială prin tulpina de *Conyza canadensis* (L.) CRONQ. Epiderma tulpinii (Oc. 10×; Ob. 40 + ampl.) (original).

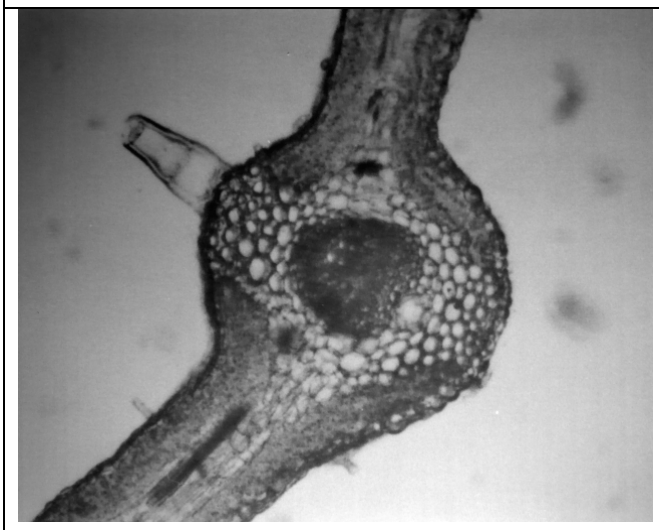

Figure 7. Cross section through the leaf of *Conyza canadensis* (L.) CRONQ. (Oc. 10×; Ob. 40). / Figura 7. Secțiune transversală prin frunza de *Conyza canadensis* (L.) CRONQ. (Oc. 10×; Ob. 40) (original).

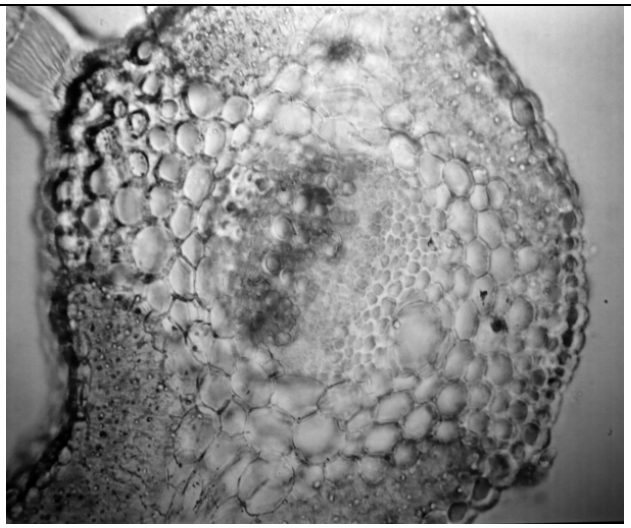

Figure 8. Cross section through the leaf of *Conyza canadensis* (L.) CRONQ. The midrib (Oc. 10×; Ob. 40+ampl.). / Figura 8. Secțiune transversală prin frunza de *Conyza canadensis* (L.) CRONQ. Nervura mediană (Oc. 10×; Ob.40+ampl.) (original).

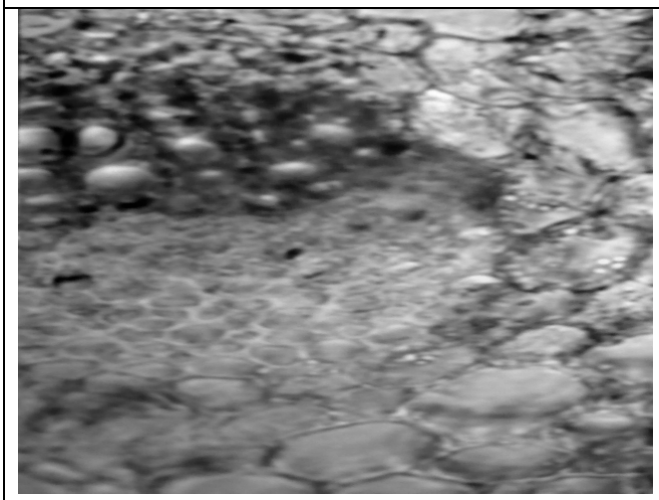

Figure 9. Assimilation perifascicular sheaths at *Conyza canadensis* (L.) CRONQ. (Oc. 10×; Ob. 40 + ampl.). / Figura 9. Teacă perifasciculară asimilatoare la *Conyza canadensis* (L.) CRONQ. (Oc. 10×; Ob. 40 + ampl.) (original).

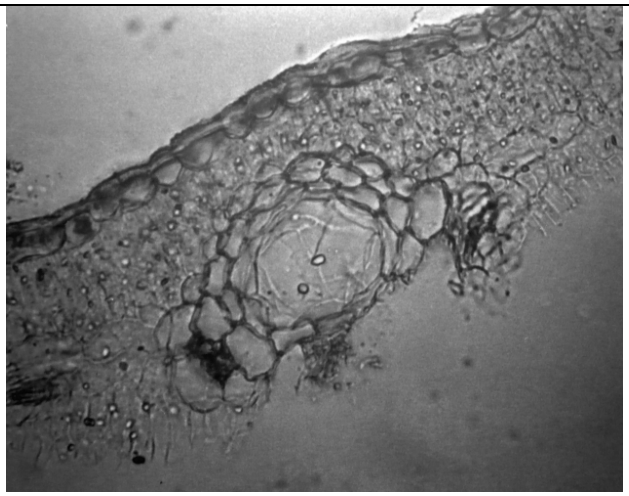

Figure 10. Secretory cavities in the leaf of *Conyza canadensis* (L.) CRONQ. (Oc. 10×; Ob. 40 + ampl.). / Figura 10. Cavități secretoare din frunza de *Conyza canadensis* (L.) CRONQ. (Oc. 10×; Ob. 40 + ampl.) (original).

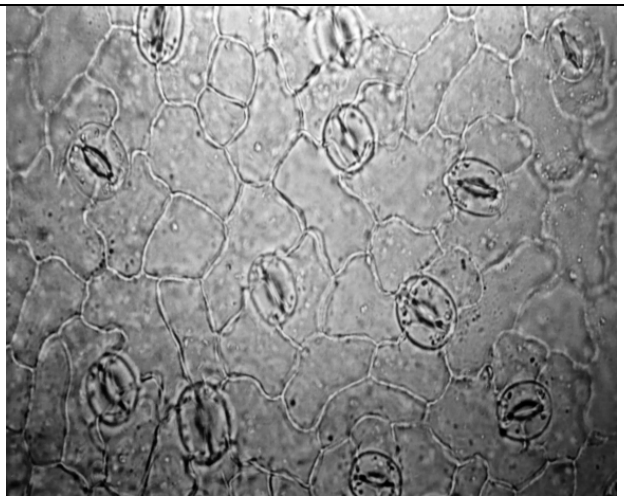

Figure 11. Anisocytic-type stomata in the leaf of *Conyza canadensis* (L.) CRONQ.(Oc. 10×; Ob. 40 + ampl.). / Figura 11. Stomate de tip anizocitic din frunza de *Conyza canadensis* (L.) CRONQ. (Oc. 10×; Ob. 40 + ampl.) (original).

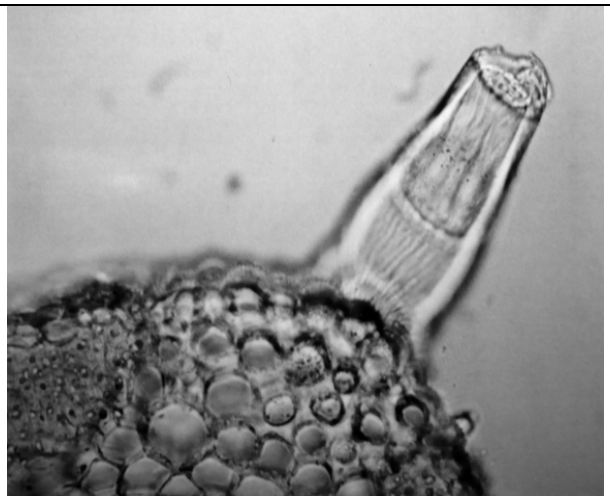

Figure 12. Trichomes in the upper epidermis of the leaf of *Conyza canadensis* (L.) CRONQ. (Oc. 10×; Ob. 40 + ampl.). / Figura 12. Păr din epiderma superioară a frunzei de *Conyza canadensis* (L.) CRONQ. (Oc. 10×; Ob. 40 + ampl.) (original).

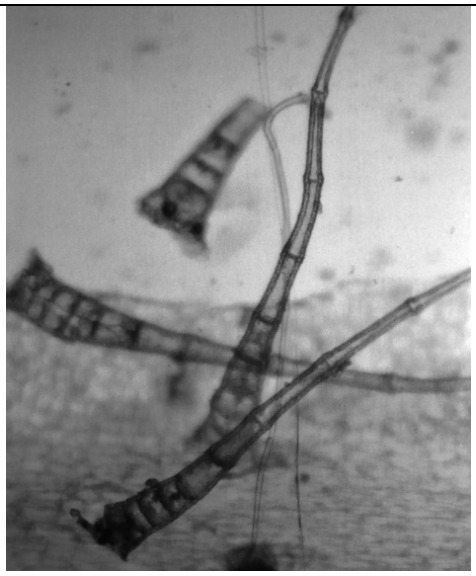

Figure 13. Epidermis trichomes at *Conyza canadensis* (L.) CRONQ. (Oc. 10×; Ob. 40). / Figura 13. Perii epidermali la *Conyza canadensis* (L.) CRONQ. (Oc. 10×; Ob. 40) (original).

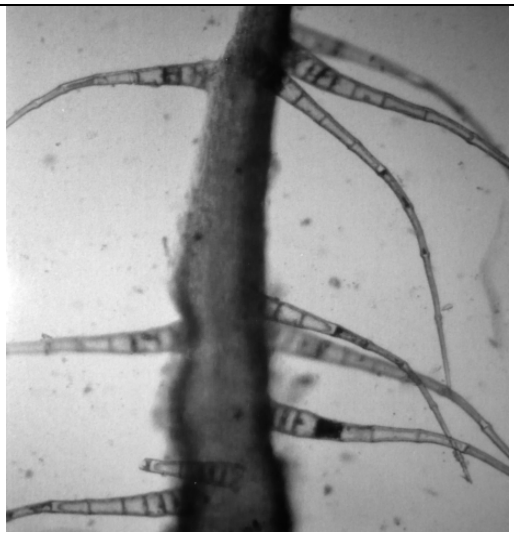

Figure 14. *Conyza* type trichome (Oc. 10×; Ob. 40). / Figura 14. Peri de tip *Conyza* (Oc. 10×; Ob. 40) (original).

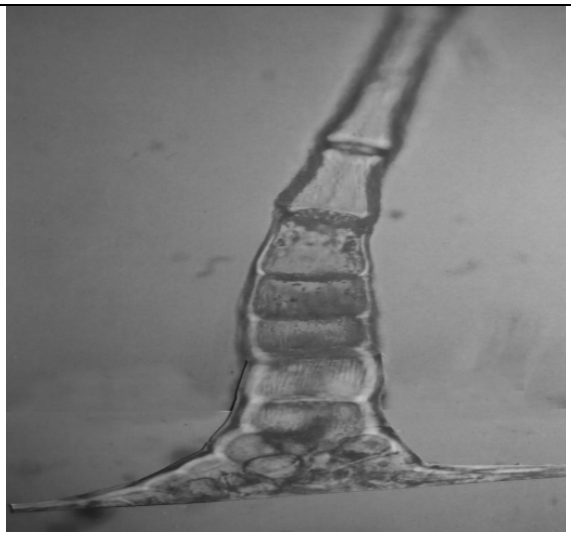

Figure 15. *Conyza* type trichome structure (Oc. 10×; Ob. 40 + ampl.). / Figura 15. Structura părului de tip *Conyza* (Oc. 10×; Ob. 40 + ampl.) (original).

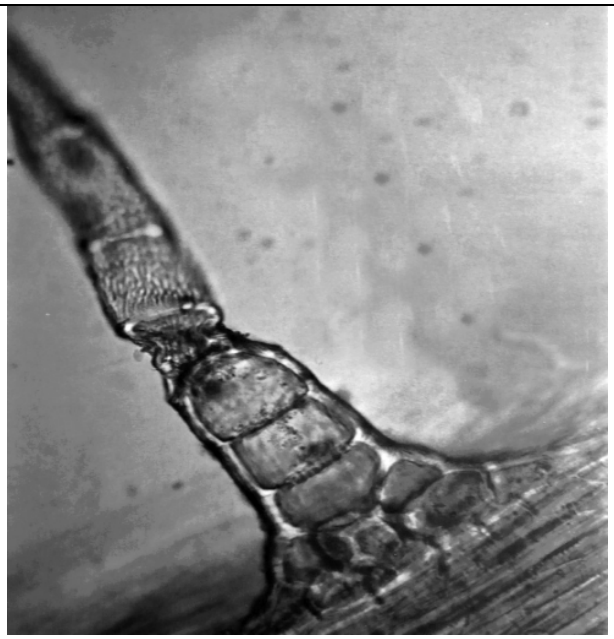

Figure 16. Detaching the *Conyza* type trichome top (Oc. 10×; Ob. 40 + ampl.). / Figura 16. Detaşarea vârfului la părul de tip *Conyza* (Oc. 10×; Ob. 40 + ampl.) (original).

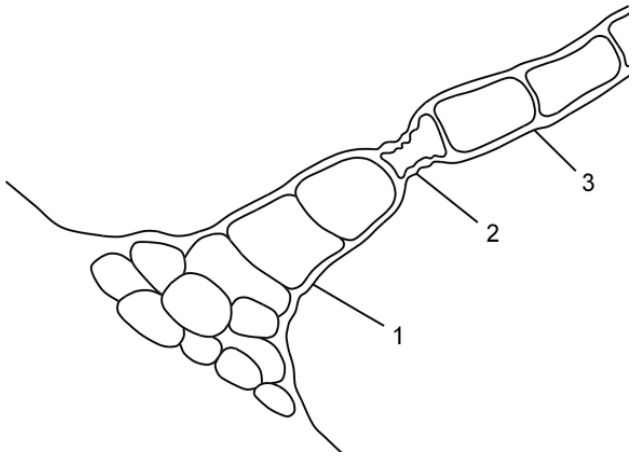

Figure 17. Detaching the *Conyza* type trichome top Scheme (1-trichome bottom; 2-tanin cell; 3-trichome top). / Figura 17. Detaşarea vârfului la părul de tip *Conyza*. Reprezentare schematică (1-bază păr; 2-celulă cu tanin; 3-vârf păr) (original).

Figure 18. "Assimilating stumps" of *Conyza* type trichome (Oc. 10×; Ob. 40). / Figura 18. "Cioturi" asimilatoare ale perilor tip *Conyza* (Oc. 10×; Ob. 40) (original).

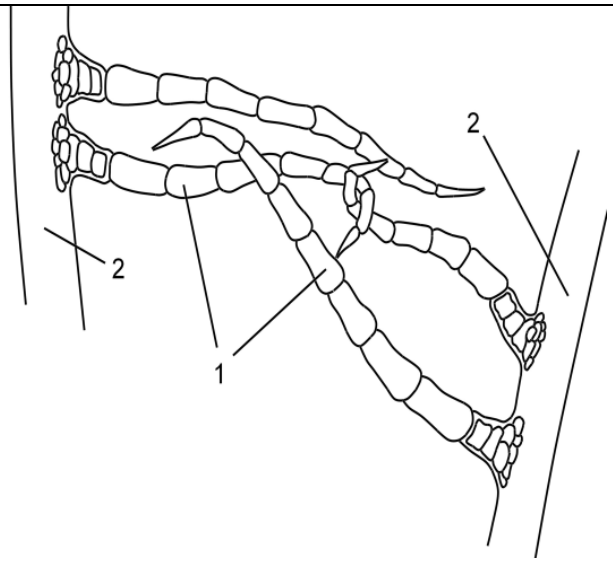

Figure 19. Curved *Conyza* type trichome (1-trichome, 2- stem fragment) (Oc. 10×; Ob. 40). / Figura 19. Curbarea perilor de tip *Conyza* (1-păr; 2- fragment de tulpină) (Oc. 10×; Ob. 40) (original).

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