# MORPHOGENETICAL ASPECTS IN *HELIANTHUS ANNUUS* L. DURING THE ONTOGENESIS

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*Sunflower (Helianthus annuus) is annual plants native to Mexico and is valuable from economic, as well as from ornamental point of view. In this paper the edification of the primary and the secondary structure of the vegetative organs were followed during the ontogenesis. The root with primary structure is tetrarch, with four strands each of xylem and phloem that alternate with one another. In the secondary structure a massive of xylem could be observed in the central cylinder. The young stem has primary structure and circular shape in cross-section. The central cylinder is delimited by an endodermoid layer with starch grains. The vascular bundles are of collateral type, with an intense morphogenetic activity. The secondary structure is formed by only by cambium activity. It produces new vascular bundles, only with secondary structure, between the initial one. At the plant stem basis, a continuous ring o secondary xylem is present. Both in the stem with primary and secondary structure, secretory canals could be observed in cortex, pith and medullar rays. The petiole has semicircular shape, with small and large vascular bundles distributed on an arch. A continuous band of angular collenchyma is visible under the epidermis. The mesophyll of the leaf is formed only from by palisade parenchyma.*

***Key words****: anatomy, secretory structures, sunflower*

*Asteraceae* family member sunflower (*Helianthus annuus* L.) has a great importance in industrial crops with its high oil content. The sunflower seed is not used only for the industrial production of table oil or bio diesel, but also for the production of cold pressed table oil, husked seeds, roasted or fresh, that could be used whole or grounded for different foods [7].

There are a lot of studies on anatomical properties of taxa of family *Asteraceae* [1, 2, 4, 5, 6, 9, 10, 11], but they only few information about the morphogenetical aspects of *Helianthus annuus* [3, 8].

In this paper, some specific histological features concerning the moment of the passing to the secondary structure of stem, development level of the mechanical tissues, tectors and secretory hairs structure, secretory canals places, conducting system conformation, disposition of stomata and mesophyll differentiation are evidenced.

### MATERIAL AND METHOD

Vegetal material investigated from histo-anatomic point of view was preserved from a cultivated field near Iasi city. It consists in whole plants, in different stages of ontogenesis. All plants were been fixed and preserved in ethylic alcohol 70%. The sections made with free hand using a razor blade and colored with ruthenium red and methylen-blue. At this species the anatomical longitudinal symmetry phenomenon was evidenced. The photos were made after the obtained permanent slides using an Olympus BX51 microscope with an Olympus E-330 digital photo camera.

## RESULTS AND DISCUSSIONS

The root with primary structure is tetrarch with 4 strands of xylem and 4 strands of phloem (*fig. 1a*). The secondary structure is generated from the vascular and cork cambium activity. The vascular cambium arises from a combination of the procambium and pericycle cells. The cork cambium is formed entirely from pericycle cells (fig. 1b). Secretory canals occur on the inner cortex and phloem, but they may also occur internally to the endodermis, associated with the pericycle; these situations have been recorded in two species of the tribe *Heliantheae* [6].

The stem is circular in cross section at all analyzed levels (*fig. 1c, 2a, c*). The epidermis shows numerousness large non-glandular and glandular hairs (*fig. 1c*). Under the epidermis, 8-11 layers of angular collenchyma could be observed (*fig. 1d, e, 2b*). The cells have visible thick walls at their corners; between cells, especially in the internal part, some intercellular spaces are visible. The endodermis is sinuous, more visible near the vascular bundles; between bundles, isolate islands of phloemic tissue could be observed (*fig. 1e, f*).

The stem with primary structure contains collateral type vascular bundles arranged cyclically. At the top of the stem, an undifferentiated mechanic tissue protects each bundle (*fig. 1d*). In the secondary structure, this tissue will become a sclerenchyma (*fig. 2a, c*). In the cortex and in the pith, secretory canals, with a tight or large lumen and 4-10 epithelial cells could be observed (*fig. 1c, d, 2c, d, e*). The organization of secretory structures in *Asteraceae* has been extensively studied by Col (1904) [2]. He recognized two distinct types of secretory canals: the secretory canal itself, which is always formed near the endodermis, and secretory purses, which are wider and shorter than the canals, and have their cavity surrounded by secretory cells.

The secondary structure is formed by only by cambium activity. It produces new vascular bundles, only with secondary structure, between the initial one. At this level only the secondary phloem is functional (*fig. 2f*).

The petiole is semicircular in cross section, with rounded angles. In hypodermic position angular collenchyma could be observed (*fig. 3a*).

The midrib is visible prominent on the adaxial and abaxial sides, both in young and mature leaves (*fig. 3b, d*). The young leaves are covered with

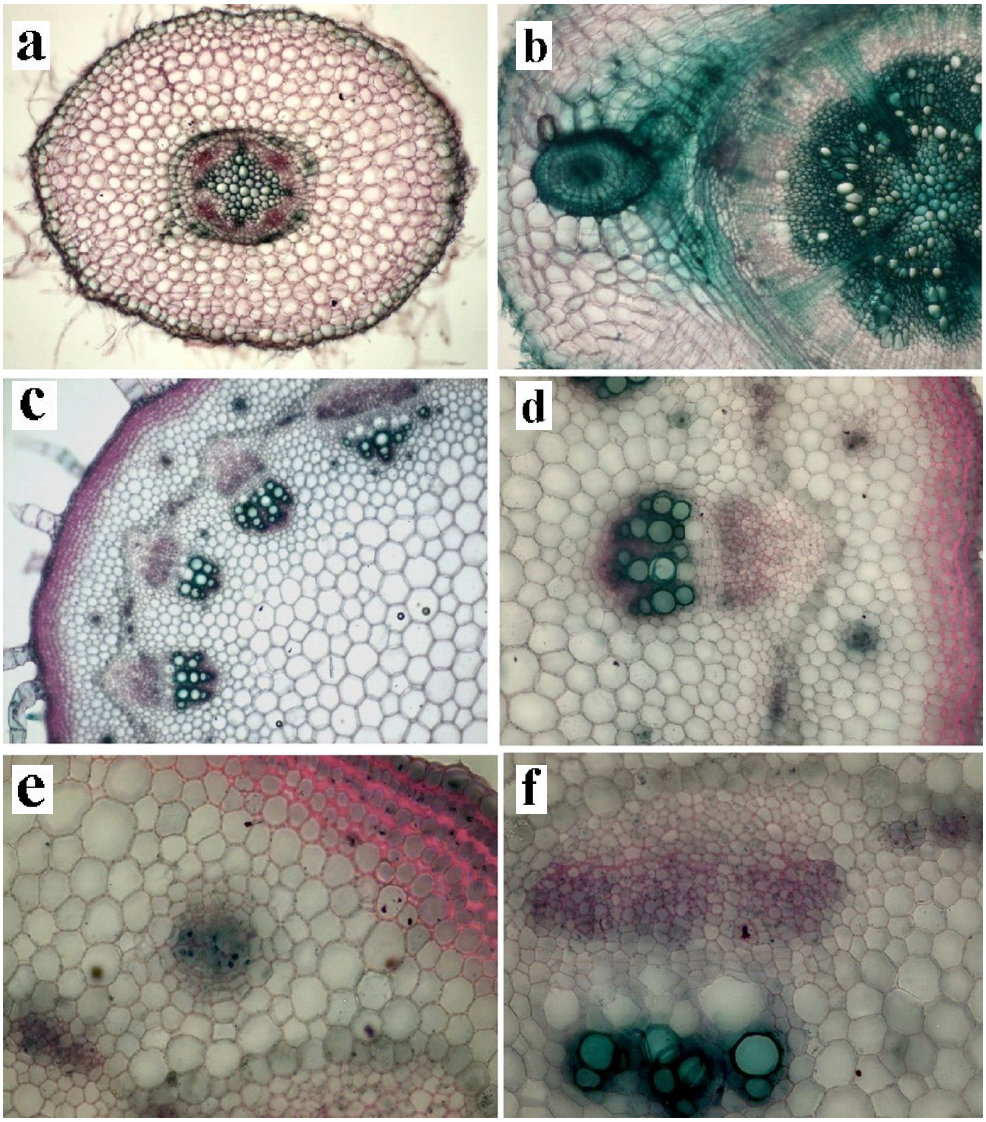


Figure 3 a, b **cross sections through the root: a – primary structure, b – secondary structure; c –cross sections through the top of the stem, d - detail, e – detail from a secretory canal, f – detail from a vascular bundle (original)**

numerousness tector and secretory hairs (*fig. 3b, c*). Their number decrease visibly on the mature leaf (*fig. 3d, e*).

Upper and lower epidermis has large cells; the stomata are present in both epidermises (amphystomatic leaf with anomocytic stomata). The leaf has bifacial isofacial structure; the mesophyll is formed only from palisade parenchyma. The length of the palisade cells decrease from the upper to the lower epidermis.

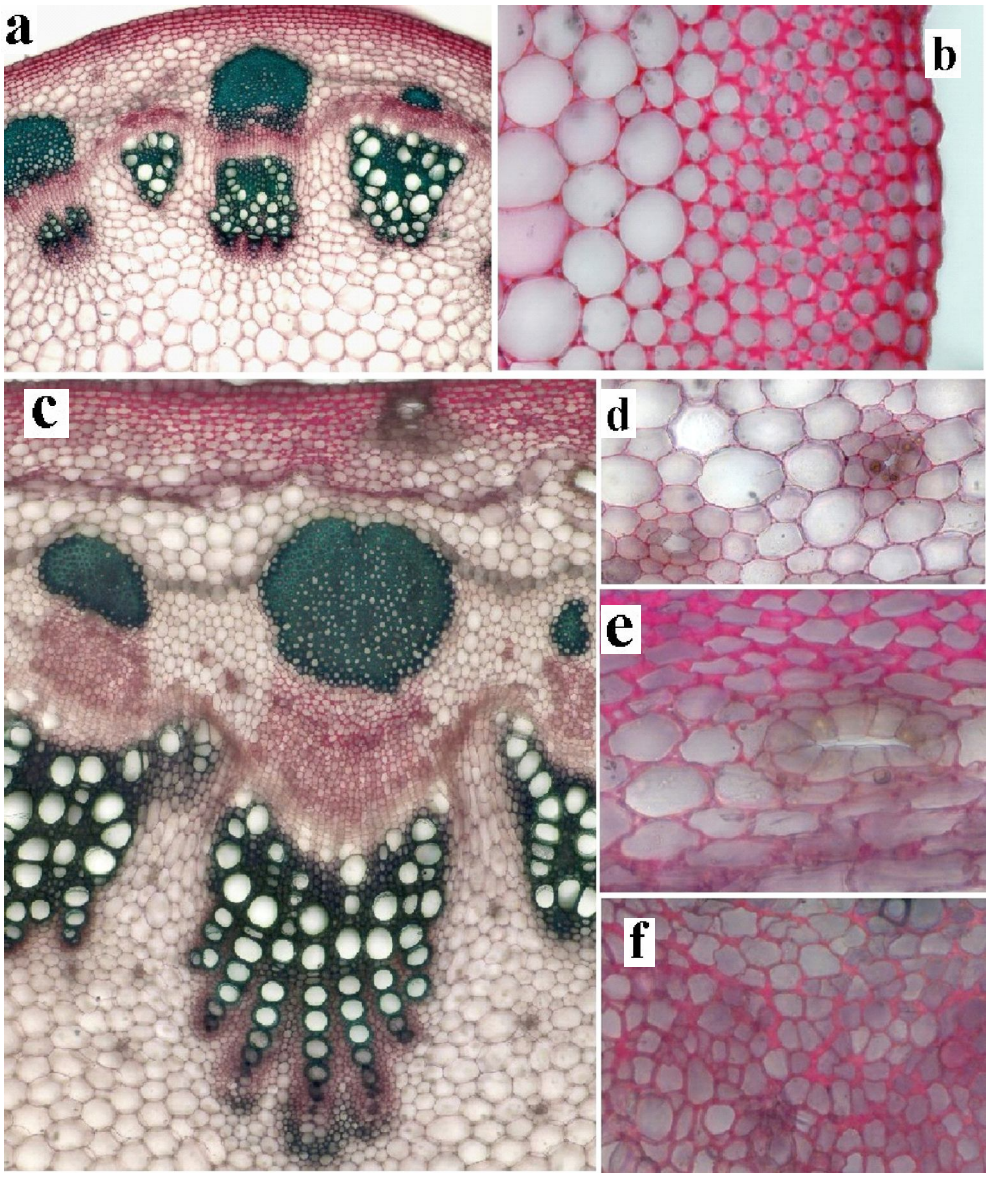


Figure 2 **Cross sections through the stem: a – middle part of the stem, b – detail from the subepidermic collenchyma, c – basal part of the stem, d, e – details with secretory canals, f – detail from primary (crushed) and secondary (functional) xylem (original)**

At the ribs level, secretory canals could be observed (*fig. 3f*). They are missing from the leaf lamina. The vascular bundles from ribs have only primary structure (*fig. 3f*).

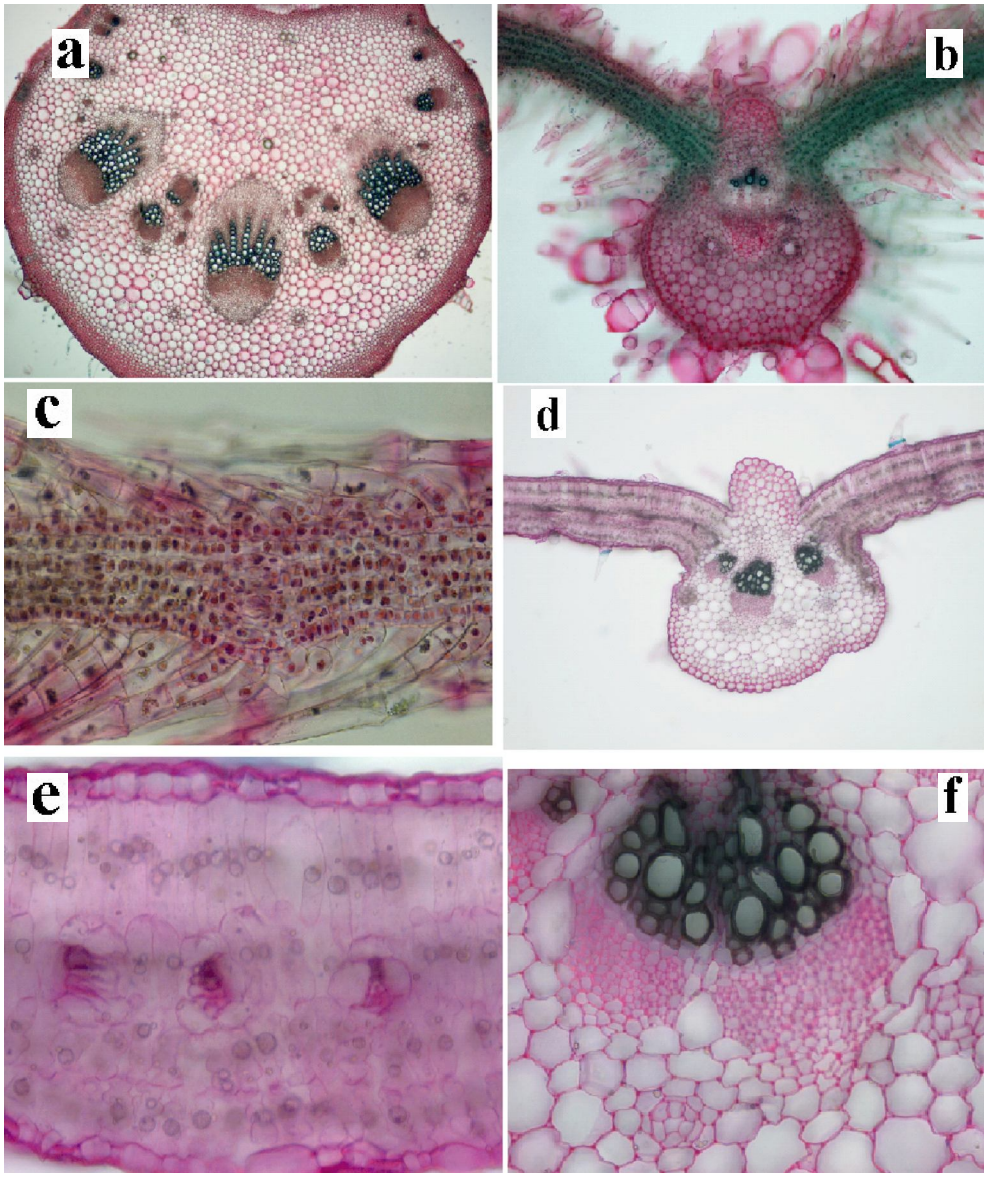


Figure 3 a **Cross section through the petiole; b, c – cross sections through the young leaf: b – detail from midrib, c – detail from lamina; d-f – cross sections through mature leaf: d – midrib, e – detail from lamina, f – detail from midrib (original)**

## CONCLUSIONS

*Helianthus annuus* is an annual plant with a rapid grow rate; this fact is supported by the intense activity of the meristematice tissues (both in primary and in secondary structure). The roots acquire quickly secondary structure and rapidly increase the uptake rate of the water from the soil. The stem has primary structure only at their top and only in young plants. The secondary structure assures the necessary resistance for the sustainability of the inflorescence. At the flowering stage, the stem has secondary structure in all their length. The leaves have isofacial structure and the mesophyll consist only in palisade parenchyma. It assure the best photosynthesis rate because their structural peculiarities.

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