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Anatomic study of the main root and stem-root localization and identification of secretor vittae *Sphaerosciadium denaense* (*Apiaceae*)

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ABSTRACT: For the first time studied the structure of the underground organs and localization in their secretor vittae *Sphaerosciadium denaense* relict and endemic plants listed in the Red Book of the Republic of Uzbekistan. The root system of the studied species represented the main root and branching weak biaxial stem-root. It was revealed that the morphological structure of the main root is closely related to its anatomical structure - deep taproot type of root system led to strong development of xylem tissue of the conduction system, vegetation on rocky slopes and in rock crevices gave spindle-shaped because of the constant squeezing hardwoods increased layering and wrinkling exfoliated traffic jams. Stem-root has a similar structure to the main root and differences stem-root is reflected in the presence core and of small cell phloem tissue. The main part of the secretor vittaes in underground organs located in the phloem tissue, partly secondary cow parenchyma of epithelial cells in an amount of 6-8, in the main root secretor vittae of different size than stem-root.

***Keywords*:** Main root, deep taproot type, stem-root, secretor vittae, endemic, rare species, *Apiaceae, Sphaerosciadium denaense*, Hissar Range.

Symbols. C – cork, GS – grains starch, K – cambium, MR – main root, RB – radial beam, SV - secretor vittae, SR – stem-root, V - vessel.

INTRODUCTION

Family - *Apiaceae* Lindley, spread across the globe. Center of family diversity is considered average and part of Central Asia (Pimenov, Ostroumova, 2012). Among the species of this family - valuable vegetable, forage, spicy, aromatic, medicinal and technical plants. There is information about the presence of biologically active substances in many forms. Representatives of the family in all its parts contain essential oils or resinous substances, coumarins, flavonoids, saponins rarely possessing pharmacological value. Plants containing a high amount of flavonoids, are used as cholagogue, capillary tonic means (Minaev, 1991).

The study of the secretor vittae of various organs and characterization of terpenoids containing receptacles is important to determine the localization of some biologically active compounds (Safina 2012). Underground organs of species of the family *Apiaceae*, thanks to the high content of tar, are the main source of raw material, which was the study of the chemical composition for use in the pharmacopoeia. The underground and above-ground organs of many species of the genus *Ferula* L., found polysaccharides, determined esters and estrogenic activity of terpenoids (Borisov et al, 1976; Sagitdinova et al, 1978; Nazrullaev et al, 2008; Ghulameden et al, 2012). The literature contains information on research of the morphological and anatomical structure of the underground organs of some species of the genus *Ferula* L., *Archangelica decurrens* Ledeb. (Denisova, 1968; Krasilnikov, 1968; Markova and Medvedeva, 1968).

Many species of *Apiaceaes* endemic plants, the study of these species is relevant in connection with the possibility of extinction. Representative mountain Central Asia flora monotypic genus *Sphaerosciadium* Pimenov et Kljuykov includes relict, rare and endemic species *Sphaerosciadium denaense* (Schischk.) Pimenov et Kljuykov.

Species included in the Red Book of the Republic of Uzbekistan with the status 1, polycarpic, grows on stony and clayey open slopes, in rock crevices (Pimenov, 2009).

Due to the absence in the literature of detailed structural descriptions underground organs *Sphaerosciadium denaense* conducted this study.

Objective: To study the structural features of the underground organs localization and identification of secretor vittaes *Sphaerosciadium denaense*, in connection with the peculiarities of the biology of the species.

MATERIALS AND METHODS

The material collected on the southern macro Hissar ridge in the valley. Sangardak in its middle reaches the area between the village Nilyu and lower reaches of the river. Khandiza in Surkhandarya region of Uzbekistan in 2013-2014.

To study the structure of the underground organs and localization of secretor vittae were taken in the generative phase of the plants during fruiting. The material collected for the study were fixed in 70 ° ethyl alcohol. Dissect the basal part of the main root and apical part stem-root. The anatomical structure of the underground organs were studied in cross sections prepared by hand. Preparations were stained with methylene blue followed by attaching to the glycerol-gelatin (Barikina, Chubatova, 2005). Average quantitative traits figures taken out of the 30 measurements. Statistical analysis of quantitative data carried out by G.N. Zaitsev (Zaytsev, 1991) using MS Excel. Drawings made by a drawing apparatus RA-6, photos taken with a digital camera (Canon A 2300).

RESULTS AND DISCUSSION

Sphaerosciadium denaense - herbaceous perennial plant polycarpic (Figure 1 a). Deep taproot type root system, with weak branching (biaxial) stem-root (Fig. 1 b). Stem-root formed from the stem of the plant, located at some depth or near the soil surface and is a very short portion of long-term basal monocarpic escape bearing kidney regeneration. With the withering away of the escape monocarpic parent ceases monopodial rise and in the axils of rosette leaf sheaths last year laid the kidney (Fig. 1 c). The following year, one of them starts to move in the growth and repeats in its development cycle of maternal escape. Thus, the growth of the shoot monopodial replaced sympodial.

Underground stem portion located on the basal part of the taproot, variously described in the literature. According to the "Atlas on descriptive morphology of higher plants. The stem and root " (Fedorov et al., 1962), part of the underground stem of herbaceous perennials referred to as "stem-root". It consists of a woody perennial shoots connected with woody bases hypocotyls, passing in woody taproot, usually having contractility.

Due to the contraction represents one of the ways of expression of biological adaptations such as geophiles, especially inherent taproot from representatives of umbrella, perennial stem portion retracts into the soil to a considerable depth, protecting plants, both from freezing and from eating animals (Markova , Medvedeva, 1968) . According to the literature (Denisova, 1968) coincides with the reduction in root growth of above-ground organs, that is enhanced by the intensive growth of the stem and leaves. Due to the contractility parenchymal tissue underground organs greatly destroyed with the appearance of cracks and crevices, the cells surrounding the secretor vittaes and tight filled with starch does not undergo changes.

The main root is spindle-shaped, slightly widened in basal part, wrinkled bark, brown, older areas are covered with a thick layer of cork to crack and exfoliate. Cork is uneven, multi-row, oblong-flattened cells (Figure 2 a, b). Phellogen single row, lays out the cork fabric, and the inside - phelloderm.

Secondary cortex parenchymal, multi-row, its cells are densely filled with starch, it radial and tangential located secretor vittaes. Secondary phloem thin-walled, multi-row, the cells are densely filled with starch (Figure 2 c). Epithelial cells secretor vittaes amount of 6-8 cubic form. Closer to the tube are old, dilapidated, empty lumen secretor vittaes; in phloem parenchyma - well-developed secretor vittaes; and directly under the cambium smaller, young secretor vittaes (Figure 2 d, table 1). Parenchymal tissue bark basal part of the main root is destroyed as a result of the contraction process, formed cavities and gaps.

Cambium cells of rectangular shape, small, thin-walled, 5-6-row (Figure 2 e). This root zone remains unaffected contractility.

The xylem tissue is not mechanical. The bulge radius is larger than it (up to 80% in diameter) than the inner bark of the root. In the xylem, too, there is a decrease, resulting in parenchymal tissue is destroyed it, with the appearance of cracks and crevices. Vessels large and small, are arranged in radial chains (Figure 2 f, g). The cells are arranged radial rays elongate, they xylem parenchymal cells densely filled with starch (Figure 2 h).

Stem-rooth as a stem structure, a cylindrical shape. The bark is wrinkled, dark brown, cracked and exfoliated. Cork is uneven, multi-row, oblong-flattened cells (Figure 3 a, b). Phellogen single row, lays out the cork fabric, and inside - phelloderm.

Secondary cortex parenchymal, multilayered, dense cells filled with starch. Secondary phloem thin-walled, multi-row, small cell than in the main root cells densely filled with starch (Figure 3 c). It is located secretor vittaes, the number of epithelial cells of 6-8, the shape of the cubic (Figure 3 c; table 1). In the cortex, also seen the destruction of the parenchymal tissue due to contractility.

Cambium-row 5-6 (Figure 3 d). This root zone remains unaffected contractility.

Xylem no lignified, is 60% of the diameter. Contractile destroys parenchymal tissue in the xylem of cracks and crevices. Small and large vessels, arranged in radial chains (Figure 3 e, f). Cells radial beams placed horizontally, they xylem parenchyma cells also densely filled with starch (Figure 3 g). Core poorly developed, consists of a circular thin-walled parenchyma cells, which are densely filled with starch (Figure 3 h).

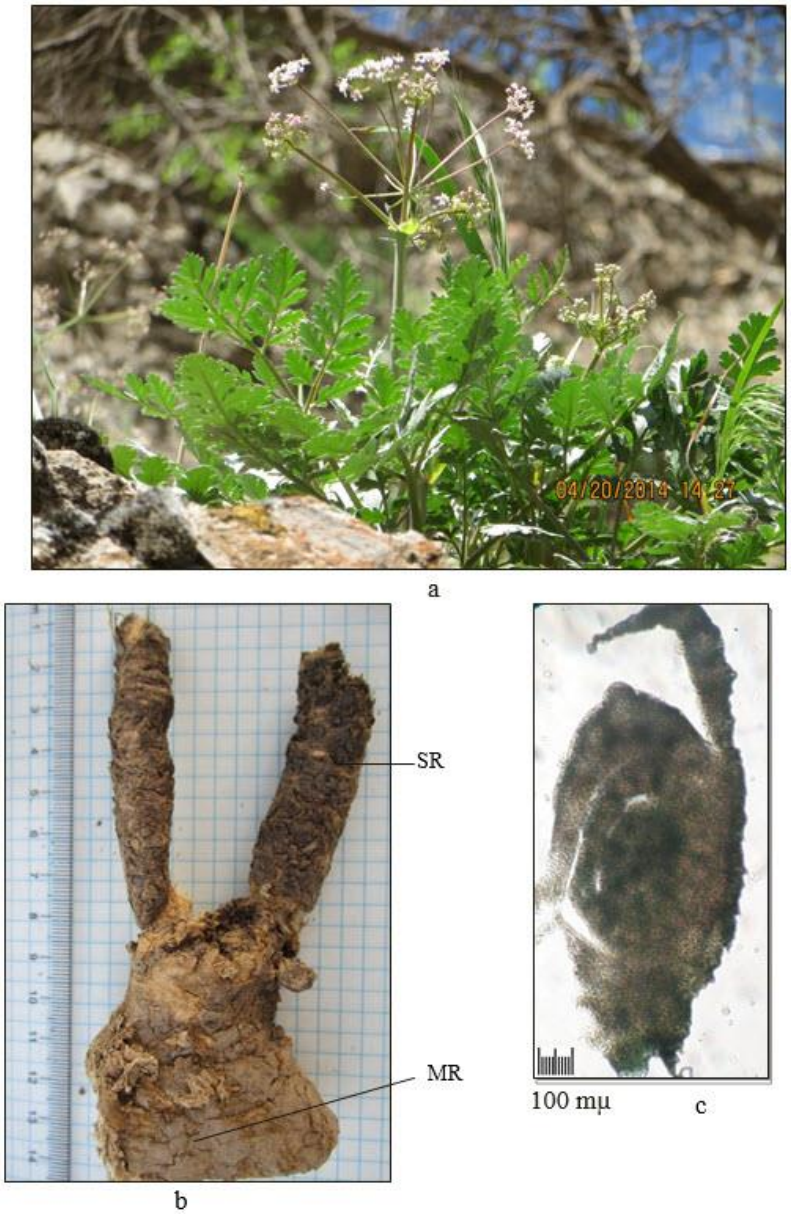

Figure 1. a - general view of the plant; b - a general view stem-root and the basal part of the main root; c - general view of the kidney

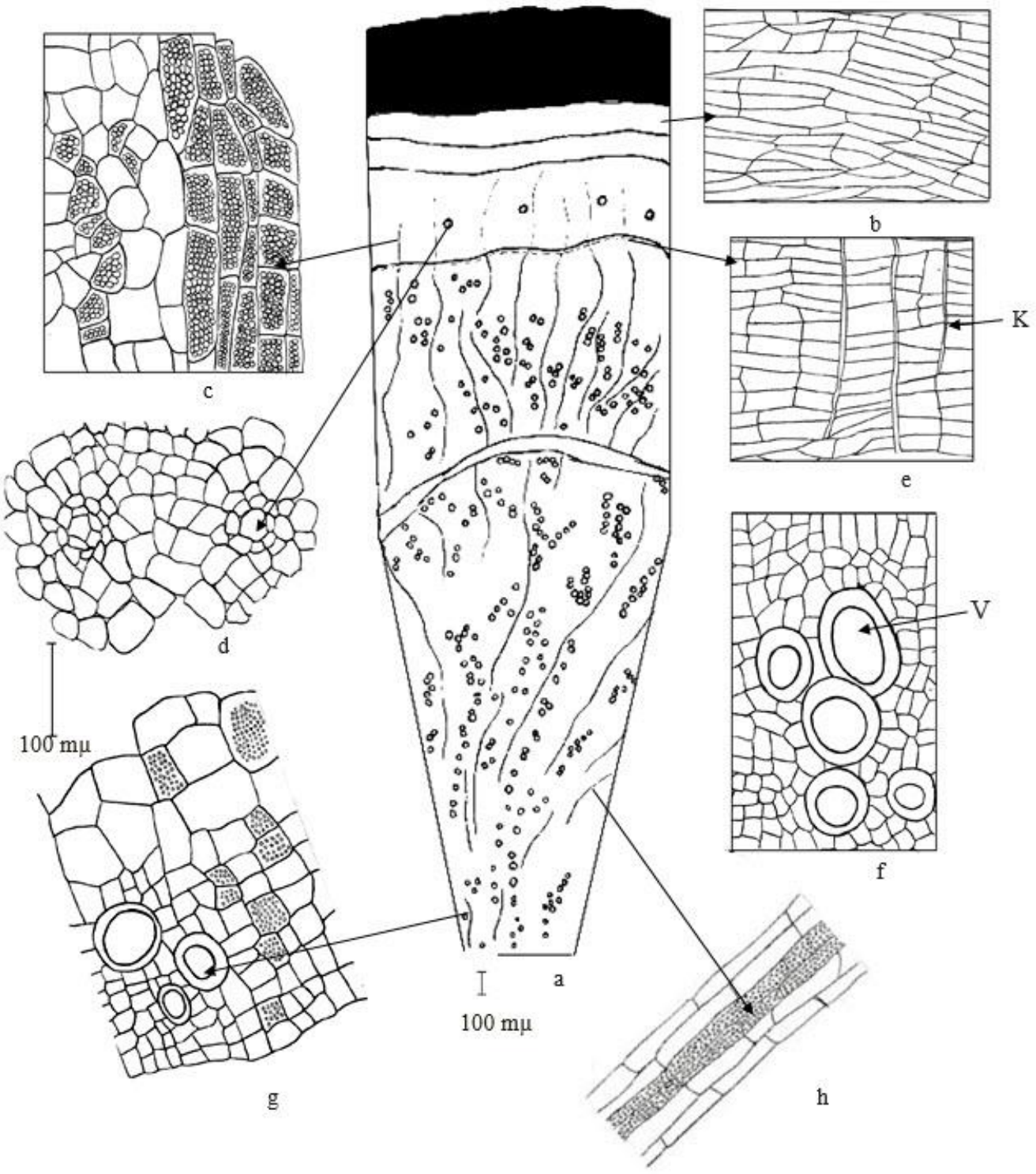

Figure 2. Structure of the main root *Sphaerosciadium denaense*
a - the scheme; b - cork; c - secondary phloem; d – secretor vittaes in the phloem; e - cambial zone; f - a vessel outer xylem zone; g - xylem vessel inner zone; h - radial beam of wood

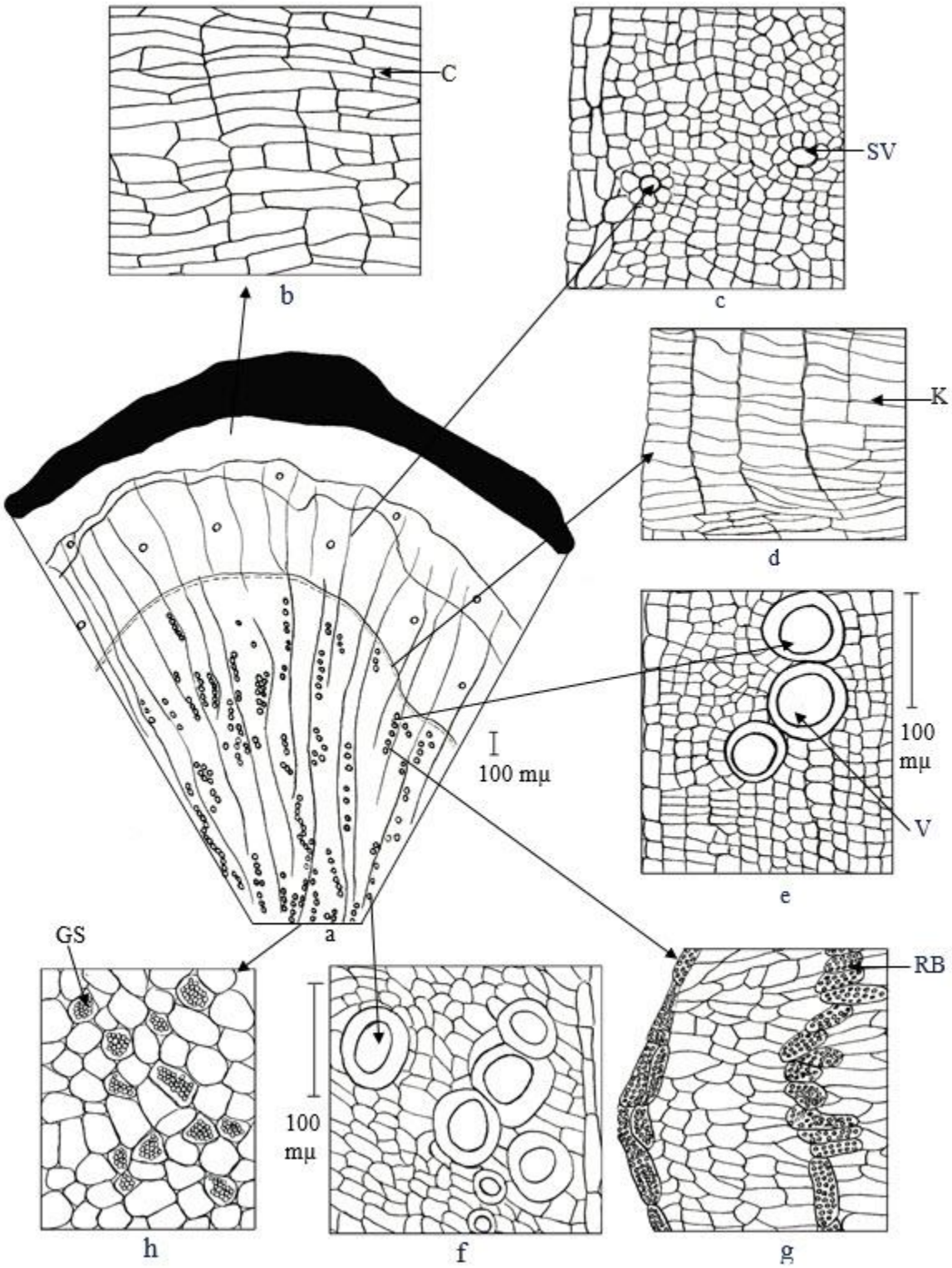

Figure 3. Structure of the stem-root *Sphaerosciadium denaense*
a - the scheme; b - cork; c - secondary phloem; d - cambial zone; e - a vessel outer xylem zone; f - xylem vessel inner zone; g - radial beam of wood; h – core

Table 1. Morphometric indicators of secretor vittaes in the main root and stem-root *Sphaerosciadium denaense*, n = 30

№	Main root, M±m			Stem-root, M±m	
1	diameter of cavity secretor vittae, µm	large	30,7±1,71	diameter of cavity secretor vittae, µm	17,1±1,1
2		small	19,7±1,32		
3	height epithelial cells, µm	large	11,6±0,68	height epithelial cells, µm	5,6±0,4
4		small	10,8±0,79		
5	width epithelial cells, µm	large	20,6±0,79	width epithelial cells, µm	18,8±0,45
6		small	19,2±0,95		
7	number of epithelial cells	large	7±0,12	number of epithelial cells	7±0,14
8		small	6±0,09		

CONCLUSION

1. In underground mining bodies showed signs of endemic *Sphaerosciadium denaense* policarpic – deep taproot type and the presence of biaxial stem-root.
2. The structure of the underground organs (main root and stem-root) *Sphaerosciadium denaense* has similar features: multi-row plug, parenchymal multilayered secondary cortex, single-row phellogen, localized in the phloem secretor vittaes, 5-6 cambium-row, small and large vessels arranged radially chain, no lignified and developed xylem than the phloem.
3. Distinguishing features stem-root from the main root: the presence of a core, of small cell phloem, secretor vittaes uniformity of size, the elongated shape of the cells of the radial rays in the main root and horizontal form in their stem-root.
4. With the type of main root (deep taproot type) and life form (polycarpic) ratio of conductive elements connected at the root - extensive xylem and phloem is less developed with the presence of secretor vittaes *Sphaerosciadium denaense*. Unlike monocarpic species p. *Ferula*, who have seen strong development of phloem with napiform thickened main root (Markova, Medvedeva 1968; Safina, 2012), respectively, the number of secretor vittaes in the main root in *Sphaerosciadium denaense* less than that monocarpic kinds of Apiaceae family.
5. The starch accumulation in almost all cells of the underground organs, except for the outer cortex is related to stock up their function in the arid climate of mountain regions. The absence of mechanical tissue underground organs is compensated fullness of starch parenchymal tissues underground organs.

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