

ADAPTIVE FEATURES IN THE CONSTITUTION OF ROOTS OF SOME SPECIES OF CEREAL IN DESERTS OF UZBEKISTAN

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ABSTRACT: In the article described impact of various conditions of ecotope on anatomical structure of cereals in Kyzylkum Desert and Ustyrt Plateau. Adaptive features of 7 types of cereals are analyzed by the structure of root. Prevalent species are described, also halophytes and psammophytes, annual plants and perennial plants are emphasized.

Keywords: Poaceae, Kyzylkum, Ustyrt, cereals, anatomical structure, root, rhizoderms, exoderma.

INTRODUCTION

Family of Poaceae Barnart. Is considered to be significant and represents enormous scientific interest, as the largest family of deserts of Middle Asia.

Different ambient conditions cause essential affection to the structure of root system of cereals. Studying the structure of roots of cereals of Kyzylkum Desert and Ustyrt Plateau with quantitatively anatomical method had not been organized before.

Materials and Methods. Cereals of Kyzylkum Desert and Ustyrt Plateau are propagated in different soils. Environmental conditions of ecotope has an effect on their anatomical structure. In connection with this, we studied the structure of roots of 7 cereals: *Poa bulbosa* L.-annotinous bunchgrass fibrous root cereal in the plain of Ustyrt Plateau, *Bromus tectorum* L. - annotinous bunchgrass fibrous root cereal in the plain of Ustyrt Plateau, *Eremopyrum buonapartii* (Spreng.) Nevski – Ephemere on sandy soil in Kyzylkum Desert. *Aeluropus litoralis* (Gouan.) Parl.- rhizomatous perennial cereal of Ustyrt Plateau, *Crypsis aculeata* (L.) Ait.- ephemere, were collected on saline soil of Kyzylkum desert, *Stipagrostis pennata* Trin.- perennial caespitose cereal on semi-arid barchan sands in Kyzylkum, *Stipa hohenackeriana* Trin. Et Rupr.- perennial caespitose cereal on compacted sandy soil in Kyzylkum.

Information about structure of root of cereals from other ecotopes are in the works [1] [2] [3]. Our research revealed difference in the structure of roots of halophytes and psammophytes.

Results and Discussion. *Poa bulbosa* L.- is orbicular on cross section. Rhizoderms is monostichous, consists of unequal cells with slender walls (Table-1, Fig-1). Cells of rhizoderms have scarce root fuzz. Under rhizoderms are located three layer cortexes. First layer is monostichous, large cellular, thin-walled and exoderm is thin-walled. Second layer consists of trifarious parvicellular phelloderm. In the third layer cortex is located 3-4-rangethin-walled, large celled parenchyma. Endoderm is monostichous with strongly thickened inner tangential wall. Central cylinder is polyarchial type. A bast represented as shallow bands and xylem represented as a solitary vessel with wide vessels of metaxylem in the centre.

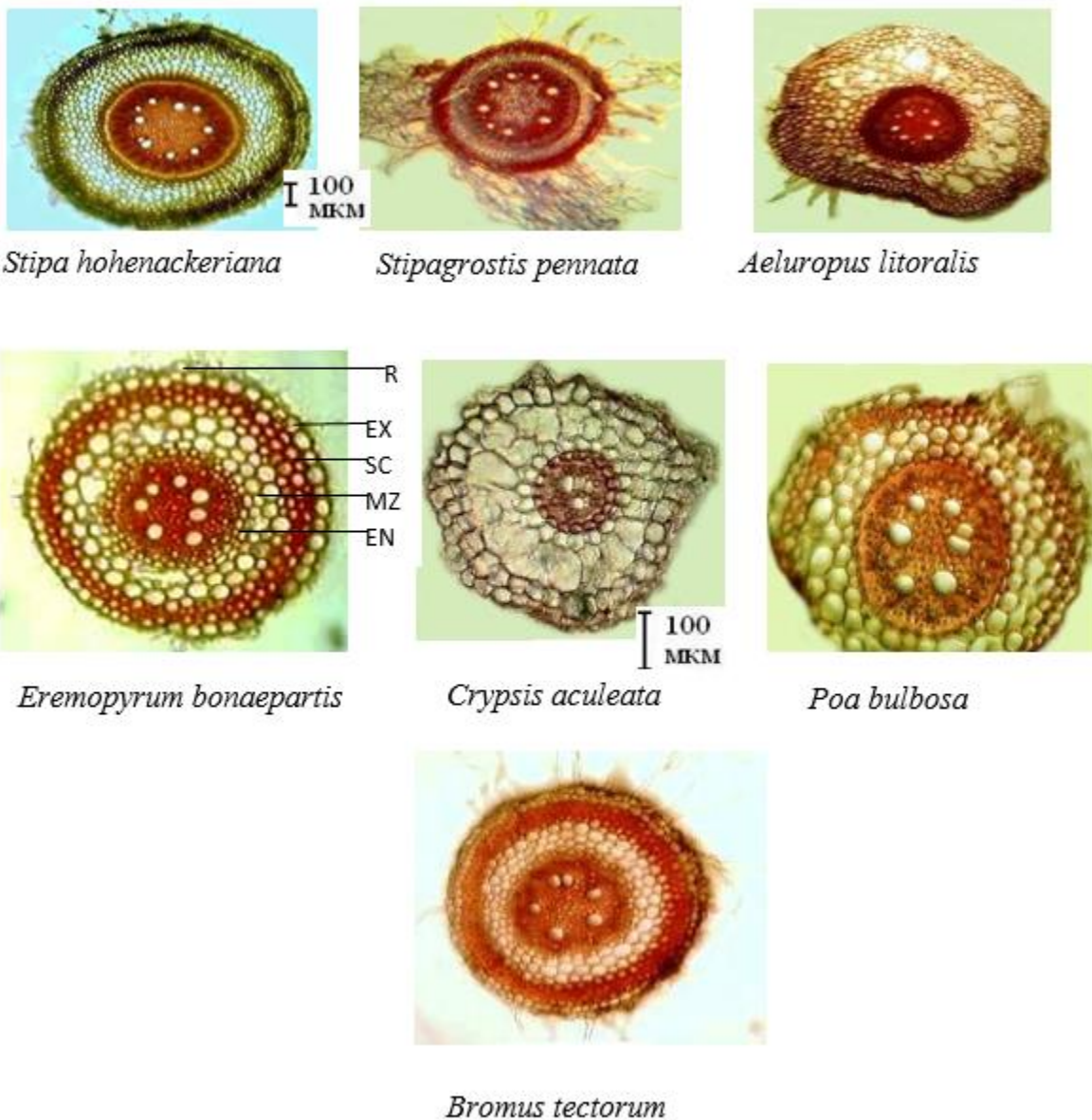


Figure 1. Transverse sections of the root of the studied cereals: R-rhizoderm, EX-exoderm, SC-sclerenchyma, MZ-mesoderm, EN-endoderm

Поперечные срезы корня исследованных злаков: Р-ризодерма, ЭК-экзодерма, СК-склеренхима, МЗ-мезодерма, ЭН-эндодерма.

Bromus tectorum L.-is orbicular on cross section. Rhizoderms is monostichous, consists of unequal cells with slender walls (Table №1). Under rhizoderms are located three layer cortexes. First layer is monostichous, large cellular, thin-walled and exoderm is thin-walled. Second layer consists of trifarious parvicellular phelloderm. In the third layer cortex is located 3-4-range thin-walled , large celled parenchyma. Endoderm is monostichous with strongly thickened inner tangential wall. Central cylinder is polyarchial type. A bast represented as shallow bands and xylem represented as a solitary vessel with wide vessels of metaxylem in the centre.

Aeluropus litoralis (Gouan.) Parl.- is orbicular on cross section. Rhizoderms is monostichous, consists of unequal cells with slender walls (Table №1), carrying root fuzz. The cortex is multilayer, heterogenous. Under rhizoderms are located 2-3 layers, which are medium-sized, isodiametric cells of exoderm. They are underlayed with 2-3 layers

,which are large destructive cells. After there are 2 layers of multicellular parenchyma. In inferior layer cortex is filled cork cambium ,which formed 3-4 ranges of phelloderms. Pericycle is monostichous, parvicellular. The bast represented as shallow bands and xylem –groups of 2-5 vessels. Wide vessels of metaxylem are located in the centre. Between vessels there are thick-walled sclerenchymalvessels , which are sclerenchymaized.

Crypsis aculeate (L.) Ait.-is orbicular on cross section. Rhizoderms is monostichous, consists of unequal cells with slender walls (table№1), partially destructed. Under rhizoderms is situated three-ply cortex. First layer is monostichous, consists of relatively large thin-walled cells located tightly. Second layer consists of large cellular and thin-walled cells. Third layer consists of one range comparatively to small by size oval, thin-walled cells of parenchyma. Endoderm is monostichous. Under endoderm is located range of uniserial large- celled pericycle. The bast is represented as shallow bands and xylem represented as solitary vessels. Vessels of metaxylem are surrounded by sclerenchyma.

Stipagrosti spennata Trin. - is orbicular on cross section with diameter 1168,7 mcm (table№1). Rhizoderms is monostichous, consists of shallow cells with slender walls, partially destructive. Absorbent root fuzz are long , which are equal to ½ depth of root. Exoderm consists of large, equal and rectangular thin-walled cells and 3-layer parvicellular sclerenchyma. Mesenchyme consists of 4-range thin-walled parenchyme. Endoderm is monostichous with effete lignification of tangential walls.Pericycle is monostichous , vessels of protoxylem are obliterated , metaxylem surrounds wide core , which consists of orbicular , large and shallow parenchymal cells.

Stipa hohenackeriana Trin. Et Rupr.- is orbicular with long and short root fuzz on cross section with diameter 1116,8 mcm (table№1). Rhizoderms is monostichous, thin-walled, consists of unequal cells of triploblast, which form root fuzz. First layer cortex is one-range exoderm, consists of large, equal and rectangular,thin-walled cells. Mesenchyme is 3-range parvicellular sclerenchyma of 4-6 range friable thin-walled parenchyma.

Layer, which is adjacent to endoderm has scarce hydrocitic cells. Friable situation of cells of mesenchyme is important for aeration. Endoderm is monostichous with strongly thickened walls. Under endoderm is located pericycle, which consists of coarctated cells. A central cylinder is polyarchialtype. Abast represented as shallow bands and xylem represented as inner and tangential groups, which consists of 3-7 vessels located circularly. Wide vessels of mesenchyme surround narrow parvicellular, sclerenchymaized core.

Eremopyrum buonapartis (Spreng.) Nevski- is orbicular on cross section. Rhizoderms is monostichous, consists of unequal cells with slender walls (table №1). Cells of rhizoderms have scarce root fuzz. Under rhizoderms are located three layer cortexes. First layer is monostichous, large cellular, with thin-walled endoderm. Second layer consists of trifarious parvicellular phelloderm. In the third layer cortex is located 3-4-range thin-walled, large celled parenchyma. Endoderm is monostichous with strongly thickened inner and tangential wall. Among cells of endoderm there are thick passing-through cells, which do not have thickened walls. The central cylinder is polyarchial type. A bast represented as shallow bands and xylem represented as solitary vessels with wide vessels of metaxylem in the centre (Fig-1).

Table 1. Anatomical parameters of root on cross – section

Features(mcm)	<i>Poa bulbosa</i>	<i>Bromus tectorum</i>	<i>Eremopyrum buonapartis</i>	<i>Aeluropus litoralis</i>	<i>Crypsis aculeata</i>	<i>Stipagrostis pennata</i>	<i>Stipa hohenackeriana</i>
The diameter of the root	503,2±3,0	511,4±3,1	523,6±3,2	809,4±12,4	335,7±7,3	1168,7±13,0	1116,8±15,3
Height of rhizoderms	20,1±0,5	21,5±0,5	24,1±0,5	20,8±0,5	22,5±0,5	23,5±0,5	22,2±0,4
Height of the endoderm	13,3±0,3	14,3±0,3	11,3±0,3	8,5±0,2	12,2±0,3	25,5±0,4	20,4±0,3
The number of large vessels	9,1±0,3	10,1±0,3	8,1±0,3	11,6±0,4	4,2±0,1	10,9±0,2	12,7±0,2
The Diameter of large vessels	36,5±0,9	38,5±0,9	40,5±0,9	35,8±0,9	27,1±0,5	64,3±2,6	37,8±0,6
The diameter of the Central cylinder	210,8±8,4	213,8±8,4	218,8±8,4	267,0±8,9	139,7±3,2	670,3±27,7	471,2±10,8
The sickness of the crust	143,6±2,0	150,3±2,0	156,6±2,0	271,0±5,3	97,8±2,5	249,3±6,8	322,8±7,0
The sickness of sclerenchyma	49,2±1,4	53,2±1,5	56,2±1,4	46,0±1,0	no	62,9±1,2	50,4±1,0

Types	Annual	Bromus	Eremopyrum	Crypsis	Perennial	Stipagrostis	Stipa
Features	Poa bulbosa	tectorum	buonapartis	aculeata	Aeluropus litoralis	pennata	hohenackeriana
The covers made of sand	no	no	no	no	no	Highly-developed	Underdeveloped
The presence of pneumatic lacunas in the bast	no	no	no	Exist	Exist	no	No
Hydrocity cells	No	no	no	no	no	no	In the cortex
The number of vessels in the tufts	Average	Average	Average	Few	A lot	A lot	A lot
The thickness sclerenchyma	Few	Few	Few	no	Average	Thick	Thick

Conclusions

Common traits of structure of root of explored species are: multilayer vigorous cortex, central cylinder of polyarchial type, which is almost twice as less by diameter and characteristic for plants of deserts [5] [6] [7]. In the structure of root are revealed features, characteristic for each species. Cells of rhizoderms are shallow 20,1-24,1mcm, thin-walled, which is essential for absorption of water and material on initial stage of development [8] [9]. On rhizoderms almost in all species root fuzz are well-developed, with the exception of *C. aculeata* which stay alive during some years.

For all the investigated species, the nonradial arrangement of parietemic cells of the cortex is characteristic. Behind the rhizoderm is an exoderm, which is 2-3 rows in *A. litoralis*. Sclerenchyma exoderma ring is present in all species, except *C. aculeata*. Sclerenchyma ring in all species is quite thick, especially in *Stipagrostis pennata* and *Stipa hohenackeriana*. The mesoderm consists of several cells. Endoderm in all species is single-row, but in *Stipa hohenackeriana* its individual cells are doubled by tangential division. The core is at the root of all the species studied, with the exception of *C. aculeata*.

Each species has characteristic adaptive features (tabl. №2). *Stipagrostispennata* is distinguished by an abundance of root fuzz releasing a cementing substance, that adheres sand particles, resulting in a sandy cover. To a lesser extent the sand cover is formed in *Stipahoheckeriana*. The ecological significance of such an education is indisputable, since it protects internal tissues from siccation and damage [10] [11]. *Stipa hoheckeriana* - presence of hydrocite cells in the cortical layer adjacent to the endoderm, an extremely strong thickening of the tangential walls of the endoderm, which is a large cell pericle, densely impregnated silica; halophyte species *A. litoralis* and *C. aculeata* - large auriferous lacunas. Annuals *Poa bulbosa*, *Bromus tectorum* and *Eremopyrum buonapartis* are rounded, small-sized of conductive system, root diameter, thickness of the cortex, height of rhizoderm cells, diameter of the central cylinder, diameter of large vessels, sclerenchyma thickness, smaller than in perennials.

Thus, adaptive signs of desert cereals have: a cover of cemented sand, a sclerenchymal ring under the exoderm, a compact structure of the inner crust, a vein-shaped divergent vessels, a 2-3 row exoderm, airway lacunas and parenchyma.

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