Anatomical structure of the Alhagi pseudalhagi stem

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Abstract. The present research focuses on studying the anatomical structure of annual shoots of Alhagi pseudalhagi, growing in the Karakum Desert in Turkmenistan. The Camelthorn plays a huge role in the desert biogeocenosis stability, restrains the advance of sand dunes, and is the main component of the country's natural pastures. The non-tufted type of structure of Alhagi pseudalhagi offshoots was established in the work; the degree of development of the photosynthetic bark parenchyma of the stem was identified. Diagnostic features of the offshoots were determined - the presence of a two-layer epidermis, unicellular receptacles, a continuous ring of conductive tissues, and a filled core of the stem. The nature of the distribution of reservoirs in the stem and the degree of development of mechanical and conductive elements in wood and bast are considered. The results of the study can be used in further studies of the Alhagi genus in the field of botany, physiology, ecology of desert biogeocenoses.

1. Introduction
The research focuses on the study of the biology of the Camelthorn, which grows in the Karakum Desert. Like any desert plant, the Camelthorn plays a keystone role in the biocenosis composition of the range. In particular, the plant is a year-round feed of natural pastures for farm animals. In the deserts, the Camelthorn plays the role of sand fixers. Quite often, residents surround their fields with a fence made of thorns, which remarkably protects the crops from sand and wind [1-2]. From ancient times, plants have been used by desert residents as a source of firewood, as food for unfortunate travelers - people eat “manna” and make tea from leaves. Tea is characterized by a huge range of beneficial properties. In addition, tinctures and decoctions of plants are successfully used by the local population to treat wounds and sunburn [3-5]. To complete, it can be added that the thorn is considered as a valuable honey plant in Turkmenistan, the honey obtained is characterized by a low allergic index [6].

Based on the foregoing, it is difficult to overestimate the relevance of studying this plant. Thus, the purpose of the research is to study the morphological and anatomical structure of the stem of representatives of Alhagi pseudalhagi growing in the Karakum Desert.

2. Materials and research methods
Alhagi pseudalhagi samples were collected in August 2019 in Turkmenistan, in the area surrounding the city of Köneurgench, located on the outskirts of the Karakum Desert. Each sample consisted of 10 copies. Morphological analysis of the sample was carried out according to the generally accepted technique [7]. Anatomical research was performed by the traditional method of light microscopy. Cross sections of the stem were made by hand with a razor. Sections were examined using a Biolam microscope. Anatomical drawings were made using the RA-4 drawing apparatus. The preparation of
slices, measurements and description of the drawings were made according to the generally accepted method [8].

3. Main part
Examples of the Camelthorn, growing in the Karakum Desert, are shrubs about 66 cm high. About 22 lateral shoots are produced on one plant; the total width of the plant often exceeds 30 cm. About 23 leaves are laid on the main shoot. The linear dimensions of the leaves decrease with increasing level of formation, but on average they are about 3 cm long and 1 cm wide, petiole about 0.5 cm long, and internodes 4 cm.

For anatomical analysis, the most developed annual shoots of the Camelthorn were chosen, with a diameter of about 2.5 mm. On a cross section, the stem shows a non-tufted type of structure. The ground tissue of the stem is represented by the epidermis; its thickness is about 20 μm. Below the epidermis the cortical parenchyma is lying, represented by assimilation cells; the thickness of this tissue is about 150 μm. The cortical parenchyma is followed by a phloem ring, about 200 μm thick, then a thin row of cambium cells, and a ring of water-conducting tissue. Xylem accounts for about 450 μm of the total shoot thickness. The central part of the stem is occupied by core cells; their total thickness varies from 840 to 900 μm (figure 1).

![Figure 1](image.png)

In a schematic illustration of the stem, unicellular reservoirs in the shoots are visible. The reservoirs have a rounded or oblong-oval shape, their sizes are very variable. The reservoirs are located in the boundary region of the cortical parenchyma and phloem where the ring can be clearly seen, composed of 1 to 3 layers of unicellular reservoirs, with a diameter of about 100 μm. In addition, binominal reservoirs are found in the thickness of the phloem and the core of the stem. Very small reservoirs with a diameter of not more than 10 μm are also seen in the water-conducting part of the stem, here they are localized along the radial rays of the xylem, however, as a rule, are confined to their peripheral parts.

The water-conducting tissue of the stem is represented by randomly located vessels, angular cells of wood sclerenchyma and radial rays. Xylem vessels have round and oval gaps, their diameters vary greatly. Vessels are located singly or in small groups. Most of the vessels are surrounded by living cells of the tree parenchyma. Wood sclerenchyma is represented by small, penangular, thick-walled cells. The sclerenchyma is separated by distinct radial rays. Radial rays are composed of one or two rows of living parenchyma cells connecting the living cells of the bast and the stem core (figure 2).
The ground tissue of the stem is represented by a two-layer epidermis. The epidermal cells are colorless, densely closed and covered with cuticles. Below the epidermis, 3 to 5 layers of cortical chlorenchyma are located. Between chlorenchyma and phloem, there is one layer of endoderm cells. Also, a large accumulation of cell cells can be noted here, which were mentioned previously. The phloem of the stem is associated with a large amount of the soft bast cells, and the hard bast looks like small islands composed of very small, thick-walled, angular cells (figure 3).

4. Conclusion
The annual stem of the *Alhagi pseudalhagi* has a non-tufted structure; the conductive tissue is represented by a continuous phloem ring, composed mainly of soft bast cells and a massive xylem ring. Xylem vessels are scattered randomly, most of them are surrounded by wood parenchyma cells. The ground tissue of the stem is folded by a two-layer epidermis, the cortical parenchyma photosynthesizes. The shoots of the Camelthorn are unicellular receptacles; their sizes vary from 100 to 10 µm. The largest reservoirs form a ring between the cortical parenchyma and phloem. Smaller ones are singly localized in the thickness of the phloem and core, and, in the conducting tissue, along the radial rays.

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