COMPARATIVE MORPHOLOGICAL AND ANATOMICAL STUDIES OF SALVIA OFFICINALIS AND SALVIA TESQUICOLA

A.A. Shmygareva[1], V.A. Kurkin[2], A.N. San'kov[3], M.A. Nikandrova[4]

1 A.A. Shmygareva, The department of management and economy of pharmacy, pharmacognosy and pharmaceutical technology, State budgetary educational institution higher professional education "The Orenburg state medical university" Ministry of Public Health Russian Federation, Orenburg, Russia

2 V.A. Kurkin *The department of Pharmacognosy with botany and basics of herbal medicine, State budgetary educational institution higher education "The Samare state medical university" Ministry of Public Health Russian Federation, Samara, Russia*

3 A.N. San'kov, *The department of management and economy of pharmacy, pharmacognosy and pharmaceutical technology, State budgetary educational institution higher professional education "The Orenburg state medical university" Ministry of Public Health Russian Federation, Orenburg, Russia*

4 M.A. Nikandrova, Pharmaceutical faculty, State budgetary educational institution higher professional education "The Orenburg state medical university" Ministry of Public Health Russian Federation, Orenburg, Russia

Abstract

Salvia officinalis - widely used in medicine as an astringent, bactericidal, anti-inflammatory agent. Leaves of Salvia officinalis used to rinse the throat and mouth in catarrh of the upper respiratory tract and stomatitis. However, some problems from the point of view of pharmacognostical analysis remain unresolved. So, in an Orenburg region the potential admixture to Salvia officinalis is Salvia tesqicola, however, anatomical characteristics of Salvia tesqicola leaves has not been studied. In the State Pharmacopoeia of Russia, XII edition the Pharmacopoeia article on leaves of Salvia officinalis are missing, as for the State Pharmacopoeia of the USSR, XI edition, the microscopic features described poorly. Description of morphological and anatomical diagnostic criteria of Salvia officinalis leaves, in a comparative plan raw material of this plant and the Salvia tesqicola leaves as a potential impurity has not been studied. Salvia officinalis grows only in sub-tropical zone of Russian Federation. In Orenburg region grows closely-related species Salvia tesqicola which don't use in the medicine in connection with lack of information. Morphological and anatomical diagnostic criteria of leaves Salvia tesqicola were revealed during the study. Additional diagnostic criteria of leaves Salvia officinalis were also defined. A number of evident differences in the morphology and histology of leaves observable species was revealed: differences in the shape and sinuosity of the cells, presence and absence of druses and glands with essential oil, differences in the shape of filaments. Criteria of differential diagnostics given species were worked out on the base of received facts. Possibility of potential use leaves Salvia tesqicola in the official medicine was also revealed.

Keyword: *Salvia officinalis, Salvia tesqicola , microscopic criteria, leaves, glands with essential oil*

1. Introduction

Salvia officinalis is an officinal plant that had found wide application in the medicine and pharmaceutical practice thanks to presence of essential oil (2,5%) [4]. The main component of essential oil is α- and β-thujone [1]. *Salvia officinalis* grows only in sub-tropical zone of Russian Federation [2]. In Orenburg region grows closely-related species *Salvia tesqicola* which don't use in the medicine in connection with lack of information.

The aim of present research is morphological and anatomical compare medical plant raw material *(folia)* given species and work out of criteria for the differential diagnostics which helps clearly identify medical plant raw material.

2. Materials and methods

The present research objects were dried examples of leaves *Salvia officinalis* and *Salvia tesqicola* (figure 1).

A **B**

Fig – 1: Research objects: A- *Salvia officinalis*, B- *Salvia tesqicola*.

Salvia officinalis is a hoary subshrub with the grey-green stalks and leaves and height under 500 mm. Stalks are numerous, branchy, tetrahedral with lignification in the foundation. Leaves are stalked, opposite, oblong with dull top and with cut lappet on foundation. Flowers 6 – 8 are gathered in the whorl. Bells are bilabiate and hoary. Crowns are bilabiate and blue-violet, 2 stamens which covered with upper labium [3].

Salvia tesqicola is a perennial herbaceous plant with height 300-600 mm. Apical inflorescence has 1 – 2 side branch (es). Bells are bilabiate, hoary violet or reddish color. Crowns are bilabiate and blue-violet 10 – 13mm. Leaves are folded, oblongly-oval, toothed on the sides, hoary. Stalk is also covered with filaments.

Light microscope (trade name is digital microscope «MoticDM 111» with increase possibility: $4^{\times}10$, $10^{\times}10$, $40^{\times}10, 100^{\times}10$) and Motic Educator (Software) were used for the realization of experiment. The microscope slides of plant raw material examples were prepared with the following scheme: dried examples of leaves *Salvia officinalis* and *Salvia tesqicola* were placed in the test-tubes, 5% sodium hydroxide (dissolved with water 1:1) was also added. Test tubes were boiled 2 – 5 minutes after that cross sections were done with the help of edge from the hand and were placed on the object-plate in the water drop [5].

3. Results

3.1. Microscopy of medical plant raw material (*Salvia officinalis*): Polygonal cells with straight or twisting sides and folded cuticle were revealed. Intracellular inclusions of calcium oxalate in the form of druses were also found out (figure 2).

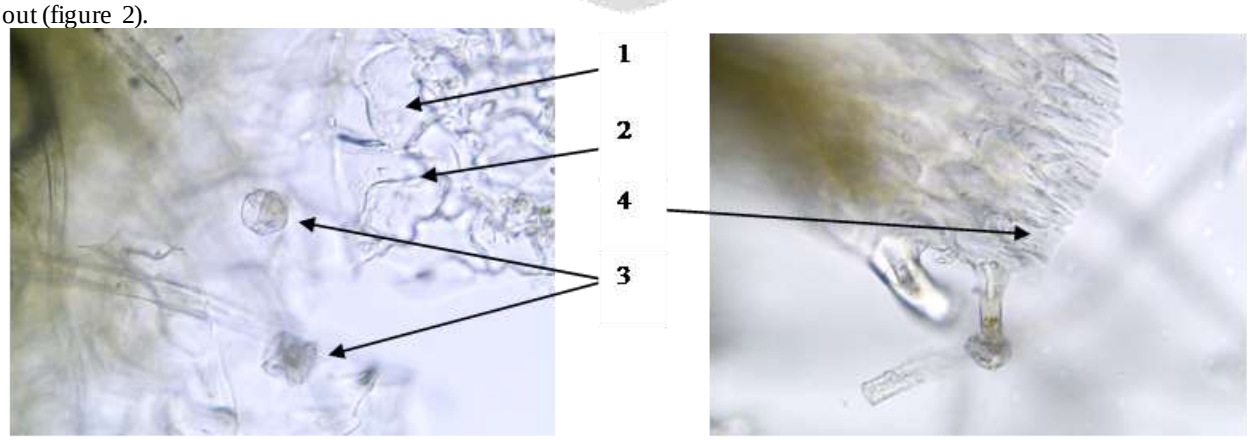

Fig – 2: The microscope slides of leaves *Salvia officinalis*. Upper epidermis.

1 - polygonal cell, 2 - straight or twisting sides, 3 - calcium oxalate in the form of druse, 4 - folded cuticle

Stomata were surrounded with 2 cells which located perpendicularly to stomatic cleft, guard cells were lens-shaped (figure 3).

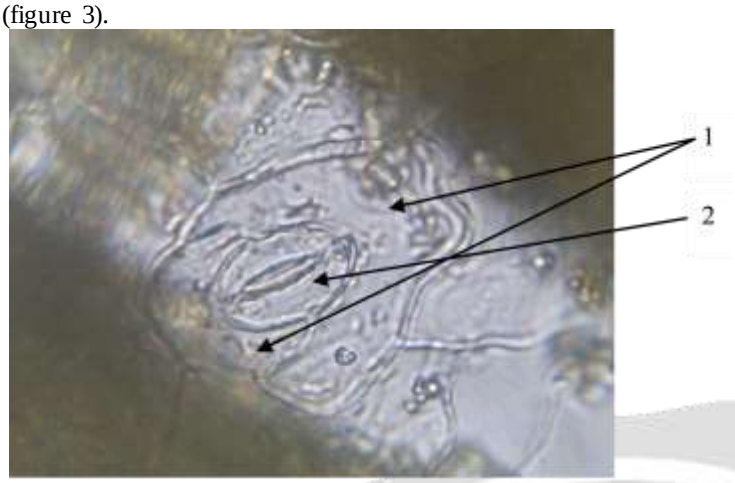

Fig – 3: The microscope slides of leaves *Salvia officinalis*. Upper epidermis. (x100)
1 - cells which located perpendicularly to stomatic cleft, 2 - lens-shaped guard cells

In great amount glands full of essential oil were revealed. Glands had rounded shape with diaphanous stalk and hardly observable 6 – 8 secretory cells (figure 4).

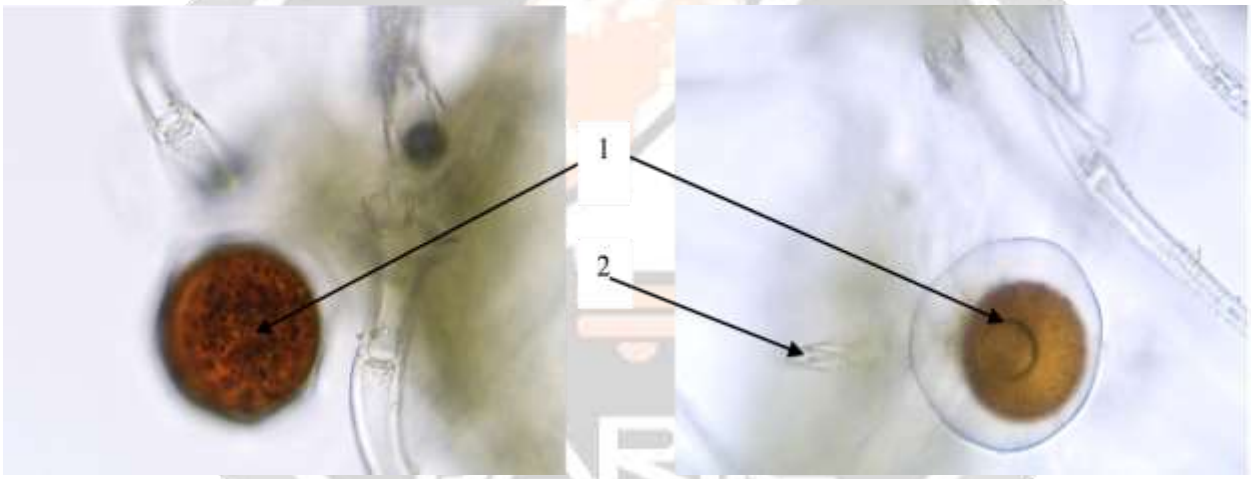

Fig – 4: The microscope slides of leaves *Salvia officinalis*. Upper epidermis.
1 - glands full of essential oil, 2 - diaphanous stalk

Filaments were numerous capitate and simple were revealed on the upper and lower epidermis (figure 5).

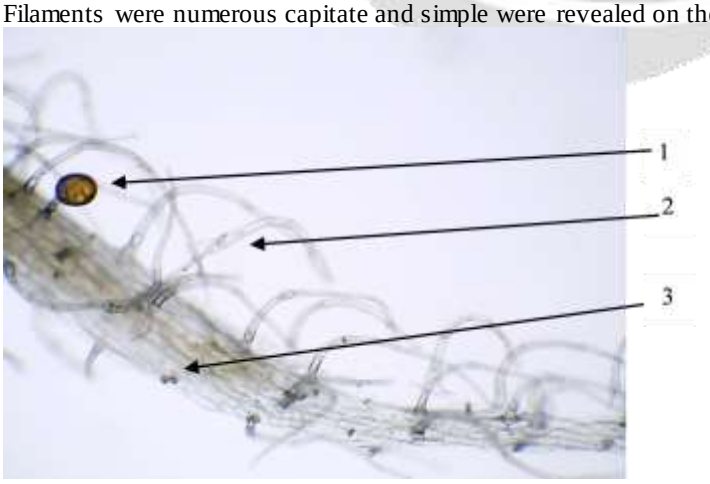

Fig – 5: The microscope slides of leaves *Salvia officinalis*. Upper epidermis. (x10)
1 - gland full of essential oil, 2 - simple filament, 3 - capitate filament

Simple filaments had some types: multicellular, cone-shaped with thickened, smooth sides and multicellular, cone-shaped with thickened, tuberous sides (figure 6).

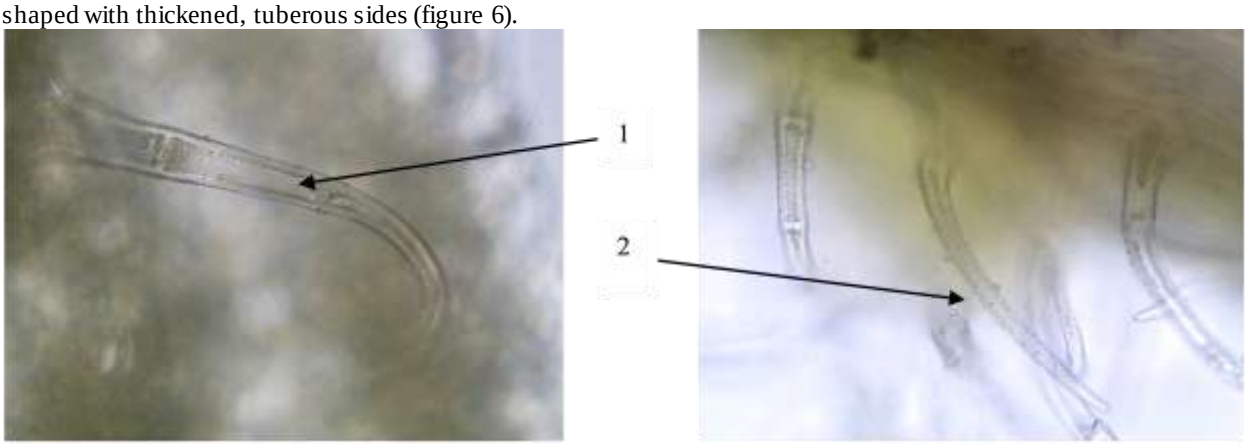

Fig – 6: The microscope slides of leaves *Salvia officinalis*. Upper epidermis.
1 - simple filament multicellular, cone-shaped with thickened, smooth sides
2 - simple filament multicellular, cone-shaped with thickened, tuberous sides

Capitate filaments had some types: filaments with unicellular head and unicellular stalk, filaments with unicellular head and multicellular stalk (figure 7) and filaments with multicellular head and multicellular stalk which were founded on the epidemis and petiole.

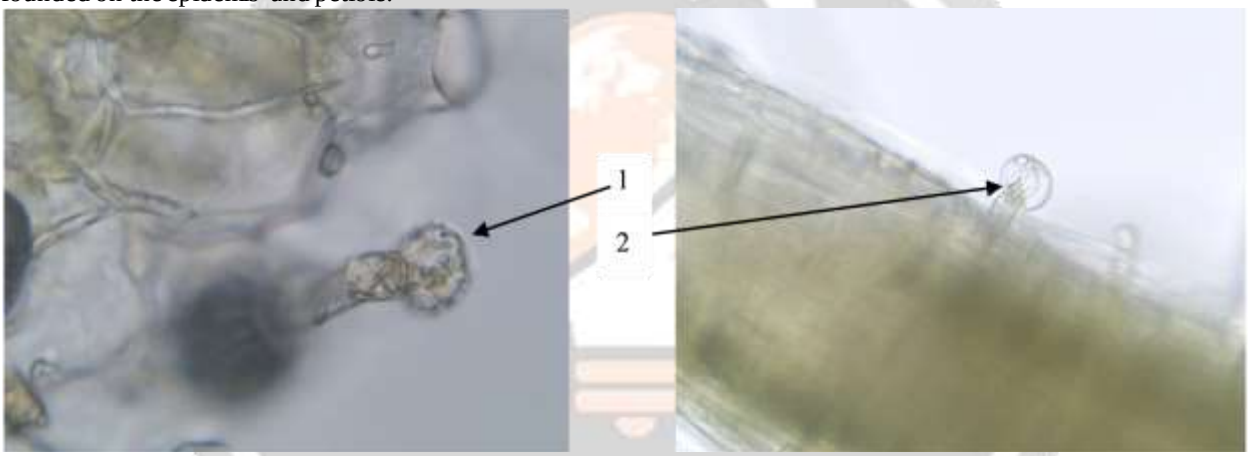

Fig – 7: The microscope slides of leaves *Salvia officinalis*. Upper epidermis.
1 - capitate filament with unicellular head and multicellular stalk
2 - capitate filament with unicellular head and unicellular stalk

3.2. Microscopy of medical plant raw material (*Salvia tesqicola*): Combined cells with straight sides and longitudinal-folded cuticle were revealed. Stomata were met in small amount. Stomata were surrounded with 2 cells which located perpendicularly to stomatic cleft, guard cells were lens-shaped (figure 8).

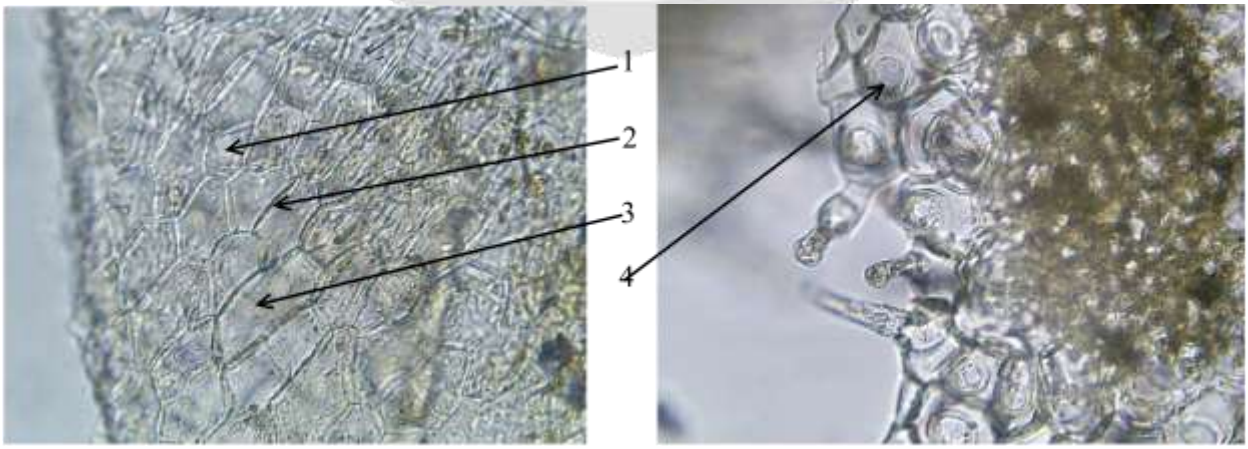

Fig – 8: The microscope slides of leaves *Salvia tesqicola*. Upper epidermis.
1 - combined cell, 2 - straight sides, 3 - longitudinal-folded cuticle, 4 – stomata.

Capitate and simple filaments capitate and simple were revealed on the upper, lower epidermis and petiole (figure 9).

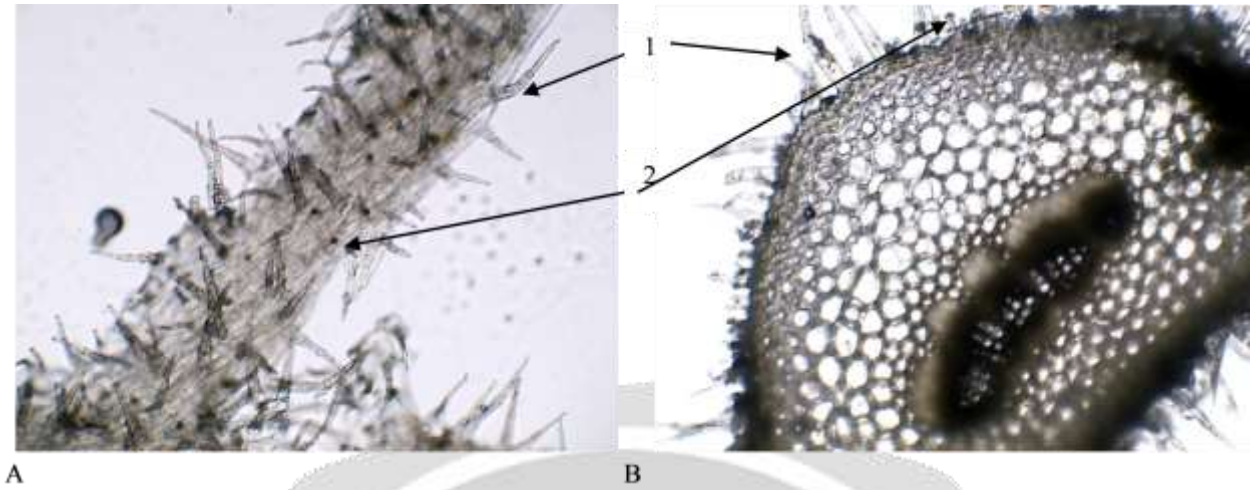

Fig – 9: The microscope slides of leaves *Salvia tesqicola*. A - Lower epidermis, B - Petiole
1 - simple filaments, 2 - capitate filaments.

Simple filaments had some types: multicellular, cone-shaped with thickened, smooth sides and unicellular nipple-shaper (figure 10).

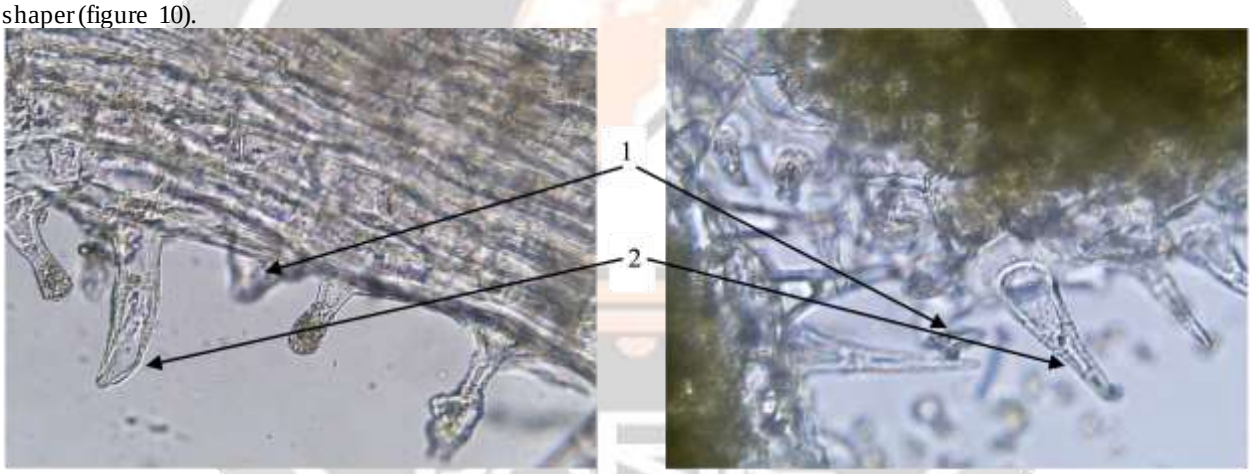

Fig – 10: The microscope slides of leaves *Salvia tesqicola*. Upper epidermis.
1 - unicellular nipple-shaper simple filaments, 2 - multicellular, cone-shaped with thickened, smooth sides simple filaments

On the petiole simple, multicellular, cone-shaped filaments with thickened, tuberous sides and simple, bladdery filaments were revealed (figure 11).

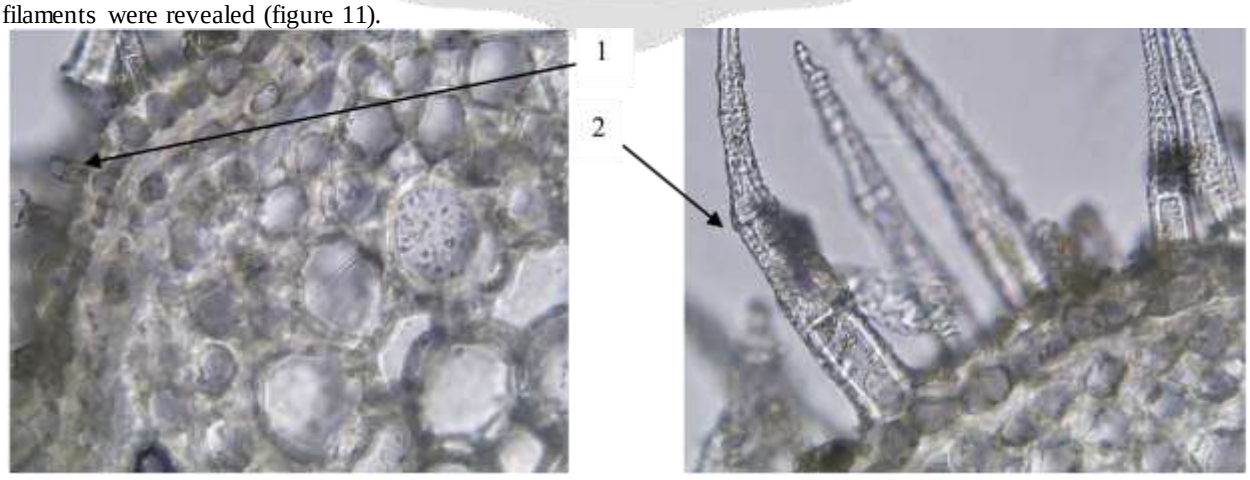

Fig – 11: The microscope slides of leaves *Salvia tesqicola*. Petiole.
1 - bladdery simple filaments, 2 - simple, multicellular, cone-shaped with thickened, tuberous sides filament

On the lower epidermis in small amount capitate filaments with unicellular head and multicellular stalk were revealed (figure 12).

Fig – 12: The microscope slides of leaves *Salvia tesqicola*. Lower epidermis.
1 - capitate filament with unicellular head and multicellular stalk

Discussion and conclusion

Morphological and anatomical signs of leaves *Salvia tesqicola* and *Salvia officinalis* were studied in the compare (see table).

Table 1- Distinctive microscopic signs of leaves *Salvia officinalis* and *Salvia tesqicola*

Microscopic sign	*Salvia officinalis*	*Salvia tesqicola*
Shape of the cells	Polygonal cells	Combined cells
Sinuosity of the sides	Straight or twisting sides	Straight sides
Simple filaments	A) Multicellular, cone-shaped with thickened, smooth sides B) Multicellular, cone-shaped with thickened, tuberous sides	A) Multicellular, cone-shaped with thickened, smooth sides B) Multicellular, cone-shaped filaments with thickened, tuberous sides C) Unicellular nipple-shaper D) Bladdery filaments
Capitate filaments	A) Capitate filaments with unicellular head and unicellular stalk B) Capitate filaments with unicellular head and multicellular stalk C) Capitate filaments with multicellular head and multicellular stalk	D) Capitate filaments with unicellular head and multicellular stalk
Glands full of essential oil	Large quantity	Not in the least
Intracellular inclusions	Druses	Not in the least

A number of evident differences in the morphology and histology of leaves observable species was revealed: differences in the shape and sinuosity of the cells, presence and absence of druses and glands with essential oil, differences in the shape of filaments.
Criteria of differential diagnostics given species were worked out on the base of received facts. Present criteria will help clearly identify medical plant raw material.

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