## Morphological and anatomical study of the gorse (Genista tinctoria L.) flowers used in traditional medicine in Russia I.L. Drozdova, Ya.S. Trembalya, E.I. Minakova

(Federal State Budgetary Educational Institution of Higher Education "Kursk State Medical University" of the Ministry of Health of the Russian Federation, St.

Kursk)

Morphological and anatomical study of Genista tinctoria flowers, used in traditional medicine in Russia IL Drozdova, Ya.S. Trembalya, EI Minakova (Kursk State Medical University, Kursk, Russia)

### SUMMARY

The article presents the results of studying the morphological and anatomical features of the flowers of the gorse (Genista tinctoria L.) of the legume family (Fabaceae). As a result of the studies carried out, characteristic diagnostic signs were revealed that allow to reliably identify medicinal plant materials and can be used in the development of regulatory documentation for the sections "External signs" and "Microscopic signs". The morphological and anatomical features of the gorse flowers have been studied for the first time.

Key words: gorse dyeing, Genista tinctoria L., flowers, morphological and anatomical characters, identification of plant materials.

### RESUME

The article presents the results of studying the morphological and anatomical features of the flowers of Genista tinctoria L. family Fabaceae. The result of the research revealed the characteristic diagnostic features that allow to reliably identify medicinal plant material, and can be used in the development of regulatory documents for "External features" and "Microscopic features". Morphological and anatomical characteristics of flowers of Genista tinctoria were studied for the first time.

Keywords: Genista tinctoria L., flowers, morphological and anatomic features, raw material identification.

### INTRODUCTION

Medicines of natural origin have been successfully integrated into the modern healthcare system in many countries of the world [9]. According to the World Health Organization (WHO), the basis of the nomenclature of modern official herbal preparations in many cases is traditional therapeutic agents, and the developers of modern standardized drugs around the world are turning to the experience of traditional medicine, including with the aim of searching for biologically active substances (BAS) of natural origin [13]. One of the promising plants of the flora of Russia, used by folk medicine for many centuries for the prevention and treatment of various diseases, is the gorse (Genista tinctoria L.) of the legume family (Fabaceae). Dyeing gorse (Fig. 1A) is a semi-shrub with a significant raw material base. This species is widespread in Europe, the Caucasus, and Siberia. In Russia, it is found in the European part (except for the northern regions), in Western Siberia; is known in all average Russian regions [7, 8]. Grows in light forests, on open grassy slopes, limestones, meadow steppes, river valleys. Dyeing gorse has recently been often grown for decorative purposes. Flowers and shoots were previously used to dye yarns and fabrics yellow, and today they are used in natural professional hair dyes to create golden hues; that is why this type of gorse is called dyeing [2, 7, 14].



Rice. 1 A. gorse dyeing (Genista tinctoria L.)(Photo from the site https://zakupator.com/sad/drok.html)

Dyeing gorse in Russia has long been used in traditional medicine, as well as in veterinary medicine [7]. Literature data show that the aerial part of the plant has a choleretic and diuretic effect, is used for hepatitis, for the treatment of the kidneys and urinary tract (with cystitis), for sexually transmitted diseases, rheumatism, bronchial asthma, gout, thyroid diseases, edema of cardiac and renal origin [2]; flowers and seeds are used for malignant neoplasms [2, 14]. The herb infusion is used in dermatocosmetology for allergic itchy dermatoses, vasculitis and psoriasis [3]. In the experiment, the extract of the shoots has analeptic, hypotensive, lactogenic, estrogen-like, and water-alcohol tincture has antibacterial properties; methanol extract inhibits the growth of melanoma cells [2, 14]. The aerial part is effective for hypothyroidism, bronchiectasis, metabolic polyarthritis, cholecystitis, hemorrhoids, metrorrhagia [2]. The pharmacological action of gorse dyeing is due to the complex of biologically active substances that make up its composition. Literature data indicate that the plant contains alkaloids (cytisine, methylcytisine, tinctorin, lupanine, rhombifolin, baptifoline, anagirin and others), flavonoids (luteolin, cinaroside, genistein, ononin, rutin and others) [2, 14], tannins, essential oil, vitamin C [2], organic acids, triterpene saponins [3].

The complex of biologically active substances contained in the plant, a sufficient raw material base, the possibility of cultivation, as well as historical data on the use in traditional medicine and the results of pharmacological experimental studies substantiate the prospects of introducing gorse dye into official medicine. The possibility of using gorse dyeing in scientific medicine makes it necessary to establish morphological and anatomical features that will be used in the diagnosis of medicinal raw materials.

Purpose of work: to study morphological and anatomical featuresstructure of gorse flowers and identify diagnostic signs.

### MATERIALS AND METHODS

The object of the study was the flowers of gorse dyeing. Samplesmedicinal raw materials were collected in the vicinity of Kursk in 2017 in the phase of mass flowering of plants.

Research methods. For the analysis, we used gorse flowers:freshly harvested, dried and fixed in a mixture: ethyl alcohol 96% purified water, glycerin (1: 1: 1) [5, 6, 10, 11, 12, 17]. The establishment of macro- and microdiagnostic signs was carried out in accordance with the articles of the State Pharmacopoeia of the Russian Federation of the XIII edition: OFS.1.5.1.0004.15 "Flowers" and OFS.1.5.3.0003.15 "Technique of microscopic and microchemical examination of medicinal plants and herbal medicinal products" [1]. To study the obtained micropreparations, a light microscope "Biolam Lomo" was used with a different magnification of the device  $(10 \times 20; 15 \times 20; 10 \times 40)$ . Micrographs of the preparation fragments were taken using a digital camera and edited using the Adobe Photoshop CC software.

# RESULTS AND DISCUSSION

As a result of the studies carried out, the macro- and microdiagnostic features of the gorse flowers were described for the first time.

# External signs

Flowers (Fig. 1B) irregular, from 7 to 15 mm long, with a double perianth, fivemembered, on short pedicels. The calyx is green, five-toothed, two-lipped, covered with appressed hairs. Corolla moth, bright yellow, the upper petal (flag) is ovoid with an almost rounded limb; two side petals (wings) are almost equal in length to the flag; the lower fused petals (boat) are elliptical, almost equal in length to the wings; the boat is stupid. There are ten stamens, all fused into a tube. One pistil with subulate column and upper unilocular ovary.

# Microscopic signs

The structure of the calyx. Epidermal cells on both sides of the calyx varyin shape from elongated straight-walled (along the veins and along the edge of the teeth) to parenchymal polygonal with almost straight or slightly sinuous lateral walls in the middle part of the sepals (Fig. 2A, 2B). The stomata are oval, submerged, located mainly on the lower side of the sepals; the type of stomatal apparatus is anomocytic (Fig. 2E). Sepals on both sides along the margin, along the veins and along the entire surface are pubescent with numerous simple one- and two-celled hairs. Unicellular hairs of 2 types. Often there are short, pointed, thin-walled hairs with a slightly warty surface; narrowed at the base, often pressed against the cells of the epidermis (Fig. 2A). Occasionally, there are short, blunt-pointed, thick-walled hairs with a smooth surface (Fig. 2B). Bicellular hairs of 2 types. The most numerous are thick-walled hairs with a narrow cavity and a smooth surface, consisting of a short basal cell and a long terminal cell, which is more or less pressed against the epidermis (Fig. 2D). Occasionally there are two-celled hairs, basal cells of which are short, terminal cells are long, thin-walled, often with collapsing, twisted walls (Fig. 2D). Around the place of attachment of all types of hairs, epidermal cells are located radially and form a rosette (Fig. 2B, 2C, 2D); when hairs fall off, a rounded ridge remains at the site of their attachment. The radiant-wrinkled folding of the cuticle is well pronounced (Fig. 2B).

Corolla petal structure. Upper epidermal cells in the middlepetal parenchymal, with almost straight or slightly sinuous walls (Fig. 3A). The cell contour of the lower epidermis is more sinuous; in the middle part of the petal, the cell walls are zigzag, with well-pronounced folding (Fig. 3B). Along the edge of the petal and along the veins on both sides of it, cells are oblong, rectangular or with beveled ends. The stomata of the anomocytic type are located mainly on the lower epidermis (Fig. 3B). The petal has papillary outgrowths of epidermal cells along the edge and over the entire surface (Fig. 3B). Along the edge of the petal, occasionally there are simple unicellular, thin-walled, filiform hairs with a smooth surface and twisted cell walls (Fig. 3d). Pollen in the form of large elliptical grains with a smooth surface (Fig. 3D).

Thus, for the first time, a study of the morphological and anatomical structure of flowers (calyx, corolla petal) of the gorse was carried out. Macro- and microdiagnostic features of gorse dye flowers, typical for other plants of the Fabaceae family, have been established, which is consistent with the literature data [1, 4, 15, 16]. In addition, distinctive diagnostic features have been identified that allow for reliable identification of gorse flowers, and can be used in the development of regulatory documentation for the "Authenticity" section (external signs and microscopic signs) for a new promising type of medicinal raw material.



Rice. 2. Fragments of the gorse dye cup (× 300; × 400).

A - cells of the upper epidermis; simple short, unicellular, pointed conical, thinwalled hairs with a slightly warty surface; B - a simple short, unicellular, bluntwalled thick-walled hair with a smooth surface; B - a simple two-celled, thick-walled hair with a smooth surface with a short basal and long terminal cells (top view); a rosette of epidermal cells around the base of a hair; folded cuticle; G

- a simple two-celled, thick-walled hair with a short basal and long terminal cell (side view); D - simple two-celled, thin-walled hair with a short basal and long terminal cell with falling walls; E - cells of the lower epidermis and stomata of the anomocytic type.



Rice. 3. Fragments of the gorse dye corolla petal (× 300; × 400). A - cells of the upper epidermis; B - cells of the lower epidermis; B - papillary outgrowths of the epidermis; D - simple unicellular, thin-walled, filamentous hairs with a smooth surface and twisted cell walls; D - pollen.

CONCLUSIONS

1. For the first time, a study of morphological and anatomical signs of flowers (calyx, corolla petal) of gorse used in traditional medicine.

2. Revealed a set of macro- and microdiagnostic signs, which allow to reliably identify the flowers of gorse dyeing and can be used to confirm the authenticity of a new type of medicinal plant raw materials in the development of modern regulatory documentation with the aim of further introducing this type of raw material into medical practice.

# LITERATURE

1. State Pharmacopoeia of the Russian Federation, XIII edition. - M .: MZ 2016. RF, [Electronic publishing]. Access mode: http://pharmacopoeia.ru/gosudarstvennaya-farmakopeya-xiii-online-gf-13online, free.

2. Wild useful plants of Russia. / Resp. ed. A. L. Budantsev, E. E.

Lesiovskaya. - SPb .: Publishing house of SPKhFA, 2001 .-- 663 p.

3. Dmitruk S.I. Pharmaceutical and medical cosmetology. - M .: OOO "Medical Information Agency", 2007. - 184 p.

4. Drozdova I.L., Kalutsky I.A. Morphological and anatomical study of grass multicolored knotweed (Coronilla varia L.) // Kursk scientific and practical bulletin "Man and his health". - 2017. - No. 1. - P.93–97. - doi: 10.21626 / vestnik / 2017-1 / 17

5. Drozdova I.L., Lupilina T.I. Morphological and anatomical study of grass gray hiccups (Berteroa incana (L.) DC.) // Kursk scientific and practical bulletin "Man and his health". - 2014. - No. 2. - P.94–98.

6. Drozdova I.L., Trembalya Y.S., Minakova E.I. Anatomical study grasses of urban gravity (Geum urbanum L.) // Kursk scientific and practical bulletin "Man and his health". - 2017. - No. 4. - P. 125-131. - doi: 10.21626 / vestnik / 2017-4 / 22

7. Illustrated guide to plants of Central Russia. Volume 2: Angiosperms (dicotyledonous: dicotyledonous) / I.A. Gubanov, K. V. Kiseleva, V. S. Novikov, V.N. Tikhomirov. Institute of Technological Research. - M .: Partnership of scientific publications KMK, - 2003. - 665 p.

8. Kiseleva K.V., Mayorov S.R., Novikov V.S. Flora of central Russia. -M .: ZAO "Fiton +", 2010. - 544 p.

9. Kiseleva T.L., Smirnova Yu.A. Medicinal plants in the world medical practice: state regulation of the range and quality. - M .: Publishing house of the Professional Association of Naturotherapists, 2009. - 295 p.

10.Kiseleva T.L., Frolova L.N., Alieva A.A., Melnikova N.N., Tsvetaeva E.V., Pinchuk E.O. Study of anatomical and diagnostic signs of collection No. 1 for the prevention and treatment of frostbite // Traditional medicine. - 2009. - No. 2 (17). - P. 60–64.

11. Kiseleva T.L., Frolova L.N., Soyunova Zh.A., Konovalova E.V., Melnikova N.N., Tsvetaeva E.V. Morphological and anatomical study of freshly harvested raw materials Artemisia absinthium L. - wormwood used in homeopathy // Traditional medicine. - 2009. - No. 1 (16). - P.20-24.

12. Kiseleva T.L., Frolova L.N., Soyunova Zh.A., Konovalova E.V., Melnikova N.N., Tsvetaeva E.V. Morphological and anatomical study of freshly harvested raw materials Artemisia abrotanum L. - wormwood God's tree // Traditional medicine. - 2009. - No. 4 (19). - pp. 17–20.

13.Tutelyan V.A., Kiseleva T.L., Kochetkova A.A., Mazo V.K., Bessonov V.V., Sidorova Yu.S. Plant sources of phytonutrients for specialized antidiabetic food products / Edited by Academician VA Tutelian, Professor TL Kiseleva, Professor AA Kochetkova. - M .: BIBLIO-GLOBUS, 2016 .-- 422 p.

14. Plant resources of Russia: Wild flowering plants, their component composition and biological activity. T.3. Family Fabaceae-Apiaceae / Otv. ed. A.L. Budantsev. SPb .; M .: Tov-in scientific publications KMK, 2010. - 601 p.

15. Samylina I.A., Anosova O.G. Pharmacognosy. Atlas: in 2 volumes. - M .: GEOTAR-Media, 2007. - Vol. 1. - 192 p.

16. Trembalya Y.S., Prokosheva L.I., Lapina E.S. Anatomical structure

vegetative organs of Astragalus chickpea (Astragalus cicer L.) // Pharmacy and Pharmacology. - 2014. - No. 6 (7). - S. 33–35. - doi: 10.19163 / 2307-9266-2014-2-6 (7) -33- 35

17. Trembalya Ya.S., Prokosheva L.I., Pozhidaeva D.N. Study of the anatomical structure of the flower of meadow geranium (Geranium pratense L.) // Uchenye zapiski Oryol State University. Series: Natural, technical and medical sciences. - 2014. - No. 7 (63). - pp. 226–227.

Author's address

Doctor of Philosophy Drozdova I.L., Dean of the Pharmaceutical and Biotechnological Faculties, Professor of the Department of Pharmacognosy and Botany. irina-drozdova@yandex.ru

Drozdova, I.L. Morphological and anatomical study of the gorse (Genista tinctoria L.) flowers used in traditional medicine in Russia / I.L. Drozdova, Ya.S. Trembalya, E.I. Minakova // Traditional Medicine. - 2018. - No. 1 (52). - S. 33-37.

To favorites