



### Opportunities for growing of ural licorice in Yakutia

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The article deals with the material on the study of an alien medicinal species – Ural licorice in the environment of Yakutia. The herb exhibits a slower phenorhythm and ontogenetic rate of development in the introduction. In general the species manifested itself as sustained, winter-hardy and producing mature seeds. It can successfully propagate itself by a vegetative way or by seeds

**Key words:** introduction, phenorhythm, alien species, ontogenesis, vegetative and generative periods.

The Ural licorice *Glycyrrhiza uralensis* Fisch belongs to the pea family *Fabaceae* Lindl. being one of the officinal herbs mostly used for a long time (Pavlov, 1947). It is popular with its diverse officinal, food and technical applicability. Sickly sweet taste mirrored the plant's name in different countries: it has the name – “sweet herb” in China, ‘sweet root’ in Mongolia and Greece. The underground parts of the licorice (rhizomes) have been successfully used as promising officinal raw material in the Chinese, Tibetan, Indian and Japanese medicine.

Drug worth of the licorice root is defined by the content of biologically active substances: glycyrrhizic and glycyrrhetic acids, flavonoids, glucose, saccharose, starch and cellulose. Essential oil, alkaloids and coumarins are found in the underground organs, vitamin C – in the leaves. Years ago the licorice was used as an expectorant to treat deceases of the respiratory tract, as a laxative with chronic constipation and as an agent regulating water-salt metabolism. Glycyrrhizic acid and some of its derivatives possess an anti-inflammatory action as well as an antibiotic action against streptococcus, staphylococcus and other bacteria. Glycyrrhizic acid is administrated at food intoxications and some infectious and allergic disorders such as eczema, nettle rash, asthma (Khadzhai, 1970). Long since the licorice root was widely used mixed with different herbs as officinal collections or teas; it is an ingredient for diuretic, pectoral and laxative teas. Recently the licorice root has been used for preparation of a flavonoid drug - liquivirton for treating gastritis, stomach and duodenal ulcers (Telyatiev, 1991). The licorice is part of many officinal drugs against cough (bromhexine, different mixtures, etc).

The Ural licorice does not occur in the indigenous flora of Yakutia. It grows in steppes, semi-deserts preferring sandy sites, along rivers, hills; rising until 2000 m high above sea level in the mountains. The plant occurs in the southern regions of Eastern Siberia – Minusinsk, Balagan, Bichur areas, down the Argun and Onon rivers, along the lakesides of Zun-Torei and Tsagan-Torei, the Shilka River, Western Siberia, Central Asia, Mongolia and Northern China (Flora of the USSR, 1948; Flora of Siberia, 1994; Telyatiev, 1991).

The Ural licorice was first planted in the Yakutsk Botanical Garden (YBG) in 1991. It was a seeding made by T.V. Andreyeva, by seeds from Novosibirsk (CSBG). The Ural licorice is a perennial herbaceous plant, long-rhizomatous, vegetative moving, with a powerful and deep lying root system developing a complex network of roots and rhizomes. Root dry weight of one plant may attain 800-1200 g. Stalks are tomentous, simple, upright or branched, 70-100 cm high or higher. Alternating leaf position, imparipinnate. Flowers whitish-violet, raceme-assembled, fruit – bared and solid bean, sickle-bent, tortuous, closely gregarious, dense ball-like.

Observation of licorice ontogenesis in the culture lasted for 20 years. Its vegetative period is about 5-6 years, further it enters the generative period.

The licorice is propagated by seeds or rhizome parts 15-30 cm long with 2-3 buds. It is planted in the early spring spaced 25-30 cm from each other with a 50-80-cm of row-spacing. Cuts are fixed upright 2-3 cm above the ground.

Seeds of the Ural licorice have a very solid hull, so to accelerate germination a pre-sowing scarification is needed. Straight before planting seeds are treated with the solution of strong sulphuric acid during 30 min. Sowing is made with thoroughly washed wet seeds at a 1.5-2.0-cm depth into well-fertilized and loose soil. Young growth appears in 8 days. During its first life year licorice plants are of 6-8 cm high (stooling stage). Plants enter the winter dormant period with soft green leaves. Therefore the Ural licorice is regarded as a plant with a slow rhythm of development.

During the first life year the major root grows to 18 cm in length with some lateral roots. In the 2<sup>nd</sup> year the major root goes on growing (28.0) together with abundant lateral roots and appearance of secondary roots

There is a substantial growth of all parts of the root system when the plant is 3-4 years old. By the end of the fifth year the main root attains 122 cm and lateral roots intensively lengthen developing a vegetative sphere. Roots grow very quickly and begin sprawling diversely occupying new sites. The major root attains 12 mm in diameter, and lateral roots average 5 mm. It is important because roots as drug raw material of the first commercial grade must be not less than 8 mm. The Ural licorice introduced in the CSBG had the primary root as long as 2.5 m being 15-20 mm in diameter, its lateral roots stretched out up to 5 m with diameter reaching 5-8 mm. 50% of roots were of commercial quality. (Trankina, 1973, 1975).

During the 6<sup>th</sup> life year the plant comes to a generative state.

V.P. Trankina and A.A. Diakonova (1973) verified that accumulation of extractive matters and glycyrrhizin occurs unevenly. In plants aged 1-3 there is their highest content totaling 42-46%, but their root weight is very low. Further the content of biologically active substances decreases owing to the generative change (15-17%). Since the sixth year their amount increases again and reaches 25% by the seventh year that satisfies the requirements of GosStandard of Russia.

During 19 years of study conducted in the YBG the licorice exhibited itself as a highly stable species in introduction. The plant annually increases its mass, flowers, yields fruits and produces ripe seeds. All this contributes to pre-requisites for the establishment of the local production of the species crude drugs. Moreover the licorice can be successfully planted in Central Yakutia by private owners in their backyards.

Under the condition of Yakutia the observation concerning the development rhythm of the introduced species evidence that this plant has a slow rhythm (Table 1). Plants' regrowth is marked only in early June whereas native species begin their regrowth in late April-early May. The booting stage is observed since mid-June lasting until early July. Budding comes in the end of the second July decade; flowering begins in the second August decade. It is established that the licorice begins flowering in the sixth year of life. Commonly ripening of licorice seeds occurs in the first decade of September, sometimes in unfavorable seasons its seeds do not become ripe.

Table 1

Phenological development of the Ural licorice in culture

Year	Spring regrowth	Booting stage	Budding		Цветение Flowering			Seed setting	Full seed ripening
			beginning	mass	beginning	масс.	end		
2007	4.06	16.06	15.06	18.06	9.07	12.07	23.07	11.07	24.08
2008	13.06	13.06	14.06	20.06	28.06	8.07	20.07	13.07	25.08
2009	14.06	25.06	29.06	4.07	19.07	23.07	27.07	23.07	25.08
2010	14.06	23.06	18.06	22.06	6.07	9.07	20.07	8.07	24.08

Morphological plant values, that we received, evidence about successful introduction of the Ural licorice in Central Yakutia (Table 2). Comparing morphometric parameters of the licorice grown in our environment and in Western Siberia we should justify that a vegetative sphere of plants in both regions is much similar. Average height of our plants (7-8 years old) is 90-95 cm sometimes reaching to 100 cm whereas in Western Siberia these values made up 60-70 cm. Much the same is leaf and inflorescence number on 1 shoot. In our conditions a bush of licorice has from 3 to 11 generative shoots bearing from 3 to 7 inflorescences/shoot. Inflorescences length composes 4-6, their width 3-4 cm. An inflorescence may have as many as 30 flowers. During summer the stem becomes lignified and very elastic. One shoot may have 18-20 imparipinnate very dense leaves 16-20 cm in size and from 6 to 10 cm wide.

Success criterion of the species introduction lies in its efficient fruiting, i.e. seed formation. To know the features of seed propagation of plants is very important when they are introduced in culture. Percent of producing capacity shows the plants' viability (Golovkin, 1973).

Study of the seed yield of the Ural licorice evidences that the species successfully experienced the adaptation and can be grown under Central Yakutia conditions. An estimate of the reproductive ability of licorice plants was made by composing the following elements of productivity: average number of generative shoots per 1 individual, average number of flowers per a generative shoot, average number of seed buds in the flower ovary and average number of mature good seeds in a carpel. The number of set seeds in the carpel depends on ambient conditions and strongly varies from year to year. According to our data ripe seeds formation from seed buds made up 77%, i.e. real productivity as against potential was 1.5 times lower.

Table 2

Morphometric values of the Ural licorice in culture

Indices	2001 г.	2002 г.	2003 г.	2005 г.	2006 г.
Plant height, cm	96,5	101,3	91,0	90,0	86,0
Number of inflorescences on one shoot, pieces	5,75	3,2	12,0	11,0	10,0
Number of flowers in an inflorescence	29,7	28,7	26,0	35,3	33,0
Inflorescence: length, cm	5,9	5,7	5,1	6,1	5,8
width, cm	3,6	3,3	3,2	3,3	3,1
Leaf: length, cm	18,1	21,7	13,2	14,5	19,7
width, cm	7,2	9,9	5,9	8,6	7,8
Number of leaves in a shoot, pieces	18,0	20,0	18,0	17,0	19,0
Bush diameter in the root collar, cm	0,7	-	0,8	-	-

Thousand-seed weight equals  $6.6 \pm 0.66$  g and this is not different from the value of Western Siberia.

So, it should be noted that the growth rate of the Ural licorice in Central Yakutia is much different from the one in Western Siberia. It is explained by the fact that an alien plant slows down its phenorhythm and ontogenetic rate of growth. Generally, the Ural licorice does not yield to winter hardiness and passage of full cycle of development to the indigenous introducents. And its top even outproduces their kinsmen from Western Siberia. So we do not rule out the possibility of the industrial growing of this officinal plant under Central Yakutia conditions aiming at pharmaceutical purposes. The YBG has an available foundation stock in its nurseries of the indigenous herbaceous flora and drug plants for an accelerated seed and vegetative reproduction of the Ural licorice.



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