Trends in the development of the bioresource potential of *Thalictrum* L. in Baikal Siberia

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Abstract. The article is devoted to the modernization of economic development of the Baikal region. The directions of formation of innovative bioresource potential with the use of local plant raw materials are revealed. The biotechnological potential of promising medicinal plants of the genus Thalictrum L. has been studied. The content of microelements and triterpene saponins with cytotoxic and contraceptive properties in plant raw materials from natural and cultivated populations was determined. The data on productivity of *Thalictrum minus* in culture are presented. Accumulation of biologically active substances according to age states is studied. Morphological characteristics of individuals by years of cultivation are shown. The peculiarities of the species growth in agroculture are described. The attention is paid to the formation of productive features. Phenological spectra allowing to determine the terms of phytomass harvesting are compiled. The possibility of using cell cultures of Thalictrum L. as a source of guaranteed standardized raw materials for pharmaceutical purposes is considered.

1 Introduction

It is impossible to consider the issues of modernization of the regional economy without taking into account the bioresource aspects. The conditions of the Baikal natural area impose special restrictions on the development opportunities of economic entities of the Irkutsk region and neighboring regions of Northern Asia. Today, the Irkutsk Region is characterized by significant technological and territorial development disequilibrium, which manifests itself in the predominance of the raw materials sector in the economic structure, underdeveloped infrastructure, the presence and aggravation of acute environmental problems. The use of natural resources is still considered as one of the main sources of economic growth.

2 Materials and Methods

The object of study is the introduction population of Thalictrum minus L. in the Baikal region. The plant samples for the study were aerial parts from four natural populations grown

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in cultivation. The choice of plants was determined by their age conditions, which affect the accumulation of biomass and the content of biologically active saponins. Plants for the study were taken in different experiments: two-year, three-year and four-year. Samples were dried to absolutely dry weight. The determination of triterpene saponins was carried out by high performance liquid chromatography.

3 Results and Discussion

The flora of the Irkutsk region abounds in food, medicinal, and ornamental perennials, but it is a largely undeveloped resource [1]. The prospect for resource regions is seen in the implementation of such a resource-innovation policy, which can bring the region to a new level of economic system, strategically competitive and focused on a balanced economy with growth potential. Introduction of innovative technologies demands creation of the powerful system of carrying out research and development works [2]. An objective assessment of the situation shows that the real opportunity of the Baikal region to compete with other regions is the introduction of innovative technologies and development of innovative, competitive products. Plants are a rich source of natural biologically active substances (BAS). At present, both purified BAS and complex plant preparations are used for medical purposes, promising to expand the gene pool and treat socially significant diseases. The complex of biologically active substances of Thalictrum minus L. cornflower includes alkaloids, cyanogenic compounds and other nitrogen-containing compounds, triterpenoids, flavonoids, phytosterols, carbohydrates, higher fatty acids, tannins, essential oils, coumarins, polysaccharides, organic acids [3]. The therapeutic effect of cornflower is diverse: vasodilator, coronary dilator, hypotensive, diuretic, antitumor, cytostatic (above-ground part of Th. foetidum, Th. minus). Basilica treats diseases of the nervous system (epilepsy): the underground part of Th. trum flavum, the above-ground part of Th. minus; used in neuroses and diseases of the cardiovascular system - Th. minus. In the experiment Th. minus showed sedative action, Th. foetidum - anti-inflammatory and anti-edema properties, Th. flavum - immunomodulatory properties [9-10].

Today we can form the following trends of innovative bioresource development of herbaceous perennials:

1. Creation of new phytopreparations and dietary supplements with natural origin. The most attractive features of phytopreparations are: the possibility of use for children and elderly people, high safety and sufficient efficacy. According to experts, one of the main factors hindering the development of phytotherapy and its introduction into practice is the insufficient level of production of drugs from natural raw materials. The Russian market of herbs and medicinal gatherings is currently showing growth, but the market volume and its share in the total market of pharmaceuticals at the moment look rather modest, amounting to 11-12 million U.S. dollars, or 0.5-1.5%. The general tendency of pharmindustry development is in further introduction of medicines obtained from natural raw materials (mainly medicinal plants) into medical practice. The world pharmaceutical market desperately needs new types of medicines which can at least temporarily replace widely used today means. The prevention and treatment of such diseases as AIDS, hepatitis C and a number of other particularly dangerous infections, it seems, cannot be solved with the existing approaches and requires the search for fundamentally new solutions. Of great interest are plants producing alkaloids (Aconitum kuznezoffii, A. gubanovii, Delphinium cangaicum, D. gubanovii) [4, 5]. To date, medicinal plants that synthesize alkaloids are widely used in chemotherapy for the treatment of cancer. The expansion of the list of such plants and the study of their properties opens up great prospects for obtaining new pharmaceutical products and not only for this branch of medicine.

2. Development of technology for obtaining first-demand functional products with new consumer properties using local herbal raw materials. Creation of bakery products assortment enriched with natural food ingredients of local non-traditional raw materials is of current importance. Particularly important for these purposes is the study of the possibilities of using raw materials that are not yet widely used. Products enriched with mineral elements (Cetraria islandica, SR IrSTU), having preventive and immunomodulatory properties (Thalictrum minus, BSUEL) [6]. Phyto teas and drinks for healthy and dietary nutrition on the basis of local herbal raw materials are always in demand.

3. Development of technology for obtaining animal feed and care products. It is found that many plants and have bactericidal properties, which can be used to create a balanced feed for farm animals and pets. Mushroom mycelium can be a complete substitute for lysine (Pleurotus ostreatus, Flammulina velutipes) [7]. Plant raw materials can be used to solve the problems of hygienic maintenance of animals. Plants can be used as deodorizing additives or as a substrate as containing substances that adsorb or chemically bind products of nitrogenous metabolism of organisms. These are according to the classification of plants based on their active substances: containing natural silicates, saponins and terpenoids, fragrant substances, with a high content of starch and pectin substances, with loose and spongy parts, containing tannins that prevent the reproduction of microorganisms, having adsorptive properties due to the structural features.

4. Technologies of intensive cultivation of plant biomass. The problem of standardization of plant raw materials for high-tech productions cannot be solved by using the existing approaches and requires the search for principally new solutions. Plant cell cultures as an alternative source of secondary metabolites have been widely used around the world for decades. Today the industry produces at least 85 different substances based on cell cultures, including 23 alkaloids, 19 terpenoids, 30 quinones, 11 aromatic compounds, and their number is constantly growing [8, 9, 11-13].

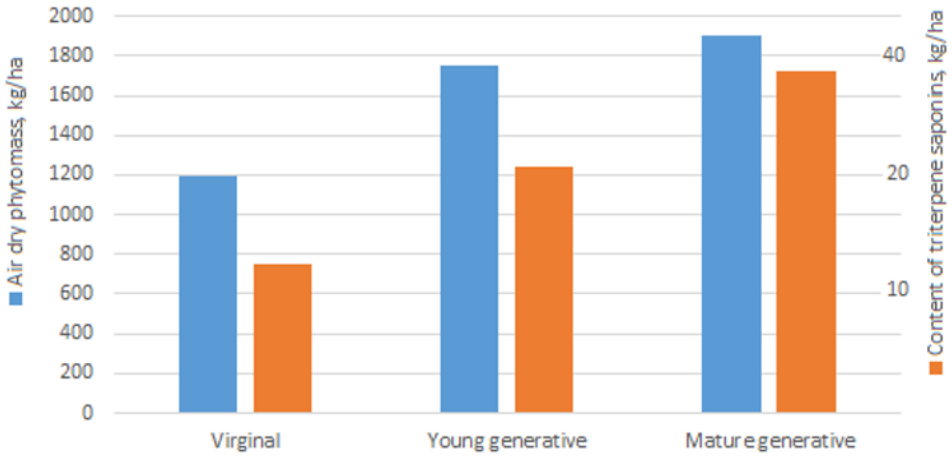

Fig.1. Productivity of economically useful biomass and the content of triterpene saponins of Thalictrum minus L. in the introduction population in ontogenesis

The study of the dynamics of aboveground mass productivity of Thalictrum minus L. during introduction showed that the high productivity is observed toward the end of mass flowering, reaching a maximum in fruiting (Fig.1). The study of the quantitative contribution of elements to the phytomass yield structure shows that the accumulation of triterpene saponins increases in the mature generative age of 3-5 years. Industrial exploitation of

introduced populations is possible from the second year of vegetation. Biomass harvesting should be carried out at the end of July, then the herbage grows without damage to the plants. Certain advantages contribute to the development of this direction of biotechnology, including independence from seasonal conditions, diseases and their vectors, the possibility of obtaining the required amount of the required product with standard quality characteristics (*Thalictrum minus* L., *Aconitum baicalense Tursz*.) [14]. Characteristics of morphological parameters of different-aged individuals of *Thalictrum minus* L. in generative period shown in Table should be used.

Table 1. Characteristics of morphological parameters of different-aged individuals of *Thalictrum minus* L. in generative period, growing in agropopulation

Trait	Age conditions		
	Virginal M+m	Young generative M+m	Mature generative M+m
Height of shoot, cm	78.2+2.4	128.6+3.3	95.7+2.0
Height of inflorescence, cm	12.8+0.8	34.2+1.2	19.3+0.9
Internodes length, cm	12.7+0.4	17.0+0.2	14.8+0.4
Number of flowers per shoot	78.3+6.3	182.5+10.4	107.1+8.6
Number of seeds per shoot	586.3+38.4	1050.2+97.4	784.2+57.3
Aboveground mass productivity, g/shoot	32.6+0.9	58.2+0.7	46.3+0.6

In the above-ground part of shoots, in axils of scaly leaves, awakening of definitive buds forming vegetative shoots is observed. Branching of rhizome due to awakening of terminal and axillary buds is observed in underground part. The hypogeogenic rhizome continues growing, with annual shoots varying significantly in length from 2 to 7 cm and increasing in diameter to 0.5-1.2 cm. Annual dying off of flower-bearing shoots leads to partial destruction of the basal part of the rhizome, which is the initial stage of particulation. Growth of Basilica minor with transition to reproduction decreases to 2-6 cm per year. Phenological spectra allowing to determine the terms of phytomass harvesting are compiled (Fig.2.).

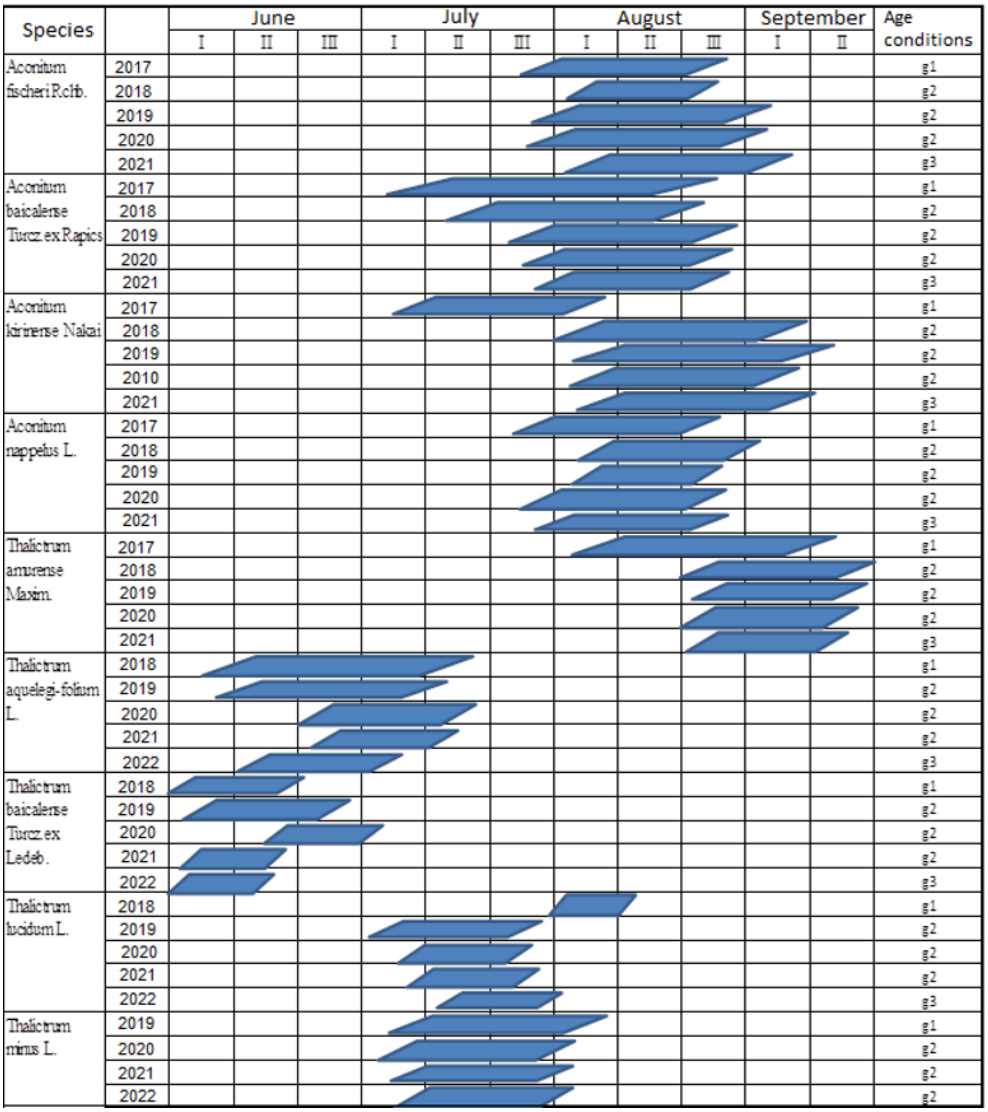

Fig. 2 Phenospectra of flowering of some useful plants during introduction

Proposed methods and approaches to solve the tasks: plant tissue and cell cultures, plants in vitro and microclonal multiplication, methods of genetic engineering, methods of chemical analysis.

4 Conclusion

Currently, the expediency of creating a state program of interregional level for the integrated study of useful plant resources as a basis for the creation of innovative industries has become obvious. At the same time it is necessary to coordinate the efforts of not only scientists, biochemists, technologists, but also economists and marketers. It is necessary to build a base for the development of rational resource use in the region. The formation of innovative bioresource potential is advisable to carry out on a program basis, to purposefully form the positions of technological leadership in this area. Further replication of the created

technologies and the creation of an interregional innovation network will give significant multiplicative effects, forming a new technological wave, and will also create conditions for the possible export of technologies of bioresource use. In addition, the attractiveness of the region will increase, because the increasing innovation potential will act as an indicator of intensive economic development and a condition for economic efficiency.

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