

PRACTICAL APPLICATION *TILIA CORDATA*

N.E. Tarasovskaya¹, B.Zh. Baymurzina², D.K-K. Shakeneva¹, N.V. Suhanova²

¹ Pavlodar Pedagogical University named after Alkey Margulan,
Pavlodar, Kazakhstan

² Bashkir State Pedagogical University named after B. Akmulla, Ufa, Russia

Abstract

The northern regions of Kazakhstan, including the Pavlodar region, are distinguished by rich and diverse nature, combining floodplain, steppe and forest landscapes. More than 500 species of wild higher plants grow in our region, and many of them can be used as food. However, the problem of using regional wild plants for food has not yet been sufficiently studied.

However, plants serve not only as a direct source of food, but also as technological raw materials for processing traditional food products to obtain original taste qualities and maximum benefit. With the help of wild plants, it is possible to solve many everyday problems – both at home and in the field conditions, not only without a food store, but also without a hardware store. In addition, plants can provide for lovers of artistic creativity such an amount of decorative materials that it is impossible to find in specialized stores.

The novelty of the results obtained consists in identifying the possibilities of using dozens of common wild plants of the Pavlodar region for food purposes, and some species are offered as raw materials for cooking, as well as in food processing technologies for the first time.

The practical significance of the results obtained will make it possible to use the data obtained by food technologists, tourism instructors and school leaders for guides, as well as all nature lovers who want to diversify their menu with unusual products from wild plants.

Keywords: technology, wild plants, region, food, medicinal plants, method, method

Introduction. *Tilia cordata* is an introduced plant in the Pavlodar region and adjacent regions of Kazakhstan. Flowers are a well-known medicinal raw material, which is used in folk medicine for colds and in the handbook of medicines by M. Mashkovsky as an antispasmodic and soothing agent.

The heart-leaved *Tilia cordata* is a large deciduous tree. The family Tiliaceae. The height of the plant is up to 25 cm. The trunk is slender, the crown is wide. Young trees have olive or red-brown bark, older trees have a darker color. The leaves are alternate, without stipules, heart-shaped, with a finely sawed edge and a whole leaf blade. Blooms in June-July. The flowers are fragrant, pale yellow, collected in half-cones. Near the flowers there are filmy bract leaves (bracts). The fruit is a nut, ripening in August-September.

Heart-leaved *Tilia cordata* in many regions of Kazakhstan (both northern and southern) is an introduced, but successfully established plant: trees live for many decades, often propagated by seeds or shoots. As an acclimatized plant, linden is widespread in artificial plantings and is characterized by durability.

Tilia cordata both now and in the past was distinguished by extensive economic use. Bast (bast) is used for washcloths, before for the manufacture of bast shoes (and now they are trying to revive weaving from bast for the manufacture of hygienic natural summer shoes). Baskets and tuesas are woven from lime bast for various household purposes, collecting

mushrooms and berries, and simply as an original souvenir. Lime brooms are no less useful than birch brooms and are popular with fans of the Russian bath. An infusion of lime color washes the face to give the skin elasticity. *Tilia cordata* wood is soft, and therefore it is an excellent ornamental material, especially for wood carving.

In the handbook of medicines by M. Mashkovsky, lime blossom appears as a spasmalyst of plant origin [3]. Flowers collected during flowering with bract leaves containing essential oils, tannins, mucus, flavone glycoside) are used as a decoction as an antispasmodic and diaphoretic agent.

Materials and methods. Pavlodar region is located within the steppe zone in the northeastern part of the Republic of Kazakhstan. The region is bordered on the north by the Omsk Region, on the northeast by the Novosibirsk Region, on the east by the Altai Territory of the Russian Federation, on the south by the East Kazakhstan and Karaganda regions, on the west by the Akmola and North Kazakhstan regions of the Republic of Kazakhstan. Most of the territory lies in the subzone of the kovylnotipchak steppes on dark chestnut and chestnut soils. There are flood meadows in the Irtysh Valley. Pine-birch forest grows in the mountains of Bayanaul, there are many picturesque lakes (Zhasybai, Toraigy, Sabyndykol, etc.). There are large deposits of coal, non-ferrous and rare metals, table salt, and building materials in the bowels of the Pavlodar region. The Irtysh River flows through the region with a length of 500 km within the region, the Irtysh-Karaganda canal with a length of 458 km has been built.

The northern regions of Kazakhstan, including the Pavlodar region, are distinguished by a rich and diverse nature, despite the poor wooded area of the region, its systematic composition of flora is characterized by a significant diversity of vegetation. The forests of the region are divided into floodplain, forest-steppe,

mountain and ribbon lands. The main role in tree and shrub plantations, especially on the territory of settlements, is played by cultural and introduced species of trees and shrubs, mainly with valuable economic properties.

Unfortunately, many local trees and shrubs are not used in green construction. Therefore, the study of the dendroflora of the Pavlodar region in order to introduce promising local species into the culture, their use for landscaping is very important, since the species of wild plants are most adapted to local soil and climatic conditions. Many wild plant species are medicinal, highly decorative, honey and food, which makes them very attractive for landscaping settlements in our region and can be used in landscape architecture of the northern part of Kazakhstan, which will increase production efficiency and economic benefits from green construction.

The formation of wild vegetation and its spatial differentiation is most influenced by climatic features. The entire Pavlodar region is located in the steppe zone. Regional climatic factors on the territory of the region depend on latitudinal changes in the distribution of heat and moisture that occur when vegetation cover changes at the zonal and zonal levels. On the territory of the region, wild plants are formed mainly in intrazonal conditions: on the floodplain of the Irtysh River, in the plains of the Bayanaul district, in the plains of medium-arid zones and in the pine forests of the Shaldai shallow relief-on sandy soils.

The climate of the region is estimated as sharply continental. In winter, the weather is frosty (drops below -25°C) with a wind of less than 5 m/s. In some years, there was a decrease in temperature to -49°C . Summer is hot, the average monthly temperature in July is $20-22^{\circ}\text{C}$, in the daytime it reaches $26-28^{\circ}\text{C}$, with a wind speed of more than 6 m/s.

The average annual precipitation is 200-300 mm, in some years up to 350 mm, the

main amount falls in the summer in the form of intense precipitation. Stable snow cover lasts for 135-145 days. An insignificant level of snow cover, the maximum height of which does not exceed 20-25 cm, in combination with severe frosts leads to deep (up to 2-3 m) freezing of the soil.

The authors of the article proposed using dry ground flowers with *Tilia cordata* bracts for milk fermentation and obtaining a sweet fermented milk drink which are added to whole milk in a mass fraction of 3-5%, followed by heating to a boil. After cooling, a finely dispersed cottage cheese with a sweet taste is formed which is not susceptible to microbial spoilage at room temperature for 7-10 days. When whole milk is frozen, it is possible to heat a dry linden color (without grinding) in milk to a boil, followed by straining of vegetable raw materials through a sieve with 0.5-1 mm mesh. In the future the product can be used as a sweet-tasting drink with a long shelf life or to separate casein from whey and use the curd mass for eating and making cheese products [1].

When searching for vegetable raw materials suitable for milk fermentation, the authors set the task of expanding the arsenal of vegetable raw materials for whole milk fermentation. To solve this problem, it was proposed to use dry ground flowers with *Tilia cordata* bracts containing the mucous flavone glycoside hesperidin.

The advantages of the technology developed and patented by the authors are as follows:

1) The possibility of whole milk fermentation without the use of special ferments and strains of microorganisms, using available and harmless plant raw materials.

2) The possibility of year-round storage of vegetable raw materials with the use of milk fermentation as needed.

3) Simplicity and ease of implementation of the method in home, field and production conditions.

4) Increasing the shelf life of the obtained dairy products with coagulated casein, preventing microbial spoilage without additional cooling or the introduction of preservatives, due to the preservative and bactericidal properties of the vegetable raw materials themselves.

5) Versatile health-improving effect of vegetable raw materials: antiseptic, antispasmodic, soothing, vasodilating, diuretic, diaphoretic, blood thinning (antiplatelet), as well as restorative and regulating metabolic processes (due to the content of vitamins and other biologically active substances).

6) Increasing the nutritional value of the product and the degree of its assimilation for people of different ages (improving the absorption of coagulated casein, emulsifying milk fats, increasing the absorption of monomers in the intestine due to saponins of vegetable raw materials).

7) The possibility of obtaining sweet varieties of cottage cheese and drinks with coagulated casein (without sour taste).

Results. The test results of the method of milk fermentation using dry linden color, production and storage of products were as follows.

Example 1. Homemade fresh milk purchased on the market was brought to a boil by adding *Tilia* flowers in a mass fraction of 5-6%. After cooling, fine colloids of casein formed in the milk, the resulting drink resembled young kefir or acidophilic milk, but its taste was sweet (organoleptically much sweeter than whole milk). Large plant particles (lime flowers with bract leaves) were removed by filtering the liquid through a metal sieve with a cell size of about 1 mm. After settling for several hours, the liquid began to separate into whey and curd mass, both had a sweet taste, without acid. When shaken, the liquid again acquired a homogeneous consistency. Cottage cheese and drink were stored at room temperature for a week. During this time, the taste of the products has not

changed, there were no signs of microbial spoilage. The first experiment ended with the fact that the resulting dairy product was drunk by a cat (the taste was not repulsive for the animal, long-term storage did not affect the quality of the product).

Example 2. Several samples of ultra-pasteurized and melted milk produced by different companies were brought to a boil in the presence of linden flowers crushed to a dusty state (collected and dried together with bract leaves) in a mass fraction of 4-5%. It turned out to be a sweet thick drink with finely dispersed casein particles evenly distributed in the liquid. Under the MBC-10 microscope, small particles of casein were detected at a magnification of 2*8. Further observations showed that in samples of pasteurized milk, the settling of cottage cheese occurs slowly, over several hours (sometimes more than a day). The products were stored at room temperature for 7-10 days, then were fed to animals.

Example 3. Bicarbonate of soda (sodium bicarbonate) was added to fresh milk in a mass fraction of 2-3% to reduce acidity. Part of the milk was left at room temperature in an open container, the other part was heated to a boil with the addition of crushed lime color in an amount of 5% of the total mass of the liquid. Milk with soda, without the addition of vegetable raw materials, did not sour for 3 days. Heating with the addition of lime color led to the production of a thick drink, with finely dispersed, evenly distributed colloids of casein, a sweet taste, behind which there was no taste of added soda. After a week of storing both batches of milk at room temperature, yogurt with the addition of soda on top began to be covered with mold fungi, and no signs of microbial spoilage were found in the drink with the addition of lime (curd particles separated from the whey without stirring the product).

Example 4. Concentrated milk "Shadrinsky" (with a mass fraction of protein 6.0%, carbohydrates 9.4%, fat –

7.1%), sterilized, made without the use of preservatives, in sealed packaging (TU 9277-024-13605199), was heated to a boil with the addition of crushed lime color in a mass fraction of 5-6%. It turned out to be a thick sweet drink with finely dispersed coagulated casein, slightly slimy consistency. Within 2-3 days, the drink was suitable for adding to tea, giving it a special taste and aroma. At the same time, elderly and middle-aged people who could not tolerate whole milk noted the absence of a negative effect on the gastrointestinal tract. Then a sweet curd mass separated from the liquid, which was stored at room temperature without signs of microbial spoilage for two weeks.

Discussion. The proposed method of milk fermentation using the proposed vegetable raw materials is as follows. Dry ground flowers with *Tilia cordata* bracts are added to whole milk in a mass fraction of 3-6%, followed by heating to a boil. After cooling a finely dispersed cottage cheese with a sweet taste is formed, which is not susceptible to microbial spoilage at room temperature for 7-10 days. When whole milk is frozen, it is possible to heat a dry lime color (without grinding) in milk to a boil, followed by straining of vegetable raw materials through a sieve with 0.5-1 mm mesh.

In the future the product can be used as a drink (acidophilic milk substitute) with a sweet taste, with a long shelf life, or to separate casein from whey and use the curd mass for consumption (direct consumption) and the manufacture of cheese products.

There is information in the literature that the rennet enzyme that ferments milk is contained not only in the rennet of ruminants, but also in many plants [2]. Rapid fermentation of milk was revealed for the juice of the *Galium verum*, which found application in cheese making.

Empirically, it is possible to find plants that contain such enzymes, as well as other factors that cause the coagulation of

caseinogen in whole milk (for example, organic acids, tannins, flavonoids).

Tilia cordata flowers as a raw material for milk protein coagulation were found by us empirically, supported by numerous experiments with milk and whole milk products, as well as analysis of known data on the chemical composition and biologically active substances of the plant raw materials used.

Tilia flowers contain essential oils (0.05%), tannins, mucus, wax, sugars, carotene, vitamin C, glycoside hesperidin, saponins, leaves and bract leaves contain phytoncides [3-5]. The aroma of *Tilia* essential oil is due to the alcohol content of farnesol, the bracts contain mucus and tannins, the fruits contain fatty oil (up to 59%) [6].

The factors of long-term preservation of the resulting drink and curd product, based on known information about the chemical composition of vegetable raw materials, may be as follows.

Mucous substances and saponins with surface-active properties contribute to the preservation of the suspended state of coagulated casein colloids, which determines the optimal consistency and aesthetics of the appearance of the resulting drink.

The sugars contained in the nectar give the drink a sweeter taste compared to whole milk and most fermented beverages.

The increase in the nutritional value of the product and the degree of its assimilation by people of different ages is due to the following factors.

1. Purified casein is well absorbed by people of any age, including the middle and elderly, when the natural mechanisms of coagulation of caseinogen from whole milk products are already disrupted.

2. Thanks to saponins an improvement in the permeability of the intestinal epithelium and the absorption of substances in the gastrointestinal tract is achieved [8], due to which the completeness

of assimilation of food increases, the absorption of vitamins, trace elements, drugs improves (which can be used for the speed and completeness of assimilation of medicines for oral use).

3. Emulsification of fats with saponins [9] and more - their digestion by pancreatic juice lipase promotes better absorption of fat-soluble vitamins (A, D, E, K), which are antagonists of thyroid hormones and reduce the intensity of redox (catabolic) processes, allowing exhausted people to gain weight [10].

4. The amount of easily digestible carbohydrates increases due to the nectar contained in the *Tilia* flowers.

Conclusion. In addition, the authors tested the use of lime leaves to increase the safety of soups, broths and other hot dishes without using a refrigerator. The addition of several linden leaves (3-7 per 1 liter of hot liquid dish) made it possible to preserve meat, fish and vegetable broths at room temperature and even in the summer heat for at least 2-3 days. Then this method was used to store wet feeds (bags) for animals – in small kennels of dog breeding and in private farms for poultry.

References

1. Patent of the Republic of Kazakhstan for invention №34347. The method of milk fermentation using vegetable raw materials/ Tarasovskaya N.E., Baymurzina B.Zh., Khasanova L.A.; publ. 08/14/2020 [32].
2. Yordanov D., Nikolov P., Boychinov Asp. *Phytotherapy. Treatment with medicinal herbs. The fourth Russian edition.* – Sofia: Medicine and Physical Education, 1976. – From 6
3. Mashkovsky M.D. *Medicines. In 2 vols. Vol. 1. – 14th ed., reprint, ispr. and add.* – M.: OOO "New Wave Publishing House", 2000. – 608 p. – p. 407
4. Kortikov V.N. *Complete encyclopedia of medicinal plants / V.N. Kortikov, A.V. Kortikov.* – Rostov-on-Don: Phoenix, 2008. – 797 p. – p. 358
5. Pastushenkov L.V., Pastushenkov A.L., Pastushenkov V.L. *Medicinal plants: Use in*

folk medicine and everyday life. – L.: Lenizdat, 1990. – 384 p., ill. – pp. 146-147

6. Ryabokon A.A. The newest reference book of medicinal plants / A.A. Ryabokon. – Rostov-on-Don: Phoenix, 2009. – 397 p. – (Live line). – P. 113

7. Biological Encyclopedic Dictionary / Gl. ed. M.S. Gilyarov; editors: A.A. Baev, G.G. Vinberg, G.A. Zavarzin, etc. – M.: Soviet Encyclopedia, 1989. – 832 S. – S. 675, dictionary entry "Flavonoids"

8. Veterinary Encyclopedia / Chief editor K.I. Scriabin. – M.: Soviet Encyclopedia, 1975. – Vol. 5 (Shoering – Toxicological analysis). – 1088 p. – p. 570

9. Petrov A.A. H. Balyan.V., Troshchenko A.T. Organic chemistry. Textbook for universities/Edited by N. A.A. Petrov. – M.: Higher School, 1981. – 592 p. – p. 505

10. Shilov P.I., Yakovlev T.N. Fundamentals of clinical Vitaminology. Ed. second, revised and supplemented. – M.: Medicine, 1974. – 343 p. – p. 255

Список литературы

1. Патент РК на изобретение №34347. Способ створаживания молока с помощью растительного сырья /Тарасовская Н.Е., Баймурзина Б.Ж., Хасанова Л.А.; опубли. 14.08.2020 г. [32].

2. Йорданов Д., Николов П., Бойчинов Асп. Фитотерапия. Лечение лекарственными травами. Четвертое русское издание. – София: Медицина и физкультура, 1976. – С 6].

3. Машковский М.Д. Лекарственные средства. В 2 т. Т. 1. – 14-е изд., перераб., испр. и доп. – М.: ООО «Издательство Новая волна», 2000. – 608 с. – С. 407

4. Кортиков В.Н. Полная энциклопедия лекарственных растений/В.Н. Кортиков, А.В. Кортиков. – Ростов-на Дону: Феникс, 2008. – 797 с. – С. 358

5. Пастушенков Л.В., Пастушенков А.Л., Пастушенков В.Л. Лекарственные растения: Использование в народной медицине и быту. – Л.: Лениздат, 1990. – 384 с., ил. – С. 146-147

6. Рябоконт А.А. Новейший справочник лекарственных растений /А.А. Рябоконт.

– Ростов-на-Дону: Феникс, 2009. – 397 с. – (Живая линия). – С. 113

7. Биологический энциклопедический словарь /Гл. ред. М.С. Гиляров; редкол.: А.А. Баев, Г.Г. Винберг, Г.А. Заварзин и др. – М.: Советская энциклопедия, 1989. – 832 с. – С. 675, словарная статья «Флавоноиды»

8. Ветеринарная энциклопедия/Гл. ред. К.И. Скрябин. – М.: Советская энциклопедия, 1975. – Т. 5 (Подковывание – Токсикологический анализ). – 1088 с. – С. 570

9. Петров А.А., Бальян Х.В., Троценко А.Т. Органическая химия. Учебник для вузов/ Под ред. А.А. Петрова. – М.: Высшая школа, 1981. – 592 с. – С. 505

10. Шилов П.И., Яковлев Т.Н. Основы клинической витаминологии. Изд. второе, переработанное и дополненное. – М.: Медицина, 1974. – 343 с. – С. 255

Tilia cordata практикалық қолданылуы

Аңдатпа

Қазақстанның солтүстік облыстары, соның ішінде Павлодар облысы жайылмалық, далалық және орманды ландшафттарды біріктіретін бай және алуан түрлі табиғатымен ерекшеленеді. Өңірімізде жабайы биік өсімдіктердің 500-ден астам түрі өседі, олардың көпшілігін азық ретінде пайдалануға болады. Дегенмен, аймақтық жабайы өсімдіктерді азық-түлікке пайдалану мәселесі әлі жеткілікті зерттелмеген.

Дегенмен, өсімдіктер тағамның тікелей көзі ретінде ғана емес, сонымен қатар дәстүрлі тағам өнімдерін өңдеудің технологиялық шикізаты ретінде қызмет етеді - ерекше дәмдік қасиеттер мен максималды артықшылықтарды алады. Жабайы өсімдіктердің көмегімен көптеген күнделікті мәселелерді шешуге болады - үйде де, экспедициялық дала жағдайында да, азық-түлікті ғана емес. Сонымен қатар, өсімдіктер өнер әуесқойларын мамандандырылған дүкендерде таба алмайтын көптеген қолөнер материалдарымен қамтамасыз ете алады. Ал жабайы өсімдіктер туралы ғылыми-қолданбалы

мәліметтерді оқу үрдісіне енгізе отырып, болашақта еліміздің «жасыл экономикасын» құрушыға айналатын креативті ойлайтын маманды тәрбиелей аламыз.

Зерттеу барысында келесі жұмыс гипотезалары алға тартылды: егер жергілікті жабайы өсімдіктер ұтымды пайдаланылса, онда көптеген өсімдік тағамдарын егістікте алмастыруға болады, ал өсімдік материалдарының кейбір түрлерін нарықтық масштабта пайдалану үшін перспективті деп санауға болады.

Алынған нәтижелердің жаңалығы Павлодар облысындағы ондаған кең таралған жабайы өсімдіктердің азық-түлік мақсатында пайдалану мүмкіндіктерін анықтауда, ал кейбір түрлері тамақ дайындауға шикізат ретінде ұсынылуда, сондай-ақ тағамдық өңдеу технологияларында алғаш рет ұсынылуда.

Алынған нәтижелердің практикалық маңыздылығы азық-түлік технологияры, туризм нұсқаушылары және мектеп жетекшілері алған мәліметтерді гидтерге, сондай-ақ өз мәзірін жабайы өсімдіктерден ерекше өнімдермен әзірленуді қалайтын барлық табиғат әуесқойларына пайдалануға мүмкіндік береді.

Кілтті сөздер: Технология, жабайы өсімдіктер, аймақ, тағамдық өнім, дәрілік өсімдіктер, тәсіл, әдіс

Практическое применение *Tilia cordata*

Аннотация

Северные регионы Казахстана, в том числе Павлодарская область, отличаются богатой и разнообразной природой, сочетающей пойменные, степные и лесные ландшафты. В нашей области произрастают свыше 500 видов дикорастущих высших растений, и многие из них могут использо-

ваться как пищевые. Однако проблема использования региональных дикорастущих растений в пищу еще недостаточно изучена.

Растения служат не только непосредственным источником пищи, но и технологическим сырьем для переработки традиционных пищевых продуктов – с получением оригинальных вкусовых качеств и максимальной пользы. С помощью дикорастущих растений можно решить многие бытовые проблемы – как в домашних, так и в экспедиционно-полевых условиях, обойдясь не только без продовольственного, но и без хозяйственного магазина. При исследовании были выдвинуты следующие рабочие гипотезы: если рационально использовать местные дикорастущие растения, то в полевых условиях можно заменить многие растительные продукты питания, а некоторые виды растительного сырья рассмотреть как перспективные для использования в рыночных масштабах.

Новизна полученных результатов состоит в выявлении возможностей использования для пищевых целей десятков распространённых дикорастущих растений Павлодарской области, причем некоторые виды предлагаются как сырье для приготовления пищи, а также в технологиях переработки пищевых продуктов впервые.

Практическая значимость полученных результатов позволит использовать полученные данные технологами пищевой промышленности, инструкторами по туризму и руководителями школ для гидов, а также всеми любителями природы, которые захотят разнообразить свое меню необычными продуктами из дикорастущих растений.

Ключевые слова: Технология, дикорастущие растения, регион, продукт питания, лекарственные растения, способ, метод

Материал поступил в редакцию
15.01.2023