REVIEW ARTICLE

Nutritional and medicinal properties of Korean cedar cones and seeds in Russian Far East

Genadii V. Gukov[1,2], Natalya G. Rozlomiy[1,2], T. V. Kostyrina[1], M. A. Li[1]

[1]Mountain-Taiga Station behalf of Vladimir Komarov - Branch of the Federal Scientific Center of the East Asia Terrestrial Biodiversity, Far Eastern Branch of the Russian Academy of Sciences Vladivostok 690022, Russia,[2]V. K. Komarov Mountain-Taiga Station FEB of the Russian Academy of Sciences, FSEO HPE Primorskaya State Agricultural Academy, Primorye Region, Ussuriisk 692533, Russia

Abstract

Cedar-broadleaf forests developed by Korean cedar (*Pinus koraiensis* Siebold et Zucc.) are the most ancient and most valuable forest formation of the Far East. More than half of these forests areas and reserves are located in Primorsky Krai, where multidimensional works are carried out during the past decades to restore its range and timber reserves. This is due to the fact that all parts of this relic species (needles, wood, cones, seeds, etc.) have different medicinal properties, which were well known to local people and were used to treat many diseases.

Key words: Cedar-broadleaf forests, complex intravital use, cones, film, husks, kernels, Korean cedar, medicinal properties, nuts, shells

INTRODUCTION

Korean cedar (Korean pine) - *Pinus koraiensis* Siebold et Zucc. - is the main and the most valuable tree species of cedar-broadleaf forests in the Far East. The range of these forests is quite extensive. Schematically, the boundaries are delineated by the following coordinates: 42°30' - 51°32' of Northern latitude and 129°50' - 140°20' of Eastern longitude. Despite such a wide distribution, cedar-broadleaf forests occupy only 3.3% of the entire forest-covered area of the Far East, and about 8% by reserve. Cedar-broadleaf forests have been the main object of lumber logging for a long time. Selective cutting of cedar led to its disappearance in many native habitats, the disturbance, and devaluation of plantations. In Primorsky Krai, the total area of cedar forests decreased from 4.2 million hectares to 2.2 million hectares since 1929 till 1993, that is, almost by half.[3] Despite the reduction of areas, Primorsky Krai accounts for more than half of cedar-broadleaf forest areas and reserves of the Far East.

Korean cedar reaches the height of 35 m and is an ancient relict species [Figure 1]. Its ancestors existed during the Paleogene (40 million years ago), and cedar made the part of the Turgai type tertiary forests. Kurentsova (1968) attributed Korean cedar to the group of prosperous or progressing relics.[8] The representatives of this group have adapted well to environmental conditions, they are viable ones, regenerate naturally in a perfect way and grow well in forest cultures. The cones of Korean cedar become ripe by the 2nd year and fall usually in autumn - in September-October, with the first frosts and on windy days [Figure 2]. Some of them remain and fall during the winter, and the unripe ones are delayed until the next calendar year.[4] The sizes of ripe cones make from 8 to 17 cm in length, they are ovate-elongated with deflected scales and are considered to be beautiful Far Eastern souvenirs. One cone has 140 nuts on the average, the length of nuts makes 12-16 mm [Figure 3].

Cedar-broadleaf forest is a unique pharmacy. Cedar needles have antiscorbutic properties. They are also used for coniferous baths. Gum (cedar tar) is an antiseptic and is used

Address for correspondence:
Natalya G. Rozlomiy, V. K. Komarov Mountain-Taiga Station FEB of the Russian Academy of Sciences, FSEO HPE Primorskaya State Agricultural Academy, Primorye Region, Ussuriisk 692533, Russia.
E-mail: gukovgv@mail.ru

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Figure 1: Korean cedar

Figure 2: Korean cedar cones

for the preparation of patches and ointments. Turpentine and rosin are obtained from gum by distillation. These products are a medicinal raw material and a technical means.

MATERIALS AND METHODS

The object of the study is the derivative production of Korean cedar (nut kernel, husk, shell, and film). Chemical composition studies were carried out in the laboratories of the Federal Scientific Center Biodiversity, Far Eastern Branch of the Russian Academy of Sciences, according to the generally accepted methods.

RESULTS AND DISCUSSION

The cones of Korean cedar consist of cover scales, called husks by people, seeds (nuts) which consist of shell, film, and a nut kernel. The most valuable nutrients and various medicinal properties are present in nut kernels, the mass of which makes 22-29% of a dry cone mass [Figure 4]. The kernels of cedar nuts contain proteins, fats, carbohydrates, starch, micro- and macro-elements (zinc, potassium, phosphorus, magnesium, iron, calcium, iodine, chlorine, sulfur, sodium, copper, cobalt, and various vitamins). According to the chemical content, nut kernels contain 60-70% of cedar oil, which is well absorbed by a human body. The proteins of cedar nut kernels (up to 20%) are characterized by an increased content of 19 amino acids, many of which have high biological value and are involved in the prevention of certain metabolic disorders in a human body. The most important of the amino acids is arginine, which is extremely useful for a growing child's organism. Thus, it is recommended to include the kernels of cedar nuts in children and pregnant women diet. Essential amino acids are absorbed by a human body almost completely (99%).

Vitamins are important for human health. They are biologically active organic compounds, which are vital for an organism, being the material of enzyme system development. There are more than 30 names of vitamins, some of them are also found in Korean cedar kernels. B vitamins are necessary for human health, they promote his growth, strengthen skin, and they are all contained in various parts of medicinal plants. The kernels of cedar nuts have A1, B1, B2, B3, C, E, K, and R vitamins. Vitamin A1 (retinol) increases a body resistance to infections. It promotes the growth and strengthening of bones, the health of skin, hair, teeth, and gums.

Vitamin B1 (thiamine) promotes the absorption of fats, carbohydrates in a body and the normal operation of a nervous system and protective forces. There is a rapid fatigue with its lack due to musculature weakening, and a digestive tract disruption takes place.[5] Vitamin B2 (riboflavin) plays an important role for the normal functioning of vision organs, the processes of cell and tissue growth and restoration. Vitamin B3 (nicotinic acid) improves carbohydrate metabolism, participates in tissue respiration, makes a vasodilating effect. Brain activity depends on nicotinic acid. It is used in a complex treatment of child anemia, improves appetite, reduces the toxic effect of lead and carbon sulfur. This vitamin is needed for mental workers. Vitamin C is one of the most important and necessary ones for the normal activity of a body. It increases the resistance of a body to infections and is used to prevent colds. Vitamin E (tocopherol) is required for cell renewal. Tocopherol promotes the rejuvenation of a body, slows the aging of cells, and increases the supply of oxygen to a body and endurance. Vitamin E promotes the absorption of fats, the excretion of cholesterol from a body. Vitamin K (phylloquinone) increases blood coagulability and is involved in prothrombin development has antibacterial, antimicrobial, and analgesic effects. The first signs of Vitamin K deficiency are: The disruption of intestine operation, bleeding, poorly healing wounds, nosebleeds, and increased fatigue. Vitamin P (rutin, quartzetin) belongs to the group of plant pigments and flavonoids. This vitamin is necessary for a body since it reduces the fragility of blood vessels and increases their elasticisty. It is useful in combination with Vitamin C. It should also be noted that cedar nut contains a rare chemical

Figure 3: Korean cedar seeds (nuts)

Figure 4: Korean cedar nut kernels

element - iodine, the deficiency of which in a body is felt by many residents of the Far East, as well as by the residents of Siberia and the North of Russia.[6]

In folk medicine, Korean cedar kernels are recommended against gastrointestinal tract diseases (gastritis, gastric ulcer, etc.), cardiovascular and pulmonary diseases, including tuberculosis and also for atherosclerosis prevention and treatment.[7] The use of cedar nuts is also useful for the nervous and immune system, during stresses, irritability, general fatigue, for mental activity maintaining, at reduced immunity and vitamin deficiency. Besides, the regular use of Korean cedar kernels restores male potency, increases immunity, and life expectancy.

Shell

The hard shell of Korean cedar seeds is covered with a thick, woody skin called shell by folk [Figure 5]. Shell makes up to 70% of nut weight. The chemical composition of a nut shell includes cellulose, fats and resins, proteins, essential oils, and vitamins (in a small amount).[11]

The shell and the kernels of cedar nuts contain a different amount of macro- and micro-elements. Such indispensable kernel elements as iodine, boron, cobalt, and strontium are not found in shell. At the same time, shell contains tin, titanium, vanadium and barium, tannic (calcium), coloring, and other useful substances and microelements. Tannic substances or tannins contained in cedar nutshells are able to alter the colloidal state of proteins, make an astringent, antimicrobial, anti-inflammatory effect, promote skin tightening, develop a protective film on the mucous membranes and wound surfaces, under which a new layer of young cells is developed. Infusions, broths, and tinctures for various diseases of bones and joints have been made for a long time from cedar nuts and even from its shells only. The infusions of seeds (together with shell) are used to treat joint rheumatism, beriberi, and metabolic disorders. Decoctions and tinctures made of shells are used against the inflammation of mouth mucous membranes. The lotions for various skin diseases are produced from husks. In general, a tincture made of cedar shell has a restorative and a tonic effect on a human body. Its regular use contributes to the activation of immunity, as well as to the effective cleansing of a body from toxins, slags, and heavy metal salts.

They also produce and use a cedar tincture against pulmonary diseases (acute and chronic bronchitis, pneumonia, asthma, the initial stage of tuberculosis). They put crushed nuts (with shell) in a glass container, pour vodka (completely covering the contents), the container is clogged tightly and placed in a dark place for 2-3 weeks. Then, the resulting dark brown tincture is filtered and a tablespoon of it is applied two-three times a day before meals.

Husk

When nuts extracted, waste is developed - the husk of cedar cones, which includes scales and the rods of cones [Figure 6]. In general, husk makes more than 50% of a non-shelled cone.[13] A tincture made of cedar nut husk is no less useful than a nut infusion. Alcohol infusions help, especially well. They are used the same way as a nut or a nutshell tincture. Colds, rheumatism, joint diseases, closed injuries, muscle pain, and strain - all these problems can be treated by cedar nut husk.[15] Traditional medicine also uses husk infusions for the treatment of abscesses. A compress with such an infusion is actually useful because all cedar products have anti-inflammatory property, and are also served as antiseptics. A small hemostatic effect can be useful for the disinfection of scratches and non-serious wounds. An infusion of cedar husk will be much more useful than an ordinary alcohol. It should be added that the husk of cedar cones (mulch) is rich in natural oils, fragrant resin has excellent mulching and drainage properties, and is widely used by local residents of the Far East south during the work in gardens and orchards.

Figure 5: Shells of cedar nuts (seeds)

Figure 7: Cedar nut film

Figure 6: Cedar cone husks

Figure 8: Treatment and prophylactic pillow with cedar nut films

Film

Each seed of a cedar nut is covered with a thin, brown film, fulfilling the protective role for a kernel like a shell to prevent the penetration of bacterial and fungal diseases to an embryo [Figure 7]. A dry film is easily released from a core, it is very light, resilient, and it occupies no more than 1% of a dry cone weight. Film contains the same volatile substances as in other parts of a cone and a whole tree. In folk medicine, a cedar nut film is used as a curative and a preventive pillow [Figure 8] with extended phytotherapeutic properties.[1,2]

A positive effect on a body is caused by the elastic properties of pillow filler, which improves the blood circulation of tissues with a simultaneous therapeutic effect due to the content of volatile biologically active substances in a film. To increase the therapeutic and the prophylactic effect of pillows on respiratory organs, it is recommended to spray pillow filler (film of nuts) with an essential oil, obtained from the husks of cedar cones or Korean cedar needles, and dry it to an air-dry state.

The "method for essential oil obtaining from the cones of coniferous plants" was developed and patented from the waste of Korean cedar cones, cleaned from seeds (nuts).[9] The obtained essential oil contains an increased content of volatile biologically active substances (phytoncides). It is a curative remedy and is used both in medicine and in cosmetology. The oil is rich in vitamins, microelements, and vegetable proteins. This remedy heals skin perfectly, fights infections, and prevents inflammation. Thus, all parts of Korean cedar cones have different healing properties, they are studied by official medicine and due to the considerable reserves of raw materials (cedar cone), the assortment of medicines will be increased annually in Russia, based on all non-timber resources of the legendary relict plant - Korean cedar. Not only cedar cones have medicinal properties. Other parts of this species have a variety of pharmacological properties and significant resources - woody green (shoots with needles), bark, and gum (resin).[10] In general, there are more than 3000 species of vascular plants in the Far East, almost half of them were known in the medical practice of the peoples of Russia and a number of East Asian countries.[12] However, their use in the official medicine of Russia is presented by only a few percent. Further comprehensive studies concerning the medicinal properties of all parts of Korean cedar for which

pharmacopoeial articles have been published already, which have GOSTs, VTU, and other regulatory documents, will include this legendary relic plant in the State Pharmacopoeia officially.

CONCLUSION

Modern comprehensive scientific studies of cedar-broadleaf forests of the Far East give a good reason to consider their lifelong use as the only alternative for the further development of Primorsky Krai. The developed technology for the extraction of nut kernels and their vacuum packaging makes it possible to import not wood and various gifts of nature into different countries, but ready-to-eat goods, whose price is higher by 1-2 orders than the existing rates for various forest products.

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