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## **The plants spices with therapeutic properties – summer savory (*Satureja hortensis* L.) and common thyme (*Thymus vulgaris* L.)**

Rośliny przyprawowe o właściwościach leczniczych – cząber letni (*Satureja hortensis* L.) i tymianek zwyczajny (*Thymus vulgaris* L.)

**Summary.** Common thyme (*Thymus vulgaris* L.) and summer savory (*Satureja hortensis* L.) belong to the Lamiaceae family. High adaptability of these plants to environmental conditions has caused that they are grown in various regions of Europe, especially in temperate climates. Herbal drugs of these plant species are *Thymi herba* and *Saturejae herba*, and their essential oils hold the main biological activities. The predominant components of savory and thyme oils are thymol, carvacrol, p-cymene, and  $\gamma$ -terpinene, found in various amounts. The herbal drugs are also abundant in flavonoids, tannins, phenolic acids, triterpene and bitter compounds, saponins, sugars, vitamins and minerals. Extracts from fresh raw material and essential oil show antimicrobial, antioxidant activity, spasmolytic, cholagogic activity. Also, they stimulate gastric activity and secretion of digestive juices. They are significant spices often used in pharmacy, medicine, as well in the food and cosmetics industry.

**Key words:** essential oil, spices, health-promoting properties

### INTRODUCTION

Herbology has been closely related to the existence of a man since ancient times. The richness of the natural landscape has always provided plant medicines for various ailments. Spices have been used for thousands of years in people's everyday lives, and knowledge about them was recorded in numerous books [Lutomski 2000]. Currently, there is an increasing trend of interest in herbal medicine throughout the world. It is associated with occurrence, the so-called civilization diseases, decrease in natural immunity

to infections and increased susceptibility to various types of allergies [Lutomski 2002]. This is also connected with development of the food industry, and more specifically, with increase in the demand for vegetable flavor and aroma additives, as well as preservative and pro-health ones, the rich source of which are herbal spice plants.

The main herbal plants, used not only as spices, but also as healing, aromatic and cosmetic agents, include the summer savory (*Satureja hortensis* L.) and common thyme (*Thymus vulgaris* L.). The name of savory comes from the word *sáturo* meaning “saturate or fill”, while the name of thyme originates from the Greek word *thyo* meaning “perfume, pleasant fragrance” or *thymos* – “courage and endurance”. Their Latin names refer to the properties they have, among others improving the taste and digestibility of dishes [Morales 2002]. The first mentions of these species appear in the literature of Ancient Greece, where they were described by Hippocrates (V/IV century BC). In his work, the *Corpus Hippocraticum*, thyme was described as a diuretic agent, and savory as a raw material for expulsion (expectorant). Theophrastus, from Eresos (IV/III century BC), showed the healing effect of essential oils of both species in the work *On fragrances*. The mention of these plants can also be found in the works of Roman scholars: Dioskurydes (first century CE) or Galenus (I/II century CE) [Balcerek and Modnicki 2007].

The aim of the work was to present the health-promoting properties of summer savory and common thyme as spice plants grown in Poland.

#### LITERATURE REVIEW

##### **Systematics, origin, biology**

Summer savory and common thyme are plants belonging to the family of Lamiaceae. They come from the Mediterranean region, mainly the areas of Spain, southern France and Italy and northern Africa, as well as areas of the Middle East [Morales 2002]. Their high adaptability to environmental conditions has enabled thyme to adjustment to temperate climates around the world, while savory is grown in the regions of central and western Europe, western and southern Asia and North America [Jafari et al. 2016].

Summer savory is an annual plant, belonging to the genus *Satureja*, which includes over 130 species. The plant grows up to a height of 60 cm, has a densely branched stem at the base of the wood-burning shoot, with a gray-green or violet color. Leaves of the savory are even, the lanceolate shape, placed opposite or in whorls. There are densely arranged oil glands on the leaves and flowers [Szempliński 2017]. The plant creates very fine, double-lipped, white or pink flowers with red spots on the neck, that grow in the angles of the upper leaves creating a one-sided apparent ear, built of pseudo-whorls. Savory blooms very intensively from June to September. The fruit is schizocarp, disintegrating into four dark-brown, egg-shaped acini. The plant has a bunch-type root system [Hadian et al. 2008].

Thyme belongs to the genus *Thymus*, which includes 300 species. It is an evergreen shrub with a height of 20–40 cm. Stems are straight or partially raised, branched, woody at the bottom. The plant forms ovate, short-legged, gray-green leaves, that are hairy from the bottom of a length up to 1.2 cm, alternatively arranged. Thyme blooms from May to September. It has double-lipped, small, pink or purple flowers collected in bulbous inflorescences on the tops of shoots [Zawiślak 2010]. Thyme flowers abundantly secrete nectar

and are often visited by honey bees. The fruit of this species is a fourfold schizocarp, containing light-brown acini [Thompson et al. 1998, Alizadeh et al. 2011].

Thyme plantations are usually established in a two- or three-year growing cycle, however, in some regions during cold winters, plants can be frozen. Therefore, in countries where winters are cold (Scandinavia, Eastern Europe, Canada), thyme is grown on an annual basis [Letchamo et al. 1999, Glambosi et al. 2002, Carlen et al. 2010]. Two forms of thyme are distinguished in western and central Europe crops: *Thymus vulgaris* L. f. *capitatus* Willk. et Lange, the so-called French, annual, not very resistant to cold and *Thymus vulgaris* L. f. *vercillatus* Willk. et Lange, the so-called German, perennial [Dzida 2013].

### Chemical composition of the raw material and its diversification

Pharmacopeal raw material, the herbal drug, for common thyme and summer savory is the aboveground part of the plant, *Thymi herba* and *Saturejæ herba* [Szempliński 2017], which use to be harvested at the beginning of plant flowering, and then dried in natural conditions or in a drying room at 35°C [Berbeć and Kołodziej 2007].

The main component of the raw material is essential oil (*Thymi aetheroleum* and *Saturejæ aetheroleum*) obtained during steam distillation of an aqueous suspension of ground flowering herb [Michalski and Zielińska 2015]. Thyme oil (*Thymi aetheroleum*) is a colorless, reddish or yellow, thin liquid with a characteristic herbal aroma. Usually, the content of oil in fresh thyme raw material does not exceed 1% of its mass [Michalski and Zielińska 2015], and in its dried form it can be at the level from 0.32% to 4.9% [Ozguven and Tansi 1998]. The essential oil of savory (*Saturejæ aetheroleum*) is a light yellow, orange or colorless liquid with an intense odor. The content of essential oil in air-dry savory range from 0.8 to 3% [Hadin et al. 2008], and may reach up to 6.5% [Baser et al. 2004].

Chemical composition of thyme and savory essential oils varied as a result of genetic, ontogenetic [Christen and Grevsen 2006, Çirak et al. 2007, Lee and Ding 2016] and environmental variation [Alizadeh et al. 2011, Mumivand et al. 2011, El-Gohary et al. 2015]. Comparing the chemical composition of thyme oil obtained from different regions, Raal et al. [2005] found large variations within the discussed species. Thymol content was the highest in oils obtained from thyme originating from the Netherlands (65.5%) and Estonia (75.7%), while plants grown in Greece were dominant in carvacrol (83.5%). The oil extracted from thyme cultivated in Armenia contained 17% thymol and high contents of neral and citronelol (32.5%), while in plants from Scotland, France, Moldova and Russia, thymol and p-cymene prevailed [Raal et al. 2005]. These data indicate that the biosynthesis of the essential oil in thyme remains under the clear influence of genetic factors related to the chemical breeds of the species within the inhabited territory, but is also affected by the environmental factors of a given region.

Common thyme shows high variability in chemical composition of the oil. Analyzing the composition of *Thymus vulgaris* oil available in the literature [Dambrauskiene et al. 1999, Lis 2003, Marzec et al. 2010], several chemotypes of this species can be distinguished: 1. oil abundant in thymol – thymol chemotype (from sub-groups thymol > p-cymene >  $\gamma$ -terpinene; p-cymene > thymol >  $\gamma$ -terpinene and p-cymene >  $\gamma$ -terpinene > thymol), 2. oil abundant in carvacrol – carvacrol chemotype, collected mainly from France, Italy and Canada, 3. oil abundant in carvacrol/thymol – carvacrol/thymol chemo-

type (from the sub-groups carvacrol > thymol and thymol > carvacrol), 4. oil abundant in linalool – linalool chemotype, found in Egypt, 5. oil abundant in geraniol – geraniol chemotype, 6. oil abundant in  $\gamma$ -terpineol –  $\gamma$ -terpineol chemotype 7. oil abundant in hydrated *trans*-sabinen/terpinene-4-ol – *trans*-sabinen/terpinene-4-ol chemotype, from France.

Therefore, there are several chemotypes of thyme, but the thymol type, the oil of which contains remarkable quantity of thymol (20–83%), is the most valuable. Other important components are carvacrol (0.5–6%), *p*-cymene (9–43%),  $\alpha$ -pinene (0.5–3%), linalool (0–21%), borneol (0–5%), 1,8-cyreneol (0–2.5%), geraniol (0–6%), as well as  $\beta$ -caryophyllene (0.6–3.6%), limonene (2.0–82.3%),  $\gamma$ -terpinene (0.4–8.3%), terpinene-4-ol (0.2–11.0%) and hydrated *trans*-sabinene (0–18.2%) [Mewes et al. 2008, Jabbari et al. 2011, Vakili and Sharafzadeh 2014, Kozera et al. 2015].

Thyme herb is also abundant in other active substances, such as flavonoids, tannins, phenolic acids, triterpene compounds, bitterness, saponins, sugars, vitamins and minerals [Lis 2003, Zawisłak 2010].

The main biologically active substance of the summer savory raw material is the essential oil, which could be of quite variable chemical composition. The major and most commonly found in components of the oil are carvacrol (0.4–70.5%),  $\gamma$ -terpinene (0–23%), *p*-cymene (0–10%) and thymol (0–27%) while the minor ones are  $\alpha$ -terpinene,  $\beta$ -myrcene,  $\alpha$ -thujene,  $\alpha$ -pinene [Góra et al. 1996, Mumivand et al. 2011, DZIADA 2013].

However, with reference to the chemical composition of summer savory oil, the literature presents three existing chemotypes found in different parts of the world. The first one is dominated by carvacrol and  $\gamma$ -terpinene, and occurs in Poland, Italy, Spain, Turkey, Iran, Scotland and Mongolia. In contrast, in Russia and the Crimea, prevail components such as *p*-cymene and carvacrol, representing the second chemotype, while in Turkey there is a third chemotype with dominating components, thymol and  $\gamma$ -terpinene [Baser et al. 2004, Mihajilov-Krstev et al. 2009].

In addition to the essential oil, flavonoids, tannins, ursolic acid, carotenoids, mucous substances, mineral salts and vitamin C are also present in the savory herbal material [Szempliński 2017].

### Pharmacological activity and culinary use of herbs

The active components of thyme and savory herbal drug act to the digestive system, stimulate the secretion of gastric juice, increase appetite, accelerate the digestion and absorption of nutrients.

Essential oil and extracts from the herb *Satureja hortensis* L. and *Thymus vulgaris* L. show a multidirectional effect on the human body. They have antibacterial properties, both against Gram-positive and Gram-negative bacteria and antifungal properties [Omidbeygi et al. 2007, Mihajilov-Krstev et al. 2009, Mihajilov-Krstev et al. 2010]. In medicine, the thyme is often used as an expectorant; it stimulates the secretion of mucus and the movement of cilia of the upper respiratory tract, also helps to thin the residual secretion and makes it easier to expectorate. In addition, it relieves bouts of cough [Lis 2003]. Inhalations with thyme oil are used in the treatment of persistent respiratory infections. Common thyme and summer savory also have a spasmolytic effect [Hajhasemi et al. 2000]. Their bitter compounds stimulate the secretion of gastric juice, accelerate digestion and facilitate the absorption of food. *Thymi aetheroleum* and *Saturejae aetheroleum*

are indicated as protective agents against bacteria that cause gastrointestinal disease [Kotan et al. 2012, Hajhasheni et al. 2012]. In addition, thyme and savory also show carminative, choleric, sedative and diuretic effects [McGimpsey et al. 1994, Kluczyńska 2001]. The studies also showed a beneficial effect of thyme oil on wound healing after burns [Al-Saimary et al. 2007].

Due to its bactericidal action, thyme oil is used as a component of toothpastes, mouth and throat fluids, after-shave cosmetics, disinfectant creams and lotions, and as an ingredient in bath additives and face masks [Kluczyńska 2001]. Research indicates the possibility of using *Thymus vulgaris* L. oils, containing thymol and carvacrol, as ingredients of antiseptic preparations used in the oral cavity. Thyme and summer savory oil proved to be an effective antibacterial agent in relation to the *Enterococcus faecalis* resistant to vancomycin, which indicates the possibility of its use in natural therapy of infectious diseases [Karami-Osboo et al. 2010, Michalski and Zielińska 2015].

Thyme is one of the oldest herbs in the world, and its importance in culinary art is as important as in medicine. It is one of the most commonly used spice plants, and its aromatic fresh or dried herb is used as an addition to many dishes. Especially the Italian, French and Spanish cuisines owe their specific character to the smell of thyme [Kluczyńska 2001]. Summer savory also has an important role in food processing and in the household as an aromatic spice due to the spicy-aromatic smell and strong peppery flavor [Bielowski 2008]. This species is an invaluable addition to heavily digestible dishes and dishes from legumes, such as: beans, peas, lentils or soy. In the culinary history of Poland, summer savory has become a permanent ingredient of venison dishes, thick sauces, stuffing or dishes with mushrooms and fatty meats. The fresh savory is also one of the ingredients of Bulgarian “Czubrica” seasoning mix, as well as one of the ingredients of herbal pepper and Provencal spice [Balcerek and Modnicki 2007].

The herb of savory and thyme, due to its preservative and antioxidant properties, is also used for preserving the food and production of herbal wines and liqueurs [Alinkina et al. 2013, Hosseini et al. 2013].

Furthermore, studies on the impact of herbal supplements properties on animal nutrition have indicated that the addition of powdered savory herb to the diet for chickens increases the overall weight of carcasses and stimulates the production of immune bodies. Therefore, introducing summer savory into the chicken diet may be an alternative to antibiotics used in broiler feeding [Balcerek and Modnicki 2007].

## CONCLUSIONS

Common thyme and summer savory are very valuable medicinal and aromatic plants, and their activity is mainly related to the presence of essential oil and its phenolic compounds – thymol and carvacrol. Due to its high antibacterial and antioxidant activity, their essential oil, can be used for medical and cosmetic purposes as well as a food preservative. The chemical composition of thyme and savory oil, especially the content of major components, change under the influence of genetic, ontogenetic and environmental factors. In medicine, the extracts from raw herbal material of thyme, the essential oil, is used in aromatherapy, for massage, or in baths. Thyme and savory are used as expectorant, spasmolytic, and cholagogic agents. In addition, they stimulate stomach functioning

and secretion of digestive juices. Preparations from the discussed species are popular natural medicines, which are effective and safe, and their use has a long tradition.

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**Streszczenie.** Tymianek pospolity (*Thymus vulgaris* L.) i cząber ogrodowy (*Satureja hortensis* L.) należą do rodziny jasnotowatych (Lamiaceae). Duże zdolności adaptacyjne tych roślin do warunków środowiskowych sprawiły, iż uprawiane są w różnych regionach Europy, zwłaszcza na terenach o klimacie umiarkowanym. Surowcem zielarskim jest ziele (*Thymi herba* i *Saturejae herba*), a główną substancją biologicznie aktywną – olejek eteryczny. Składnikami dominującymi olejku cząbrowego i tymiankowego są: tymol, karwakrol, p-cymen,  $\gamma$ -terpinen występujące w różnych ilościach. Ziele omawianych gatunków jest zasobne także we flawonoidy, garbniki, kwasy fenolowe, związki triterpenowe i goryczowe, saponiny, cukry, witaminy i związki mineralne. Ekstrakty z surowca oraz olejek eteryczny cząbru i tymianku wykazują aktywność przeciwdrobnoustrojową, antyoksydacyjną, ponadto działają spazmolitycznie, żółciopędnie i żółciotwórczo oraz pobudzająco na czynności żołądka i wydzielanie soków trawiennych. Są znaczącymi przyprawami często wykorzystywanymi w farmacji, medycynie, a także przemyśle spożywczym oraz kosmetycznym.

**Słowa kluczowe:** olejek eteryczny, przyprawy, właściwości prozdrowotne

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