

The application of Herzegovinian herbs in production of tea mixes

Marina Rajić¹, Stela Jokić^{2*}, Mate Bilić², Senka Vidović³, Andreja Bošnjak², Darko Adžić²

¹*Vextra d.o.o., dr. Ante Starčevića 38, 88000 Mostar, Bosnia and Herzegovina*

²*Josip Juraj Strossmayer University of Osijek, Faculty of Food Technology Osijek, Franje Kuhača 20, HR-31000 Osijek, Croatia*

³*University of Novi Sad, Faculty of Technology, Bulevar Cara Lazara 1, 21000 Novi Sad, Serbia*

review

Summary

Bosnia and Herzegovina (B&H) is a country that is biologically diverse in its rich and varied landscape surroundings. Due to the rapid development of chemistry in the last decade it is assumed that the synthetic substances will obtain advantage over herbs. However, there was a sudden increase in demand for products obtained from medicinal plants in western European countries. Special significance for human life had a plant species that can be used for production of herbal remedies in the pharmaceutical industry in the form of mono component herbal teas or tea mixes, which have extensive use in traditional medicine. Tea is having a share in highly competitive field - the global beverage market. A wide range of tea products are still evolving to be developed. The tea industry must follow the challenges facing the future with confidence. The pharmaceutical industry each year produced more herbal products, which are sold in pharmacies and traditional specialized herbal pharmacies. Research on the effects of tea on human health has been linked by the growing need to provide naturally healthy diet products that include plant-derived polyphenols. In line with this, there is need to explain how well known functional components in foods could extend the role of diet in disease prevention and treatment. This paper will highlight the application of tea mixes in human everyday use with emphasis on their therapeutic effects and the factors which affect the quality of herbs included in selected herbal tea mixes. The market analysis of herbs in B&H focused on different area of Herzegovina with diversity of plant species will be reviewed.

Keywords: Herzegovinian herbs, tea mixes, market analysis, tea application

Introduction

Every day we use whole plants, their parts or plant extracts in different fields: food, medicine, pharmaceutical and cosmetic industry, and in many other purposes. World Health Organization (WHO) estimates that the majority of the world's population, especially those in developing countries relies on traditional health care based on the use of medicinal plants (Lange, 1998). According to the definition of the WHO, the herbs are among those plant species of which one or more elements contain biologically active substance that can be used for therapeutic purposes or for pharmaceutical chemical synthesis (Šiljež et al., 1991). It is known that between 40,000 and 50,000 plant species (WHO compiled a list of more than 21,000 plant species) are used in traditional and modern medicine worldwide. More than half of the drugs in the world are produced from plants or represent synthetic copies of plant chemicals (Lange, 1998).

Most important Herzegovinian herbs

According to the florist analyzes, on our Planet is growing about 350,000 plant species of which about 12,000 can be used for obtaining biologically active substances which are used for healing. In B&H for this purpose are utilize around 500 species. Among them 160 - 170 types of species are native plants. Constantly discovering the new plant species occurs, but at the same time the production of synthetic preparations increase. Medicinal and aromatic plants and products (drugs, essential oils, extracts, tinctures and pharmaceutical products) made from natural substances are desirable goods especially in world developed markets (Šiljež et al., 1991). As a source for getting the drugs, wild plants from nature or cultivated grown plants can be used (Mihaljev et al., 2011). Special significance is in plant species that can be used for obtaining herbal remedies in the pharmaceutical industry in the form of mono component herbal teas/infusions or tea mixes, which have extensive application in traditional medicine (Tucakov, 1986).

*Corresponding author: stela.jokic@ptfos.hr

According to long experience in the area of herb collection our company Vextra (Mostar, B&H) gave

in Table 1 the data for the most important Herzegovinian herbs and the way of their collecting.

Table 1. The most important plants in the Herzegovinian area of and the way of collection

Herb name	Latin name	Croatian name	Wild plant	Cultivated plant
Basil	<i>Ocimum basilicum</i> L.	Bosiljak		+
English ivy	<i>Hedera helix</i> L.	Bršljan	+	
Horsechestnut	<i>Aesculus hippo- cast anum</i>	Divlji kesten	+	
White mistletoe	<i>Viscum album</i> L.	Imela	+	
Iceland moos	<i>Cetraria islandica</i> L.	Islandski lišaj	+	
Primorse	<i>Primula officinalis</i> Jacq.	Jaglac	+	
Sage	<i>Salvia officinalis</i> L.	Kadulja	+	
Chamomile	<i>Matricaria chamomilla</i> L.	Kamilica		+
St. John's wort	<i>Hypericum perforatum</i> L.	Kantarion	+	
Juniper	<i>Juniperus communis</i> L.	Kleka	+	
Nettle wort	<i>Urtica dioica</i> L.	Kopriva	+	+
Milfoil	<i>Achillea millefolium</i> L.	Stolisnik	+	
European linden	<i>Tilia cordata</i> M.	Lipa	+	
Lavender	<i>Lavanda angustifolia</i> L.	Lavanda		+
Balm beaves	<i>Melissa officinalis</i> L.	Matičnjak		+
Dandelion	<i>Taraxacum officinale</i> W.	Maslačak	+	
Mother of thyme	<i>Thymus serpyllum</i> L.	Majčina dušica	+	
Marjoram	<i>Origanum vulgare</i> L.	Mažuran	+	+
Mint	<i>Mentha piperita</i> L.	Paprena metvica		+
Calendula	<i>Calendula officinalis</i> L.	Neven		+
Rosemary	<i>Rosmarinus officinalis</i> L.	Ružmarin		+
Helichrysum	<i>Helichrysum arenarium</i> D.C.	Smilje	+	+
Gentian	<i>Gentiana lutea</i> L.	Srčanik / lincura		+
Brier hip	<i>Rosa canina</i> L.	Šipak	+	
Bearberry	<i>Arctostaphylos uva ursi</i>	Uva	+	+
Heather	<i>Calluna vulgaris</i> L.	Vrijesak	+	
Elder	<i>Sambucus nigra</i> L.	Bazga	+	

Cultivation of medicinal and aromatic plants, until recently, had no significance due to insufficiently explored domestic and international market of these products. There was no interest in plantation farming according to not enough researched production technology, and especially because of lack of mechanized harvesting and processing. The interest in plantation cultivation of medicinal and aromatic plants, as well as alternatives to wild plants, encourage the demand of manufacturing industry whose end products are based on medicinal and aromatic plants, and on the raw materials of consistent quality and quantity. In addition, targeted cultivation of medicinal and aromatic plants could reduce uncontrolled harvesting of wild plants and thus prevent its extinction (Šiljež et al., 1991).

The impact of environmental factors on plant growth

Plant life and its environment are closely linked. Environmental conditions have influence on the life of plants, while plants affect the environment (Šiljež et al., 1991). Day by day, the knowledge of plant metabolism are growing. For biosynthesis of plants environmental

factors are extremely important. It should be particularly taken into account in plantation cultivation of medicinal plants, which are the most important ecological conditions that will allow the plant species forming the maximum amount of useful biologically active substances. Agriculture is one of the sectors, which are both sensitive to global warming (e.g. on atmospheric temperature, precipitation, soilmoisture, sea level and humidity) and contributes to climate change. In response to changes in climate, through practicing adaptation options it is important to protect both market and nonmarket benefits from damages. Naturally, plants have their own mechanism to tolerate a certain level of increased temperature. As soil temperature increase, the decomposition rate of organic matter will increase, and then nutrient mineralization and availability for plants uptake become increased at presence of sufficient water if other conditions are unchanged (Amedie, 2013).

Temperature

Temperature affects the distribution, the method of growing plants and basically, the production of

biomass. Various secondary plant constituents are result of the following biochemical synthesis and each of them claims the optimum temperature. Therefore, the content of active substance increases or decreases depending on the temperature optimum for a particular type (Šiljež et al., 1991). The uptake of minerals, nutrient and water, absorption of light energy for the formation of carbohydrate through photosynthesis reactions as well as the breakdown and burning processes of carbohydrate for growth and development of the plant (respiration) is highly dependent on the amount of atmospheric CO₂ concentration and ambient temperature (Amedie, 2013). Temperature can affect photosynthesis through modulation of the rates of activities of photosynthetic enzymes and the electron transport chain and indirectly through leaf temperatures defining the magnitude of the leaf-to-air vapor pressure difference. Unlike the temperature sensitivity of processes like flowering and fruiting many other physiological processes have small genotypic variations, although some genetic adaptation have been observed (Lloyd and Farquhar, 2008).

Geographic location

Geographic location is important because of air temperatures and sunny periods during the year. A typical example of the importance of latitude is the synthesis of fatty acids (Šiljež et al., 1991). However, the acclimation potential varies a lot across taxa and biogeographic origin. With a rise in temperature at any particular location, species adapted to warmer climates would be expected to tend to increase in abundance compared to those adapted to relatively cooler conditions. If this process carries through to its logical conclusion, this would lead to a general shift in distributions to higher altitudes and latitudes (in the hottest regions, species would presumably persist if they could survive, possibly with selection for increased high-temperature tolerance). A typical example of the importance of latitude is the synthesis of fatty acids (Šiljež et al., 1991). However, it is important to recognize that the climate of a location includes not just period mean conditions (annual, monthly, decade) and normal seasonality, but also the typical variability in conditions, such as extremes of temperature and internal variation in precipitation regime (Viner, et al., 2006).

Soil

The soil can greatly affect qualitatively and quantitative properties of plants. Altitude highly

affects the amount and the quality of the active substance. Studies have shown that the lowest altitudes can reduce the amount of active substances and medicinal plants. This phenomenon is observed in herbs such as lavender, wormwood, mint and thyme. In the processes of plant growth, many processes and reactions directly affected by rising temperature, decomposition, weathering and mass flow diffusion may hasten in the soil under optimum soil moisture condition. At low temperatures, the reaction processes become slower, temperature can indirectly affect plant morphology, growth, roots turn over etc., if it is both beyond and under the optimum level for the plants. In addition, soil moisture, availability of nutrient and minerals together with other processes will play an important role in plant growth and development (Amedie, 2013).

Market analysis of herbs in B&H

The history of the collection of medicinal and aromatic plants in B&H is not sufficiently researched and documented, although is traditionally a very important sector. People have been collecting herbs for their personal use or to provide income for their families or members of herb community. During the former Socialist Republic of Yugoslavia, as well as today, B&H is a supplier of mainly unprocessed medicinal and aromatic plants. It is impossible to find reliable data on the quantities of purchased, sold or exported plant material that are originated from B&H (USAID, 2010).

Currently, about 50 small and medium enterprises in B&H operate in this sector (Fig. 1) and are engaged in the collection and sale of wild medicinal and aromatic plants (USAID, 2010).

B&H has over 700 species of medicinal and aromatic plants, of which about 200 are exploited (Gatarić et al., 1988). A relatively small number of medicinal and aromatic plants are grown (Kala, 2000). It is therefore necessary to start with the cultivation of medicinal and aromatic plants in order to provide raw material for the industry and for people who are interested in the traditional system of medicine. Conservative estimation of the value of total annual trade herbs in the world, done by The World Conservation Union (IUCN) ranges between 40 and 60 billion dollars. China is the world's largest manufacturer of herbs and medicines, followed by India. According to the data of Foundation for revitalization of Local Health Traditions – FRLHT, with a significant increase in demand for medicinal plants in the international market, it is expected that trade in medicinal plants will grow to 5 trillion by 2050 (Šiljež et al., 1991). This sector in B&H

represents a significant share of trade in medicinal plants in the world, and it is estimated that about 8 % of exports of medicinal and aromatic plants are originate from the Balkans (USAID, 2010).

In the postwar period, a significant number of companies were involved in the production and processing of medicinal and aromatic plants into products with added value, such as, essential oils, various medicinal applications and cosmetic products, spices and teas. Unfortunately, essential oils are exported to the international market mainly packaged in aluminum bottles or drums of 0.1 - 50 kg. Only a small number of companies in B&H exported essential oils as a final product, packaged in small vials (10 ml).

According to the Final Report of the EU (Analysis and presentation of the distribution of the value chain) annual harvesting of medicinal and aromatic plants in B&H ranges between 1,500 and 9,000 tons (depending on the demand and climatic conditions). They are packed and sold, mainly as a dried raw material, in bags of 25 kg. According to available data, the Foreign Trade Chamber of B&H in the field of medicinal plants and wild fruits export of

medicinal plants in the 2012 year amounted to 654 995,38 kg, which is a slight increase compared to the year 2011 when it was 627 464,30 kg.

International market has high demands for significant quantities of various medicinal and aromatic plants (herbs, other forest fruits, mushrooms, etc.). Despite the fact that the majority of medicinal and aromatic plants which are harvested in B&H are intended for export, often domestic production cannot meet the demands of foreign markets in terms of quantity / quality control of raw material of medicinal and aromatic plants, or any other product of medicinal and aromatic plants.

Experts in this field, as well as manufacturing organizations, claim that Bosnia trades with only 20 % of the total number of plants collected. Approximately 85 % of these plants are exported, mainly dried and packed in bulk in cotton or paper bags or cardboard boxes, mostly into the European countries. Collectors (around 100,000) are associated with these companies in B&H. They collect raw materials mainly on land owned by the state, where they have free access. Only a small part is grown on private land (USAID, 2010).



Fig. 1. Companies dealing with medicinal plants in B&H (USAID, 2010)

Tea consumption in B&H

Tea is infusion of the leaves of *Camellia sinensis* plant and is not to be confused with so-called herbal teas (Higdon, 2007). After water, tea is the most popularly consumed beverage worldwide with a per capita consumption of 120 mL/day. Every day, 800

million cups or glasses of tea are consumed globally (Natarajan, 2009). It is one of the most popular and the lowest cost beverages and is consumed by a wide range of age groups in all levels of society (Hicks, 2009). As tea is already one of the most popular beverages worldwide, future studies, designed to accurately assess tea consumption and tea polyphenol

status, should be directed to quantifying its role in the primary and secondary prevention of chronic diseases (McKay and Blumberg, 2002).

The tradition of drinking tea and healing herbs in Herzegovina goes far away in the past where people were only relied on nature. The proof of that is written in many Herbal manuals. Herbal manuals had been written in the monasteries, and one extremely valuable can be found in monastery in Humac, Ljubuški (Herzegovina). Herbs had been long known as human's reliable helper in his fight against various diseases and health problems. It's really amazing how many different medicinal substances can be found in certain parts of the plant (leaves, flowers, roots). It is a well-known fact that the teas are predecessor of drugs. Hippocrates left records of 400 medicinal plants and their use in the treatment as originally acted agents for the treatment. Like every other science, knowledge of action and the use of medicinal plants are also constantly evolving. Today teas come on the market in three forms: in bulk, in filter bags or instant tea.

The biggest challenges of the tea industry today are: maintaining "healthy" products, the possibilities of finding new products, promoting a healthy lifestyle, cultivation of medicinal and aromatic plants and discovering the better production technologies for other plant species (USAID, 2010).

Antioxidant capacity of teas

The complex chemical composition of teas includes polyphenols, alkaloids (caffeine, theophylline and theobromine), amino acids, carbohydrates, proteins, chlorophyll, volatile compounds, minerals, trace elements and other unidentified compounds. Among these, polyphenols are the most interesting group and are the main bioactive molecules in tea (Cabrera et al., 2003). The scientists are particularly interested in the potential health benefits of a class of compounds in tea known as flavonoids. Flavonoids in tea can bind nonheme iron, inhibiting its intestinal absorption. Nonheme iron is the principal form from iron in plant food, dairy products, and in iron supplements. The consumption of one cup of tea with a meal has been found to decrease the absorption of nonheme iron in meal by 70 %. In many cultures tea is an important source of dietary flavonoids. Tea is also good source of another class of flavonoids, called flavanols. Flavanols are the most abundant class of flavonoids in tea. All teas contain caffeine, unless they are deliberately decaffeinated during processing (Higdon, 2007).

Tea active ingredients are of interest to functional foods markets (Hicks, 2009). Clinical studies have

revealed several physiological responses to tea which may be relevant to the promotion of health and the prevention or treatment of some chronic diseases. Some apparent inconsistencies between studies on tea and health now suggest improved research approaches which may resolve them (McKay and Blumberg, 2002). Being an old and traditional beverage, tea was first grown in China and then spread to other countries and has always been liked by people all over the world. Despite the increasing market share of modern drinks such as soft drinks and alcohol drinks, tea has never lost its popularity, especially in recent years, when people are increasingly aware of the importance of organic foods and drinks, tea is being considered one of the most natural and healthy drinks which is promoted by more and more people around the world (Wang, 2011).

Application of tea mixes produced in Vextra company

Many plants through the history and in everyday use have shown exceptional healing properties. These properties, specially its versatility in the oral intake of tea are confirmed by lot of old books, knowledge and experience.

Vextra company was established in 1989 and since then engaged in education, collection and production of herbal preparations of medicinal herbs. For many years has been making the product line and now in daily sales has available about 200 species of herbs, 90 tea mixes with the therapeutic effect, and a number of herbal drops, oils and balms that are used to supplement therapy. Production takes place according to the rules of good manufacturing practice and the manufacturer's specification. The annual production capacity is about 15,000 production units. Educated staff working on improving the use of herbs with therapeutic effect and contributes to the development of medicinal plants in the service of science. The best healing property in application to human health showed herbal tea mixes. Tea mixes are composition of several species of plants in different percentages ratios. The concept of traditional recipes geared to the target action on certain problems to the specification and the chemical composition of plants.

Tea mixes that are in our sales in last two decades show extremely effective and therapeutic effects usually intended for the regulation of the cardiovascular system, digestive system, musculoskeletal system and the nervous system. Also therapy is often focused on specific diseases or where

the cause is unknown or is associated with a combination of several disorders.

Therapeutic stronghold, the old recipes and empirically proven effects, are found in plants with medicinal properties of the Herzegovinian region. The most characteristic plants that are in our recipes are Mulberry Black (*Morus nigra* L.), Sage (*Salvia officinalis* L.), Nettle wort (*Urtica dioica* L.), Milfoil (*Achillea millefolium* L.), Lady's mantle (*Alchemilla vulgaris* L.), St. John's wort (*Hypericum perforatum* L.), Helichrysum (*Helichrysum arenarium* D.C.), Lavender (*Lavanda angustifolia* L.), Calendula (*Calendula officinalis* L.), Chamomile (*Matricaria chamomilla* L.), Mint (*Mentha piperita* L.), Heather (*Calluna vulgaris* L.), Elder (*Sambucus nigra* L.), Rosemary (*Rosmarinus officinalis* L.), Golden fern (*Asplenium ceterach* L.), etc. In addition to these plants for better therapeutic effect, we added plants which are not typical for our region, but with characteristic chemical composition such as Sweet flag (*Acorus calamus* L.), Red eyebright (*Euphrasia officinalis* L.), Club moss (*Lycopodium clavatum* L.), etc.

According to long experience in our company, we had concluded that recipes which possess excellent activity are:

1. Tea mix "Antidiabetic",
Major components: Mulberry Black (*Morus nigra* L.) and Gentian (*Gentiana lutea* L.).
2. Tea mix "Regulation of blood lipids",
Major components: Golden fern (*Asplenium ceterach* L.) and Ramson (*Allium ursinum* L.).
3. Tea mix "Arthritis",
Major components: Goldenrod (*Solidago virga urea* L.) and Club moss (*Lycopodium clavatum* L.).
4. Tea mix "Psoriasis",
Major components: Calendula (*Calendula officinalis* L.) and Yellow bedstraw (*Galium verum* L.).
5. Tea mix "Herb relaxation",
Major components: Lavender (*Lavanda angustifolia* L.) and St. John's wort (*Hypericum perforatum* L.).
6. Tea mix "Function of the liver",
Major components: Club moss (*Lycopodium clavatum* L.) and Dandelion (*Taraxacum officinale* W.).

Also there are tea mixes that are characteristic for Herzegovinian area, but not important for medicinal therapeutic use. All tea mixes are made from high quality herbs according to traditional recipes and contain certain percentages of herbs combination that has a specific and targeted action.

Tea mixes which we preferred for everyday use are tea mix "Herb Detox" and "Elixir". In its structure

they include key aromatic plants for Herzegovina region. Traditional recipes tea mix „Elixir“ contains the following plants: White birch (*Betula alba* L.), Chamomile (*Matricaria chamomilla* L.), Nettle wort (*Urtica dioica* L.), Garden raspberry (*Rubus ideaeus* L.), Balm beaves (*Melissa officinalis* L.), Dandelion (*Taraxacum officinale* W.), Blackberry (*Rubus fruticosus* L.), Mint (*Mentha piperita* L.), Calendula (*Calendula officinalis* L.), Coltsfoot (*Tussilago farfara* L.), Mother of thyme (*Thymus serpyllum* L.), European linden (*Tilia cordata* M.), Shave grass (*Equisetum arvense* L.), Sweet flag (*Acorus calamus* L.), High mallow (*Malva silvestris* L.), Brier hip (*Rosa canina* L.) and Heather (*Calluna vulgaris* L.). „Elixir“ has special aromatic taste because of the combination of Mother of thyme (*Thymus serpyllum* L.), Mint (*Mentha piperita* L.), Heather (*Calluna vulgaris* L.) and European linden (*Tilia cordata* M.). The composition of this mix is designed to encourage complete detoxification, increases concentration and strengthens the immune system. Tea mix "Herb Detox" has the purpose of detoxification of the body. It is intended for the elimination of toxic substances and cleaning the liver. The emphasis is on diuretic components. This effect is realized through the pronounced effect of following plants: Basil (*Ocimum basilicum* L.), Sage (*Salvia officinalis* L.), Marjoram (*Origanum vulgare* L.) and Glycyrrhise (*Glycyrrhiza glabra* L.), and with the addition of other diuretic plants that support this action.

Conclusions

The domestic market of medicinal and aromatic plants in B&H is still in development. The need for education all participants in the value chain and the consumers are very important. The tendency is that this sector is growing more and more, despite the fact that the domestic market is still not strong enough. It is time to start with the popularization of medicinal and aromatic plants in the domestic market, taking into account the trend of the popularity of aromatherapy and wellness treatments abroad and in the country. Teas are considered to be a part of the huge beverage market, not in isolation. However, 50 – 60 % of the production cost is in the labor cost. There are numerous types of teas produced in many tea-producing countries. Generally, the age of plantation workers is increasing, as the younger generations do not wish to work in plantations. Mechanization of teas is thus inevitable, along with imported labor. There is a potential for agro / eco tourism through the tea plantations but producers should be more market-oriented and aware of the value of the tea market.

The research results of health benefits of tea consumption should also be used more extensively in promoting consumption in both producing and importing countries. In addition, strategies to exploit demand in value-added market segments, including special and organic teas, should also be more aggressively pursued. In targeting potential growth markets, recognition of and compliance with food safety and quality standards is essential. Even the impact of imposing a minimum quality standard as a means of improving the quality of tea traded internationally, would by default, reduce the quantity of tea in the world market and improve prices, at least in the short to medium term.

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