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## CASE STUDY

### Collection, cultivation and processing of medical plants, herbs and spices in the Balaton Ecomuseum – herbal medicine as intangible cultural heritage

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**Abstract** –The Balaton Ecomuseum, which is being continuously developed since 2017, will have a holistic approach, where the objectives of the ecomuseum embrace the whole cultural landscape of Lake Balaton as one unit with several thematic routes in one system and shall not be restricted to one particular subject area or a part of local heritage. One of these thematic routes is the recently developing Herbs and Spices Network, led by Zánka Herb Valley Visitor and Training Centre based on the collection, cultivation and processing of medicinal plants, herbs and spices. The place of herbs and spices in the diet needs to be considered in reviewing health benefits, including definitions of the food category and the way in which benefits might be viewed, and therefore researched. Here we describe the already established system of the Zánka Herb Valley Visitor and Training Centre, the potential of the Balaton Region in the development of herbal medicine illustrated by the scientific presentation of the 30 most collected herbs in the region and examples of other herbal centres, which are intended to become a part of the network. Herbal medicine, as an important part of the intangible cultural heritage, with hundreds of years old recipes for herbal concoctions has been known since ancient times before science related to modern medicine developed and continues to be used for generations until now. Furthermore, the medical effects of many agricultural crops should be better understood, such as the grapevine, which is being investigated for its medical compounds or the medicinal properties of other fruits and vegetables not sufficiently known to the general public. In this study we present a new system of the culture and interactive education of the collection, cultivation and use of medicinal plants, herbs and spices applying a learning by doing approach and a network embracing the whole area of the Balaton Ecomuseum.

**Keywords** – herbs, spices, herbal medicine, ecomuseum, intangible cultural heritage, Balaton, Zánka Herb Valley, grapevine, pharmacognosy, zoopharmacognosy, animal self-medication

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#### 1. Introduction – the landscape-based and multi-layered structure of Balaton Ecomuseum and the place of the herb-culture in this system

The Balaton Ecomuseum with an area of 8,500 square kilometres (Fig. 1) will have a holistic approach, where the objectives of the ecomuseum embrace the whole cultural landscape of Lake Balaton as one unit with thematic routes in one system and shall not be restricted to one particular subject area or a part of local heritage. Therefore, all major components of the intangible cultural heritage shall be included according to the multi-layered structure and the wealth of the existing and potential touristic attractions:

- The cultural landscape as intangible heritage: aesthetic value
- The built heritage as carrier of intangible heritage in traditional trades and crafts

- Collection, cultivation and processing of medical plants, herbs and spices
- Traditional trades and crafts in connection with the agriculture of the area
- Gastronomy – the traditional local and regional cuisine and new trends
- Animal husbandry – breeding indigenous Hungarian domestic animals
- The culture of wine: ancient Hungarian grape varieties, wine routes, wine festivals
- The written heritage of the landscape – literature and science
- The heritage of folk music in the Balaton area
- Thermal bath culture as carrier of intangible heritage

An important goal is to achieve excellence in sustainable regional development and management of natural resources linked to conservation of cultural landscapes and their

cultural heritage. The main stakeholders directly participating in the management of the ecomuseum include public institutions, local and regional authorities, non-profit organizations and companies, private companies and sole traders, tourism organizations, trade associations, educative centres, universities, churches and owners of heritage sites of key importance. Thus, organization of the numerous stakeholders of sustainable regional development and use of ecosystem services into effectively and efficiently working governance structures requires this participatory approach.



Figure 1. The area of the planned Balaton Ecomuseum is 8,500 square kilometres, consisting of the hydrographic catchment area of Lake Balaton, all wine districts of the Balaton Wine Region, the southern areas of the Bakony – Balaton UNESCO Global Geopark and the Balaton Highlighted Touristic Area.

Inventories are being carried out continuously, in order to produce a complete catalogue/database of natural resources: landscape sites, thermal waters, bath opportunities, mineral water springs, geodiversity and biodiversity (sites to visit and protected sites, not for tourists), particularly important plant species (including herbs and spices), wild animals, bird sanctuaries. Similarly, a well sorted inventory and database with specified categories of touristic products offered in the region and objects or special places suitable for touristic product development is being constructed. Another objective is the development of touristic products with interactive facilities to present the intangible cultural heritage linked to the natural resources, agriculture, local products, the built heritage and the local and regional history.

In this study we describe the system of collection, cultivation and processing of herbs and spices within the area of the planned Balaton Ecomuseum led by the Zánka Herb Valley Visitor and Training Centre in an interdisciplinary context. Herbs and spices have a traditional history of use, with strong roles in cultural heritage, in the different national gastronomies and their links to health. Herbs and spices often contain physiologically active compounds, raw material for pharmaceutical agents, which are small-molecular-weight organic compounds consumed in a purified and concentrated form. Cultural aspects: the place of herbs and spices in the diet needs to be considered in reviewing health benefits, including definitions of the food category and the way in

which benefits might be viewed, and therefore researched. Research may focus on identifying bioactive substances in herbs and spices, or on their properties as a whole food, and/or be set in the context of a dietary cuisine. The antioxidant properties of herbs and spices are of particular interest in view of the impact of oxidative modification of low-density lipoprotein cholesterol in the development of atherosclerosis. For example, it is a scientifically proven fact, that consuming a half to one clove of garlic (or equivalent) daily may have a cholesterol-lowering effect of up to 9% and, according to in-vivo studies, 7.2 g of aged garlic extract has been associated with anticlotting as well as modest reductions in blood pressure (an approximate 5.5% decrease in systolic blood pressure). A range of bioactive compounds in herbs and spices have been studied for anticarcinogenic properties in animals, but the challenge lies in integrating this knowledge to ascertain whether any effects can be observed in humans, and within defined cuisines. Research on the effects of herbs and spices on mental health should distinguish between cognitive decline associated with ageing and the acute effects of psychological and cognitive function.

## 2. Zánka Herb Valley Visitor and Training Centre and its partners – their herbs and spices network

This thematic route and network will be managed and coordinated by Zánka Herb Valley Visitor and Training Centre (Figs. 2 and 3), which will be the centre of the whole herb and spice network in the ecomuseum. The site at the gate of the Káli Basin is located on the western border of Zánka, in front of the Hegyestű Geological Interpretive Site. The area was partially occupied by its owners to allow access from the highway through a parking lot. The building site was created by combining two adjacent properties, some of which had to be leased to widen the road. The main goal of Herb Valley Ecotourism Training and Visitor Centre is to develop ecotourism and to introduce the typical herb culture of the Balaton Uplands. Designing an educational and visitor centre for visitors to the Kali Basin, where guests can not only learn about herbal varieties and their uses, but also learn about their processing and effects. In accordance with the development concept of the Balaton Specialized Resort Area, the project promoter has set a general goal to increase awareness of the tourism market in Balaton and the Balaton Uplands, increase the number of visitors and the number of guest nights. The overall aim of the establishment of the Herbal Centre is to provide tourists and visitors visiting Zánka with a quality offer that, in addition to their satisfaction, will increase tourism revenues in both municipal and entrepreneurial areas, thereby stimulating the employment of regional tourism enterprises.

The uniquely diverse flora of the Balaton Uplands can be explored interactively and in an adventurous way at the Zánka Herb Valley Visitor and Training Centre (Figs. 1 and 2). Depending on the season, they have close contact with the care, collection, processing, utilization and cultivation of over 1500 species of herbs through various interactive programs. Annual, biennial and perennial plants, trees bushes, shrubs, as well as various spices, edible herbs, swamps, plants with interesting shapes and leaves, a multitude of species welcome

visitors. Located next to the National Park and the Eastern Gate of the Káli Basin, the 7,000 square meter ecotourism centre offers active recreation for everyone. Visitors can obtain theoretical and practical knowledge of the use of the plants, their folklore and scientific backgrounds, and other curiosities in the seasonal programs. The caretakers of the park encourage everyone not only to see, but to touch the plants, learn the process of propagation, collection and processing, then taste the herbal teas made from them. Visitors from spring can monitor plant life until the end of autumn. Even in winter, life does not stop, as winter herbs can be collected, and the annual crop can be processed. The ecocentre offers adventurous knowledge and relaxation for tourists, sustainable farming, and naturalists and holistic healers. The centre also engages in practical training in cooperation with universities, and places great emphasis on scientific research, preservation of protected plants and gene bank development.



Figure 2. Zánka Herb Valley visitor and training centre – ecological buildings with renewable energy through solar panels (photovoltaic panels) Photo: Tamás Takács



Figure 3. The well-structured garden Photo: Tamás Takács

Herbal tours are organized around the Herb Valley in the Balaton Upland National Park they start all year round. The hiking destination is varied, from the nearby Káli Basin to the wonders of the Balaton Uplands and the Bakony. Depending on the season, the visitors will have the opportunity to know the roots, bark, shoots, flowers and fruits of the herbs and woody plants.



Figure 4. The Salföld Grange.

Forrás: [https://pelsocamping.hu/salfoldi\\_major/](https://pelsocamping.hu/salfoldi_major/)

Herbal tours are held not only at pre-announced times or according to everyday schedules and timetables, but also at pre-arranged times for professional, tourist and school groups. One of the herbal tour destinations is Salföld Grange (Fig. 4) and its environment owned and managed by the Balaton Uplands National Park, which is the most important strategic partner of Zánka Herb Valley. The agricultural village of Salföld is located at the gate of the Káli Basin towards Balaton, in the heart of the Balaton Uplands National Park, with significant geological, botanical and vernacular architectural monuments. The Salföld Grange was established by the Balaton Uplands National Park Directorate in 1997 on the outskirts of the village, where it presents the life of a working farm and indigenous Hungarian domestic animals such as racka sheep, mangalitsa pig, water buffalo, Hungarian gray cattle, horses, poultry, shepherd dogs such as puli, pumi and mudi. The continuously renewing herb and spice garden of the Salföld Grange offers a fragrant experience for visitors. By using more of our senses - sight, smell, touch and taste - we can learn about herbs, the effects and the ways of use and preservation.

#### *Target groups and services*

Examining the target groups of the Herb Valley and its network, only the typical seasonal tourists of Lake Balaton will be considered in the high season. However, the visitor centre is closely linked to health tourism, so you can expect a large number of visitors from such providers in the near and far settlements (Hévíz, Alsópáhok, Zalakaros, Sárvár, Bük) during the rest of the year. The size of the European health tourism market was primarily based on data from the European Spa Association (ESPA). Unfortunately, due to the widely differing measurement methods and willingness to provide data in the various member countries of the Federation, the sets of information obtained are not suitable to standardize and compare. Of all European travel (270 million) in 2003, 30 million were for health tourism. Of this, 30% was specifically classified as a health trip and 70% as a wellness trip. Guests spend an average of 6 nights at the places they visit, which is estimated by the ESPA to amount to 120 million guest nights per year. Compared to previous



years, these figures are already increasing and are expected to increase in the next few years too (Takács, 2014).

According to domestic economic and tourism experts, health tourism will play an even more prominent role in the domestic economy in the coming decades and in the next fifteen to twenty years, domestic health tourism and the health and wellness industry based on the utilization of thermal and medicinal water should be developed into the flagship of the Hungarian economy, becoming one of the most sought after health tourism destinations in Europe. When examining the consumer behaviour of the health-conscious target group, it is less characteristic that they travel only during the high season. They are motivated to acquire new knowledge and therefore willing to travel on weekends, but less often on weekdays. This target group interested in various health related trainings, educational programs so the seasonality is not as high as that of leisure tourists. The closer catchment area for this group is approximately within 100 – 150 km or within a 90-minute drive.

The holistic healing circle of customers is not characterized by the seasonality of Balaton. This group travels to the Visitor and Training Centre mainly because of the use of educational programs or the completion of compulsory university practice. In these cases, the summer months are considered a school holiday. They come for 2-day and 4/5-day programs to attend various themed lectures or specially tailored education programmes. The ecotourism target group also has a different seasonality than the leisure tourists of Lake Balaton. Although the main season for hikers is spring and autumn, the number of cycling tourists is strong especially during the summer months. The Lake Balaton region has 2 concentric circles: inner and outer ring. The inner circle has always been characterized by more developed infrastructure, better employment and income conditions than the background settlements. The Zánka Herb Valley is situated alongside the main road 71 and the bicycle road and contributes to the further development of this circle.



Figure 5. The main goal of the Herb Valley Ecotourism Training and Visitor Centre is to develop ecotourism and to introduce the typical herb culture of the Balaton Uplands. Photo: Tamás Takács



Figure 6. The guests can not only learn about herbal varieties and their uses, but also learn about their processing and effects. Here: the storeroom of dried herbs. Photo: Tamás Takács

The hiking trails lead to the outer ring on the nature trails of the Kali Basin. The technical development of these routes, the expansion of the route network and the increase in the number of visitors will require the involvement of additional tour guides who will also increase the employment of the inhabitants of the background settlements.

The information system of the demonstration park is organically connected to the thematic nature trail system, and the electronic knowledge base of local information boards (with QR barcodes) demonstrates the effects, conservation status and uses of the herbs mapped on the popular hiking trails of the Balaton Uplands. The information collection available on smartphones supports self-paced guided tours and is one of the most advanced technical solutions available.

#### Family-friendly services:

- indoor children's playroom
- outdoor playground (sandbox, play equipment?)
- baby changing room
- Children's chairs in the tea-room

#### Cycling-friendly Services:

- 150 bicycle parking
- cycling information service: hiking trails, catalogue of attractions and mobile applications
- bicycle service (cooperation agreement with Zánka service company)

High priority is given to environmental aspects already during planning, preparation and implementation. On the one hand, the area of the Herb Valley is adjacent to the Balaton Uplands National Park, so it is essential to protect it in the course of construction and renovation, and on the other hand, the presentation of herbs requires special care and attention. In terms of adaptation, the visitor centre is prepared for the increased number of visitors on days when, due to heat or possible heat alarms, exhibition halls and museums are full. The relaxation garden is equipped with sunshades, the reception area offers special hot / cold herbal teas on these days. In addition to communicating climate awareness locally and online, the stimulating role of the local economy is emphasized: the product range features specialties made with local products (grass wines, chocolates, cheeses, etc.).

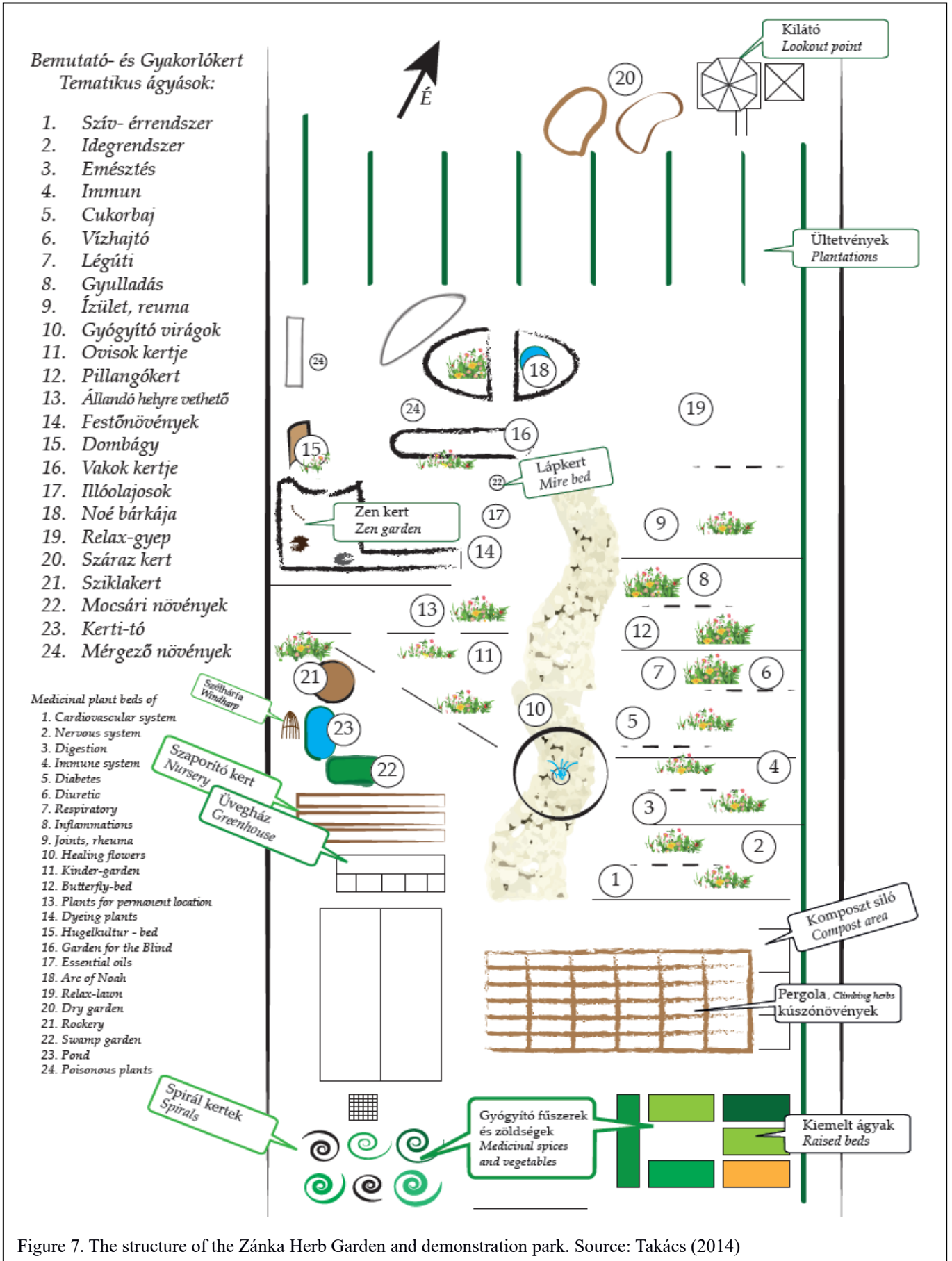


Figure 7. The structure of the Zánka Herb Garden and demonstration park. Source: Takács (2014)

### Technical conditions of operation

The following technical services have been developed for the necessary basic infrastructure ensuring the technical operation and the service provisions for the visitors.

#### Exhibition Park and Training Gardens:

- Garden area
- Irrigation system, water supply
- Ensuring proper soil composition
- Gardening contractor
- Purchase of plants
- WIFI service in the area (minimum local)

#### Demonstration and Training Room:

- Purchase of tools
- Purchase of presentation materials
- Water supply
- Current
- Internet connection (public events, open days for live webcam broadcast)

#### Visitor Centre:

- Power supply
- Display shelves, sales counter
- Furniture
- Prepared tutorials, films and multimedia tools for presentation
- WIFI access for guests
- Sending online postcards from the site

#### Online reservation system and virtual nature trails:

- Server hosting service with sufficient bandwidth
- Software and loaded databases

#### Technology:

- Tool for reading QR codes, determining GPS coordinates (for expanding and maintaining databases)

The choices were made mainly from the Internet, so the guest information elements have been equipped with modern technical solutions. Visitors will find QR-coded tables for each herb in the show garden so they can get deeper information while on a scientific walk. Those who do not have a smart phone will have access to this information at the online terminals located in the lounge.

### Strategic Partnerships

#### 1. Balaton Uplands National Park Directorate

National parks, as autonomous and self-governing authorities, have a public mission to provide public nature conservation and exercise statutory public authority activities. The directorates carry out the tasks of declaring the areas protected or Natura 2000 areas, nature conservation and asset management and continuously monitor the state of the natural values and habitats in their area of operation. They participate in, among other things, the process of district forest planning and represent nature conservation interests. Nature conservation education and awareness-raising activities are carried out by maintaining and operating facilities of nature conservation demonstration, education and

ecotourism. They contribute to the protection of wildlife (non-protected species, huntable and fishable species), to the preservation of the ancient Hungarian domestic animal species and their breeds. They are also involved in preserving the natural and semi-natural state of the landscapes, protecting the natural values, systems and aesthetic qualities that characterize the landscape. They shall prepare a plan for the assessment and management of caves requiring special protection and those which are directly threatened by environmental damage. The directorates supervise and assist the municipal nature conservation service, assist local governments in their nature conservation duties, organize and manage the nature conservation service within their organization, and issue, record, and withdraw authority certificates for nature conservation officers. They determine and record the unique landscape values and comment on the nature conservation management plan for the protected natural areas of local importance when the municipal notary or chief notary is contacted. The directors of the national parks are appointed, dismissed and exercised by the Minister for Rural Development for an indefinite period. The directors shall report to the Minister on the operation and management of the parks as required but at least once a year.

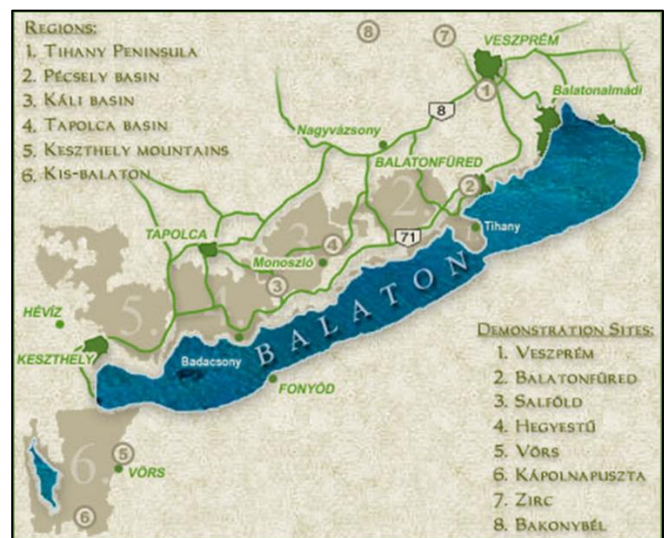


Figure 8. Map of Balaton Uplands National Park. Source: <https://waterfire.fas.is/Hungary/NationalParksofHungary.php>

The Balaton Uplands National Park, established in 1997 (56,997 hectares), consists of six former landscape protection areas whereby the old dream of Hungarian nature conservation was realized: by linking protected areas separated for a long time, a protected ecological system covering the contiguous area of the Balaton Uplands has been created. A particularly important collaborative partner both in promotion of mutual programs and services and scientific help in mapping the herbal species on popular hiking trails in the area of the Balaton Uplands National Park and make them freely available on the Internet (with photos, descriptions, GPS coordinates) in the form of virtual nature trails. The Herb Valley provides herbal trainings and presentations to the participants of the geo-tour guide training and organizes herbal tours for groups of forest schoolgirls, as well as sessions on the use of herbs. They provide professional advice



and assistance in developing herb gardens. Joint ticket systems are being developed which will be valid for the Balaton Upland National Park areas (including the Tihany Lavender House) and the Zánka Herbal Valley Visitor Centre.

Several botanical rarities live in the extreme climatic and geological conditions of the basalt mountains. A unique acidophilic ash-beech forest occurs on the rocky escarpments of the Badacsony hill; in its beech forests we find cyclamen, while in the hornbeam-oak groves, hepatica (*Anemone hepatica* (called even *Hepatica nobilis*, Fig. 9), black bryony (*Dioscorea (Tamus) communis*, Fig. 10) and broomrape grow (*Orobancha minor*). Hepatica (called even liverwort or liverleaf) is named from its leaves, which, like the human liver (Greek hepar), have three lobes. It was used as a medicinal herb thought to be an effective treatment for liver disorders. Although poisonous in large doses, the leaves and flowers may be used as an astringent, as a demulcent for slow-healing injuries, and as a diuretic.



Figure 9. Hepatica (*Anemone hepatica* or *Hepatica nobilis*). Source: Herb catalogue, Zánka Herb Valley

Black bryony (Ladies Seal, *Dioscorea (ex. Tamus) communis*) is a climbing herbaceous plant that grows from a tuber and can be up to 2 – 4 metres tall. This highly poisonous plant is normally found growing in forest understory, usually in dense woods, but it can also be found in meadows and hedges.



Figure 10. Black Bryony (*Dioscorea (ex. Tamus) communis*) Source: Herb catalogue, Zánka Herb Valley and Wikipedia

In herbal medicine the black bryony plant is not used internally, since all its parts are poisonous including the tubers, due to saponin content, calcium oxalate deposits and histamines isolated from the berry juice and rhizomes (Kovács et.al. 2006), which may contribute to skin irritation and contact dermatitis. However, the plant has been used as a poultice for bruises and inflamed joints. Black bryony should be used topically with caution, due to risk of painful blisters.

The common broomrape-grow or hellroot (*Orobancha minor*) is a fleshy, herbaceous, annual, parasitic plant that grows up to 56 cm tall. It attaches to the roots of broadleaf hosts (especially *Trifolium* spp.). The fleshy stem is yellow to straw coloured and sticky. On the sunny rocks of the Szentgyörgy Hill a small population of the rock-dwelling hardy cloak fern (*Cheilanthes marantae*; unique in Hungary) grows.



Figure 11. Common heather (*Calluna vulgaris*) Source: <https://commons.wikimedia.org/>

Several local subspecies of sorbtrees find habitat in the rock cracks. Csobánc hill is enriched by *Pulsatilla grandis*, *Saxifraga* and lilac. On the top of the Tóti Hill a picturesque flower field of white laceflower (*Orlaya grandiflora*) mixed with *Pulsatillas* and *Caryophyllaceae* can be found. In the cracks of the basalt columns the small scrubs of *Cotoneaster matrensis* line up. At the eastern edge of the area on Permian red sandstone the common heather (*Calluna vulgaris*, Fig. 11) provides a red flower carpet at the end of summer. *Calluna* is sometimes referred to as Summer (or Autumn) heather to distinguish it from winter or spring flowering species of *Erica*. The shoots of *Calluna vulgaris* contain the phenolic compound chlorogenic acid, long known as an antioxidant, which also slows the release of glucose into the bloodstream after a meal. The herb has been used in the traditional Austrian medicine internally as tea for treatment of disorders of the kidneys and urinary tract. In the cracks of the rock juniper and yellow hawkweed species bloom. On the plains, remains of ancient marshes contain several botanical rarities. At Raposka we find marsh gladiolus and orchids; next to Káptalanótóti there is a habitat of the 1 m tall and odorous large



rose gentian (*Sabatia angularis* that occurs less and less), accompanied with the blue flowered marsh gentian (*Gentiana pneumonanthe*).

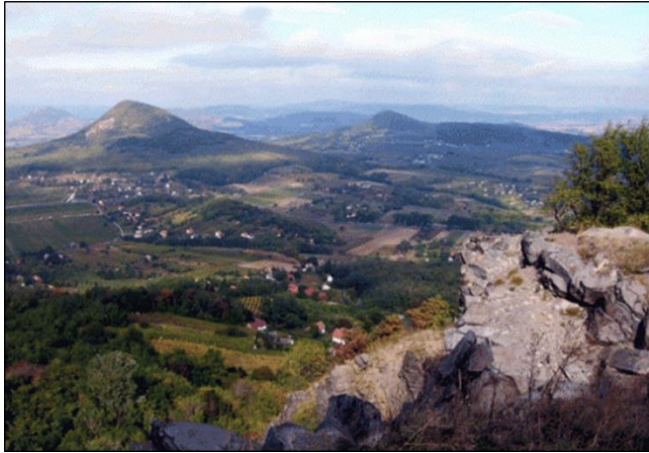


Figure 12. View over the Káli Basin. Source: <https://www.programturizmus.hu/ajanlat-tura-balaton-kali-medence-info.html>

The Káli Basin (Fig. 12) is one of the most valuable gems of the Balaton Uplands National Park. Giant rocky cliffs in bizarre, astonishing shapes, between rocky sinks, movable rocks, wind and water-eroded cliffs and boulders, shrubs clinging to cracks, gnarled trees and rooftops of church towers evoke the intimate idyll of ancient times. Each village has some special features and attractions that enhance a trend where urban people might contribute to a gentrification of the countryside in search for escaping the city. The long-term effects of this process on local economy and maintenance of traditional skills has yet to be investigated.



Figure 13. The location of the typical herb-collection areas in the Káli basin. Source: Zánka Herb Valley

The Káli Basin, with its unique natural geography and wildlife, has inspired many Hungarian artists and attracts returning visitors and opinion-forming social circles. Emerging from the artistic world of the 1980s, it is now a

popular destination for health-conscious tourists. This region is also the scene of successful "local producers' market" initiatives, which partly convey the spirit of the Kaposcs Valley Festival. Hiking trails in the Káli Basin, as a tourist infrastructure, attract many visitors through the activities of the Balaton Uplands National Park and also as part of the social responsibility of local large-scale water extraction companies. The biodiversity of plant species is outstanding. For example: in the Balaton Uplands National Park there are at least 150 – 200 herbs in a 2-hour tour (Fig. 13), while in the Great Plains National Parks, for example, only during a 4 hours tour can be found this variety of plants and only 30-40 species of herbs can be identified.

2. Bakonyerdő Zrt.<sup>1</sup>



Figure 14. Map of Bakonyerdő Zrt. In the settlements shown on this map the regional offices of Bakonyerdő Zrt. can be found. Source: <https://www.bakonyerdo.hu/>

The Hungarian Product Grand Prix winner Bakonyerdő Zrt. is the manager of the forests of the Balaton Uplands and the High Bakony region and manages 62,254 hectares (Fig. 14) of state-owned forests. Bakonyerdő is a key strategic partner. The main part, 76% of the Company's forest area is in Veszprém county and besides forest management, wood processing and game management there is a forest school (located above Zánka-Monoszló). In previous years the Zánka Herb Valley have started cooperation with mutual consultancy and professional lectures. This relationship has now been intensified at company level and the details of the planned cooperation between the Visitors Centres have been developed through promotion of mutual programs and services. Herbal trainings and presentations are organized for the participants of the tour guide training. Herbal tours and sessions on the use of herbs are arranged for groups of forest school pupils. The centre provides professional advice and

<sup>1</sup> Bakonyerdő Zrt. = Bakony Forest Ltd.



help in setting up herbal gardens and farms. In the field of ecotourism, mutual project consultancy and advice services are in practice.

### 3. Elisabeth Leisure Centre and Camp, Zánka

The Elisabeth Leisure Centre and Camp<sup>2</sup> managed by the Elizabeth Foundation for the Children of the Carpathian Basin, covers an area of about 209 hectares, surrounded by the picturesque landscape of the Balaton Uplands, rich in natural and historical values, such as the Káli Basin, the Valley of Arts, Tihany and Badacsony. The Elisabeth Leisure Centre and Camp has a long history, its main purpose is to provide recreation for children and adolescents (by embracing the holiday of disadvantaged children), and it also undertakes a number of tasks concerning public benefit and tourism. The long-term cooperation between the Foundation and the Elisabeth Leisure Centre and Camp is very important, whereby a new educational area, herbal knowledge is added to the education of school children. Collaboration is realized through promoting mutual programs and services. Creating herb garden and herbal study path in the area of the Centre, which in time can be part of a national herbal garden network and detection of herbal occurrences (GPS coordinates) on the virtual study path to be created on the Internet, constitutes an important part of the interactive education programmes. There are herbal professional activities and presentations for primary and secondary school students, based on the needs of the school.

### 4. Pál Bozzay Elementary School, Zánka

The German minority language school attracts more and more pupils from nearby and more remote villages every year. The various central measurements (monitor tests, subject and competence tests, central entrance examinations) prove that the school is far ahead of the village and small-town schools regarding the average level of pupils' performances. The expert staff of Zánka Herb Valley organize herbal tours and demonstrations on related programs of the school as well as workshops introducing herbs, educating the participants about the role of herbs and the possibilities of their use in the preparation of everyday meals, according to the needs of the school. In this way the Zánka Herbal Visitor and Training Centre takes over a considerable part of the environmental practice classes.

### 5. Tihany Tourist Ltd.

Tihany Tourist Travel Agency's history dates back to 1991, offering a comprehensive range of services on the peninsula. The travel agency also participates in the operation of a forest school, a nature education camp, a family park and the newly created Lavender House. For the participants of the programs of Tihany Tourist Ltd. the Herb Valley organizes herbal tours and presentations on an optional basis.

### 6. Káli Guesthouse (Szentbékállá)

The guest house is located in a small village of 250 people in the heart of the Balaton Uplands National Park, 10 km from Lake Balaton in the Káli Basin. Both the surrounding landscape and the selection of programs developed by the doctor couple operating the guest house make the house a sought-after wellness and recreation tourist destination. For the guests of Káli Vendégház, the Herb Valley Centre provides herbal tours, presentations and basic training.

### 7. The Zánka - Nivegy Valley Wine Route

The Wine Route Association connects the areas of Zánka, Tagyon, Szentantalfa, Balatoncsicsó, Szentjakabfa, Óbudavár and Balázs Hill, as a popular wine tourist destination, with members of the organic wine growing and family wine cellars (Fig. 16). The settlements in the valley are mentioned for the first time in documents from the 12<sup>th</sup> century, which also state that the Romans had a favourite place of establishment, and they even produced grapes. An interesting feature of the valley settlements is the many temples, and there are two or three in each village. According to the legend, the Nivegy Valley became a residential area already during the Hungarian conquest. Buda warrior settled on the slopes of the northern side hence the settlement is still called Óbudavár. The annually arranged Pentecostal Wine Festival attracts many visitors. Collaboration with the Zánka Herb Valley is the promotion of mutually developed programs, products and services. Medicinal wine is available in the visitor centre for consumption and as a gift.

### 8. Tomajvin Ltd.

The small family winery produces its typical Balaton Uplands wines in Lesencetomaj, on a 7.5 ha plantation area with a total wine cellar capacity of 500 hl. It was founded by winemaker György Aklan. By soaking specially selected herbal blends and reviving the tradition of herbal wine making, the forgotten culinary and herbal wines are made with the help of herbalist Ferenc Takács. The cooperation includes promotion of mutual programs and services, especially joint promotion of herbal wine. They offer herbal tours and presentations in the visitor centre on an optional basis to the guests of the Wine House.

### 9. Molnár Family Winery

The Molnár Family Cellar has been operating organic farming since 2000, the production processes, technology and storage are controlled by BOKONTROLL Kht. The Molnár Family Cellar is located in the picturesque surroundings of Szentantalfa in the middle of the Nivegy Valley, with a great view of Lake Balaton and the surrounding villages. The cellar is capable of catering for 40 people and considering the fact that it is situated among the vineyards, it is possible to present the work in the vineyard, the processing of the grape to wine and the storage. The company promotes a range of mutual

<sup>2</sup> The management of the former Zánka Children's and Youth Centre, later Zánka New Generation Centre Nonprofit Ltd has been taken

over by the Elizabeth Foundation for the Children of the Carpathian Basin. <http://www.erzsebetalapitvany.hu/>

programs and services with Zánka Herb Valley. The Herb Valley offers optional herbal tours and presentations to the visitors of the cellar on request. They jointly develop herbal products.

#### 10. Marianna Tourist

The Marianna Tourist Travel and Real Estate Agency has operated as a tourism provider in the Zánka region for several years. They have been organizing natural medicine courses for the last 6 years as an educational institution with the permission of the Institute of Health Education (ETI) and the Regional Labour Centre. The Zánka Herb Valley provides practical placement for the students of naturopathic training and there is also a visitor mediation agreement between the office and the visitor centre.

The abovementioned network of partners will be substantially extended during the development of the Balaton Ecomuseum, since Zánka Herb Valley Visitor and Training Centre shall be the coordinating organization for all herb-related activities, education and research in the Balaton Ecomuseum. The other interesting path for future development will be an increasing cooperation with organic agricultural enterprises, where the integration of herbs and spices into the product structure may increase the ecological and economic viability of these businesses, based on the Azienda Agricola Model (Némethy et.al. 2016).

### 3. The grapevine as medicinal plant

Grapevine cultivation and winemaking in the leading agricultural activity in the Balaton region. The beneficial health effects of the grape have been known for thousands of years and, therefore, the grape became one of the most used and well-researched medicinal herbs. The chemical structure and physiological effect of the active compounds of different parts of the grapevine plant are investigated and used for several health products and cosmetics. The various parts of the grapevine plant have been traditionally used for the following functions:

The consumption of fruit enhances cardiovascular health, improves circulation and contributes to the prevention of cardiovascular diseases.

Delaying aging processes and preventing the development of cancer due to the fruits' resveratrol content, which is a strong antioxidant (Castillo-Pichardo et.al. 2013).

Additionally, grapevine leaves have been traditionally used for disinfecting skin wounds and reducing or eliminating inflammation since leaves have anti-inflammatory properties. European traditions of folk medicine employ grapevine sap to cure skin and eye diseases.

Grapevine leaves work as astringent and are therefore suitable to treat diarrhoea and digestive infections and even severe haemorrhoids. Grapevine leaf preparations can be used for treatment of venous insufficiency, varicose veins and pain, tiredness, itching, and for treatment of symptoms of skin capillary fragility. The active compounds of the grapevine include several antioxidants, fibrous pectin, and polyphenols, which are natural antioxidants. Grape seeds, grape skin, and

grape juice contain several types of polyphenols, including resveratrol, phenolic acids, anthocyanins, and flavonoids. One of the polyphenols, resveratrol is found in high amounts in the skin of deep-purple grapes, and it has a protective effect on brain functions, cardiovascular health, and the immune system. Resveratrol has been identified as a cancer preventive due to its antioxidant, pro-apoptotic, anti-proliferative, anti-inflammatory, anti-angiogenic and anti-invasive properties (Whitlock and Baek, 2012; Aluyen et.al. 2012). Due to its proven anti-aging effects, resveratrol is a popular ingredient in skin care products.

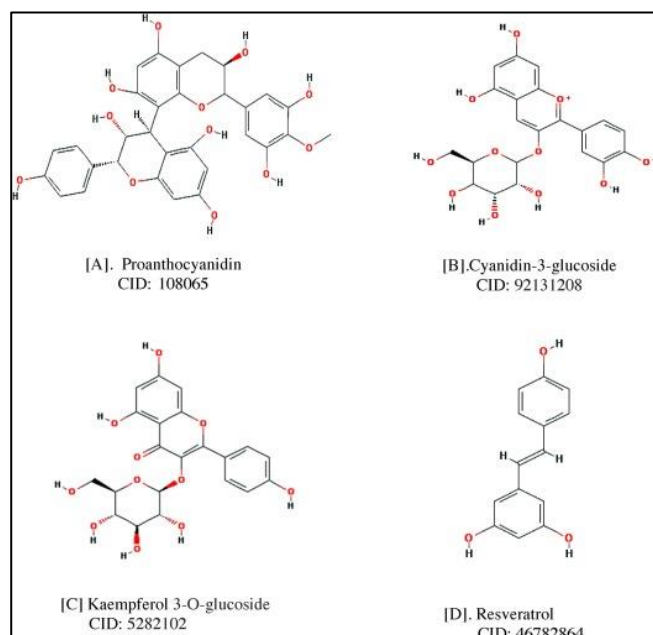


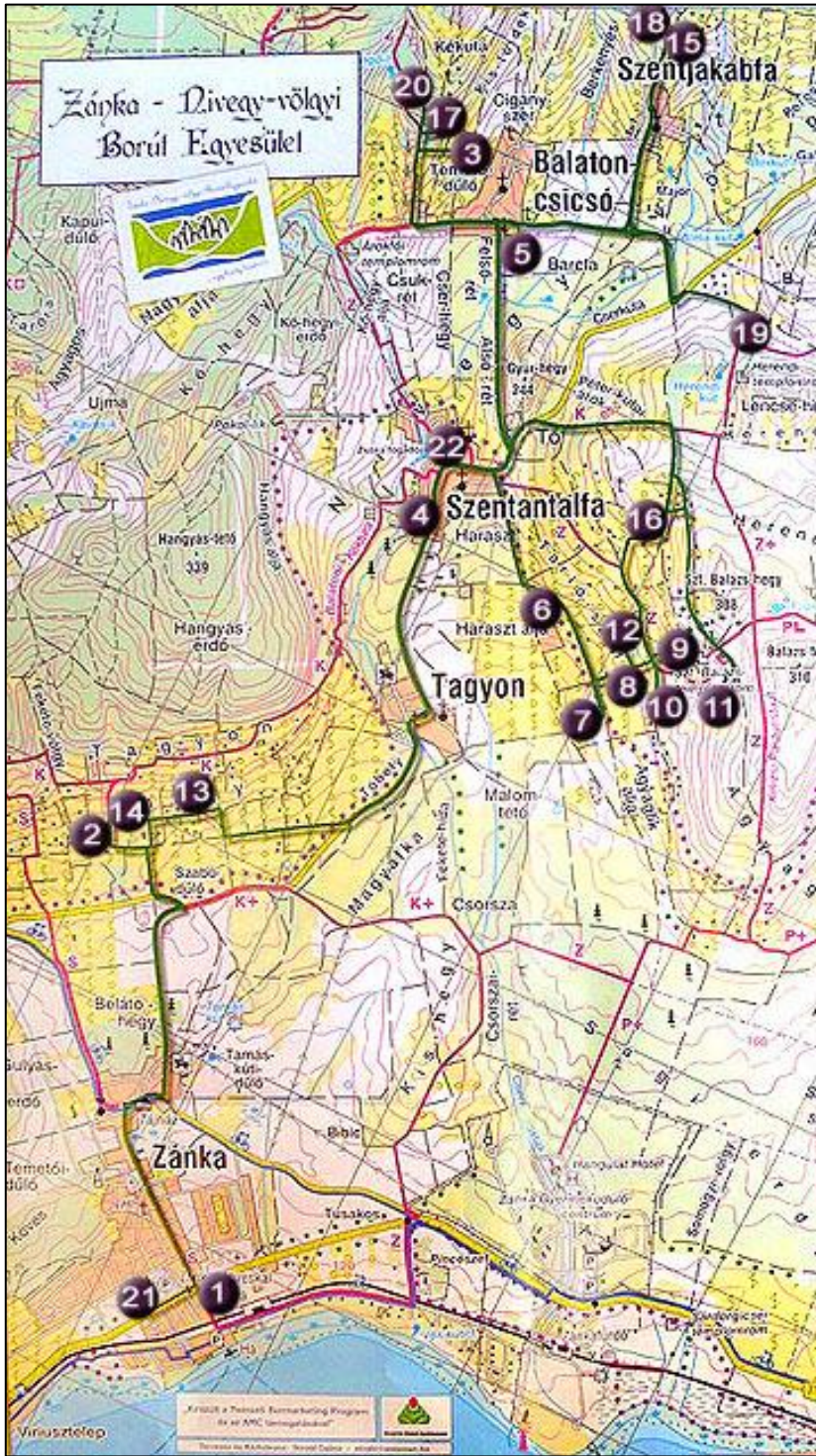
Figure 15. Important grape polyphenols. Source: Sithranga et.al. 2017.

Anthocyanins are polyphenols that not only give purple grapes their dark skin colour, but also protect the body from the damage of free radicals, helping to reduce inflammation and preventing degenerative diseases. Grapes also contain salicylates, which are believed to help reduce the risk of blood clots, however, in case of salicylate sensitivity caution should be taken. Furthermore, in the skin of purple and red grapes, all grape varieties contain vitamin K (phyloquinone), which improves coagulation and supports bones health, vitamin C (ascorbic acid), B-complex vitamins, mainly B1 (thiamin), B2 (riboflavin), B3 (niacin), B6 (pyridoxine), and minerals such as copper, potassium, and iron (Szalay, 2016).

Although grapes have high sugar content (20 – 23 g/kg dw); these are natural sugars that, contrary to popular belief, do not raise blood glucose levels and can even reduce the risk for type 2 diabetes (Szalay, 2016).

Grape seed oil extracted by cold pressing and grape seed meal are rich in bioactive, antioxidant substances, flavonoids, unsaturated fatty acids, linoleic acid (a component of vitamin F), chlorophyll, easily digestible, cholesterol-free and have outstanding anti-inflammatory effects, can contribute to the prevention and treatment of certain types of cancer, especially prostate, skin, colon and breast cancer (Bagchi et al. 2014).





1. Lídia Winery - Zoltán Varga
2. Zoltán Molnár
3. Szarka Winery - Lajos Szarka
4. Dobosi Winery - Dániel Dobosi
5. Antmann Family Winery
6. Zánka Winery Cooperative
7. Péringer Family Winery - Antal Péringer
8. Cseh Family Winery - CSE-KI Bor Bt.
9. Molnár Family Winery - László Molnár
10. Vidosa Winery - László Vidosa
11. Mersics Estate - János Mersics
12. Béla Súlyom - Soma Winery
13. Móró Winery - János Móró
14. Horváth Winery - László Horváth
15. Steierlein Winery
16. László Szabó & son - Gergely Winery
17. Péringer Winery - Miklós Péringer
18. Steixner Winery - László Steixner
19. Scher Family Winery
20. Szabó & Son Winery
21. Theodora Restaurant
22. Zsóka Guest House

Figure 16. The Zánka – Nivegy Valley Wine Route: wineries, guest houses and restaurants Source: <http://balatoniborut.hu/>

#### 4. Connections of herbal tourism points to other touristic products in Hungary

The market of tourism products nowadays contains herbal tourism on its own, but there are several interfaces with other products. There has been a connection with religious tourism in Pannonhalma since 2011, where medicinal herbs have always been present in the Abbey for centuries. All herbal

tourism appears in Pannonhalma and Bakonybél as complementary elements to religious tourism. Hobby and village tourism are related to the destination "Healing plants and minerals in Zemplén". Connections with ecotourism products can also be observed during botanical tours organized in each landscape area. Herbal tourism appears as a motivational element in cultural tourism, where the tourist wants to learn about the values of another culture and where



folk medicine elements are also utilizing herbs. There are several examples of this in Transylvania, where the collection of herbs is of special importance even today. In practice, there is also a link with gastronomic tourism, as several herbs are particularly important as spices (e.g. garlic, thyme), but in this relation the reference to the healing effect is not primary. There are still few examples of the emergence of herbal tourism as part of health tourism. In health tourism programs, it is usually possible to get professional advice on the use of herbs mainly in connection with phytotherapy. In such cases, the guest will receive various suggestions on herbal teas, tea blends, or other herbal supplements under the heading of health promotion. In Zánka's case, however, the most important connecting point is leisure tourism because of its location in the Balaton region, although there is a significant number of visitors to the Káli Basin as an open environment for eco-tourism and natural healing.

### 5. Halimba – Halimbarium

On October 23, 1902, Miklós Szalai was born in Békés (Békés county) as the child of a merchant family with many children. He completed his elementary school in his hometown and spent his high school years (1913-1921) in Liptov (today: Ružomberok, Slovak Republic) and at Piarist High Schools in Budapest. With the help of a teacher of natural science at one of the high schools, he became acquainted with herbs and, thanks to this mentor, devoted much of his life (about 40 years) to healing with herbs. He was ordained a priest in 1926 and then worked for a year at the Pázmány Péter University, Faculty of Theology, after which he received his doctorate. He then taught theology there for 3 years. He later served in several villages. In 1947, he asked the Bishopric of Veszprém to move from Bakonyszombathely to Halimba, because he knew that Halimba and its surroundings, located at the meeting point of the Bakony, Little Plain and Balaton Uplands, had a very rich (medicinal) flora. After his appointment as a parish priest in Halimba and then as dean, he continued to work as a priest and healer until his retirement. Thereafter, from 1962 until his death in 1990, he devoted all his power to the herbs he loved so much and herbal medicine. He definitely wanted to pass on his knowledge of herbs to posterity. His book was first published in 1973 and later in 1991 (the latter was maintained by the Agricultural Publishing House and the Planétás Publishing House). The former with plant graphics, the latter without. In 2009, another edition was published, illustrated with drawings and photos. In this book, Dr. Miklós Szalai describes some 300 herbs, 53 of which he used to make several herbal blends. The herbs have been used or recommended, partly on their own or in combination with other herbs, in tea mixtures. With his tea blends, he was able to cure a variety of diseases. The most sought-after herbal teas were the kidney and gallbladder teas. The management of the Szilas Cooperative discovered the teas he experimented with and the benefits of their healing effects, and in 1982 bought the recipe for 16 teas. Seven of these were manufactured and marketed under the Halimbarium trademark in the second half of the 1980s for approximately ten years. The Halimbárium trademark was acquired in June 2012 by new owners whose primary goal is to produce high quality

Hungarian herbal products, products worthy of the Halimbárium brand name. The distributor of the teas is the Bakony Reformed Food Ltd. of Halimba.



Figure 17. The herbal garden of Halimba. Source: <https://eltetobalatonfelvidek.hu/latogasson-el-on-is-a-halimbai-gyogynovenykertbe/>

Halimba is a small village in the South Bakony region, which is one of Hungary's richest herb-growing regions. In the Memorial House of Dr. Miklós Szalai, the story of the 'dean of Halimba' is presented, as well as information on healing herbs and teas made from them.



Figure 18. Herbs and honey of the Halimbarium. Source: <https://sokszinuvidek.24.hu/>

The former residence of the dean, where he lived and worked, now hosts the Miklós Szalai Herbal Garden, Demonstration and Educational Centre which is the true keeper of the heritage of the 'dean of Halimba' and promotes the revival, demonstration and propagation of herbal traditions linked with the village and the entire region. The herbal garden is in full blossom in the spring with a 'sea' of aromatic plants with colourful flowers and an array of scents. Included in the settlement is also a bee yard enabling the production of herbal honey and honey of herb flowers (Fig. 17).



## 6. The Lavender House Visitor Centre on the Tihany Peninsula

The health benefits of lavender have been known since ancient times. Tutankhamun's tomb contained traces of still-fragrant lavender and, allegedly, Cleopatra used lavender to seduce Julius Caesar and Mark Antony. The Greek physician, Pedanius Dioscorides<sup>3</sup>, author of *De Materia Medica*, a 5-volume Greek encyclopedia about herbal medicine and related medicinal substances, wrote that lavender taken internally would relieve indigestion, sore throats, headaches, and externally cleaned wounds. Modern research confirmed many of the beneficial effects of lavender, including antiseptic and skin healing effects, anti-inflammatory, antibacterial, antifungal, and wound-healing properties. Furthermore, there is growing evidence suggesting that lavender oil may be an effective medicament in treatment of several neurological disorders (Koulivand et.al. 2013).

The cultivation of lavender in Tihany started only less than one hundred years ago. In the mid-1920s Gyula Bittera, a renowned (Szaszin, 2018) herbalist of his time, planted the first lavender plantation in Hungary with propagation material brought directly from France. Until then, lavender was known only in medieval monastery gardens. It was the first large-scale lavender planting for industrial purposes. He rented an area from the abbey of Tihany and tried lavender growing according to the French model. His success is proven by the fact that the essential oil content of lavender harvested in Tihany was higher than that of the French. This is due to the special, peninsular nature of Tihany, because according to measurements it is one of the richest places in Hungary in terms of the number of sunny hours, while the exact amount of precipitation is the opposite. This semi-Mediterranean climate, southern location and volcanic bedrock provide excellent conditions for lavender. This is how the lavender planted in Tihany became world famous because it was even better in quality than the lavender grown in France.



Figure 19. The Lavender House Visitor Centre in Tihany. <https://www.bfnp.hu/hu/levendula-haz-latogatokozpont-tihany>

<sup>3</sup> Pedanius Dioscorides, (born c. ad 40, Anazarbus, Cilicia —died c. 90), Greek physician and pharmacologist whose work *De materia medica* was the foremost classical source of modern botanical

Today, the tradition has been resurrected by the Lavender House Visitor Centre on the shore of the Inner Lake of Tihany at the eastern gate of the Balaton Uplands National Park and the Bakony-Balaton UNESCO Global Geopark. At the "Ecotourism Visitor Centre of the past and present" information is provided about the Tihany Peninsula and lavender cultivation. The Visitor Centre addresses several interests: from volcanoes of pre-history to cultivated landscape and the role of lavender. In addition to making lavender ornaments, making lavender soap balls, and sewing lavender bags, visitors can test their skills by creating a variety of nature-related items. Lavender and its culture have become associated with the name of Tihany. The "Lavender Pick Yourself!" Action has become a tradition, whereby during the lavender bloom period, visitors to the peninsula can harvest lavender by hand. During the Tihany Lavender Festival and Lavender Weeks in June, many lavender and cultural programs await visitors, including lavender distillation shows, nature tours and playhouses.



Figure 20. Lavender plantations in full bloom in Tihany <https://hu.pinterest.com/pin/286541595012059906/>

## 7. The Valley of Medicinal Herbs Organic Farm, Zalaszentlászló

The Valley of Medicinal Herbs came to life in the spring of 2013 to produce and promote healthy lifestyle products, foods, traditional folk remedies. The organic farm produces 100% non-additive fruit juices, herbal tea blends, special spice oils and essential oils, depending on the season and for sale in small quantities. Its mission is non-chemical and nature-based experimental farming, of which the animals kept there are an integral part. Visitors to this Organic Farm can learn about the specialities of organic farming and observe plants and animals in their natural daily life. They can experience things that are familiar to rural people, but very special to town dwellers. They can meet local products directly, get an insight into the production process, and ultimately buy healthy local products first-hand from the manufacturer. Their products and services include fresh fruit

terminology, herbal medicine and the leading pharmacological text for 16 centuries.

and fruit juices, tea blends, spice oils, dried fruits, essential oils, accommodation, tasting and shopping, animal petting and poultry yards, herbal presentation retail and organic vegetables. Occasionally, they offer courses in handicrafts, herbal themed sessions, education in organic economy, programmes for schools; seasonally demonstration of food processing, demonstration of essential oil distillation and team building training in farm environment.



Figure 21. The Valley of Medicinal Herbs Organic Farm is a family run enterprise

## 8. Description of the 30 most often collected herbs

There are several hundreds of herbs (trees, shrubs and both annual and perennial herbaceous plants) in Hungary and many of them grow in the Balaton region. Here we describe only the 30 most extensively collected wild or semi-wild<sup>4</sup> herbs to illustrate their scientifically confirmed health benefits and medicinal use. These are mostly indigenous plants but some of them are originally alien, invasive species, which should be controlled, but from the viewpoint of their medicinal usefulness they are very important.

### (1) Black locust (*Robinia pseudoacacia*)

Black locust (*Robinia pseudoacacia* L.), a melliferous tree, originating from eastern United States, was introduced to Europe during the 17<sup>th</sup> century first as ornamental tree and later conquered vast areas by extensive plantations for timber production and by natural propagation mostly in central and south-eastern parts of Europe. Black locust is quite drought-resistant, nitrogen fixing, able to grow on bare soils under extreme conditions. Black locust is a “multifunctional” tree, as a melliferous plant it is the source of the source of acacia honey, its logs are used in agriculture as construction material and fence poles, raw material for barrels and high-quality rustic furniture.



Figure 22. Black locust (*Robinia pseudoacacia*). Source: <https://www.yatego.com/> Inserted photo: Tamás Takács

The tea made of black locust flowers is a good cough suppressant, mild diuretic and also used as a laxative. Because it is very aromatic, it can be mixed with other teas to improve the taste. The flower is also popular in the cosmetics industry. The acacia flower brew has also excellent mucolytic, antispasmodic, soothing and tonic effects. For gastric and duodenal ulcers, it should be used alternately with St. John's wort. The most important property of the black locust flower tea is that it reduces the production of gastric acid and is therefore useful to cure acid reflux disease.<sup>5</sup> Even anti-carcinogenic flavonoids have been isolated from black locust (Tian and McLaughlin, 2000).

### (2) Walnut (*Juglans regia*)

Medium or large (10-40 m high) deciduous trees, 21 species of the genus are found in the Old World, from South-eastern Europe to Japan, and in the New World, from South-eastern Canada to Western California and southern Argentina. The most well-known member of the genus is common walnut (*J. regia*, literally 'royal walnut'), which is native to the southeast from the Balkans to southwest and central Asia, the Himalayas and southwest China. Two species are more common in the Carpathian Basin, one is the common walnut (*J. regia*) that produces edible walnuts, the other is the black walnut (*J. nigra*) endemic in North America, which is planted as ornamental tree in European parks.

<sup>4</sup> Semi-wild plants are those, which are both cultivated and occur wild, outside the agricultural land areas e.g. on roadsides, deserted pastures, available for anybody to harvest.

<sup>5</sup> <https://www.home-remedies-for-you.com/herbs/black-locust.html>





Figure 23. Walnut (*Juglans regia*) Photo: Tamás Takács

One of our most valuable and versatile plant is walnut, the most important part of its fruit is the walnut kernel, but the peel is also used, and even half-ripen nuts are used as candied fruit. Walnut has many health benefits.<sup>6</sup> It is rich in vitamins A and E and contains several types of B vitamins, such as thiamine, which protects the nerves and muscles, stimulates growth. Polyunsaturated fats, such as omega-3 fatty acids, alpha-linolenic acid, found in walnut seeds are beneficial in preventing cardiovascular disease and contribute to the improvement of the condition of blood vessels. The nut itself has been used in folk medicine to treat anaemia and pallor. The beneficial effect of walnuts on the prostate is probably due to its ability to break down the protein known as insulin-like growth factor (IGF-1). High levels of this protein in the blood indicate an increased risk of prostate cancer. The fresh walnut leaves contain significant amounts of vitamin C and can be used to make tea, which is recommended, among other things, for skin problems (acne, ringworm). Walnut leaf is very rich in tannins, its tea is effective against gastritis and diarrhoea. Tea of walnut leaf can help to stop hair loss since it can strengthen the hair bulbs, and its antifungal activity is known in folk medicine. Walnuts have been reported to reduce the incidence of breast cancer, the number of tumour glands and the size of tumours (Ros et.al. 2018).

### (3) Poplar (*Populus ssp.*)

Poplar (*Populus ssp.*) is a genus of the order of *Malpighiales* and the family of the willow (*Salicaceae*) with about 99 species and hybrids. It can grow from 15 to 50 meters high and can reach a trunk diameter of up to 2.5 metres. Young trees have a smooth bark, ranging in colour from white to greenish or dark gray. Some species have deep furrows in their bark. The leaves are rhomboidal, the edges are lobed or serrated, and the stems are long and the size of the leaves, even on individual trees, can be very different: small leaves grow mainly on the side branches, larger leaves grow on the stronger branches. The leaves of many species turn yellow or

light golden in autumn. Its flowers sit in the armpit of the fronds, with loose inflorescences.



Figure 24. Black poplar (*Populus nigra*). Photo: T. Takács

In the Balaton region the aspen (*Populus tremula*) and black poplar (*Populus nigra*) are common. The tea of poplar bud has a mucolytic and diuretic effect. The bud balsam material, thawed in fat or sebum, can be used for treatment of lips, burns, frostbite, haemorrhoids and hair care.<sup>7</sup>

### (4) Linden (*Tilia spp.*)

Three of the forty species of linden are native to Hungary: the littleleaf linden or small-leaved lime (*Tilia cordata*), the large-leaved linden (*Tilia platyphyllos*) and the silver linden (*Tilia tomentosa*). The combined area ratio of these three linden species is about 1% of the Hungarian forests. *Tilia* extracts have several proven health benefits, such as anti-stress and sedative properties, anti-inflammatory and diuretic effects, painkilling, lowering blood pressure, promoting sleep, mitigating the adverse effects of gastric distress.

<sup>6</sup> <https://www.healthline.com/nutrition/benefits-of-walnuts>

<sup>7</sup> <https://www.webmd.com/vitamins/ai/ingredientmono-245/poplar>





Figure 25. Small-leaved linden (*Tilia cordata*) Photo: Tamás Takács. Source for the inserted photo: [https://www.crocus.co.uk/plants/\\_tilia-cordata-greenspire/classid.2000022369/](https://www.crocus.co.uk/plants/_tilia-cordata-greenspire/classid.2000022369/)

Tiliroside, the principal flavonol glycoside found in linden flower, has been shown to help fight infectious diarrhoea (Allio et.al. 2015, Calzada et.al. 2017).

#### (5) European horse-chestnut (*Aesculus hippocastanum*)

Horse Chestnut (*Aesculus*) is one of the most well-known holarctic genus of *Sapindaceae* family of about 15 species. The common horse chestnut (*Aesculus hippocastanum*) is the most well-known species of the genus *Aesculus*, known as also as white horse-chestnut, it is a large, deciduous ornamental tree, which grows up to 30-35 m tall in favourable conditions. Its leaves are complex, serrated. The wall of the fruit is fleshy, green outside and less spiny than the noble chestnut; its core is bright reddish brown - inedible but used by folk medicine and the pharmaceutical industry. Research has confirmed the anti-inflammatory and vein tone effect of aescin (Li et.al. 2015), a vasoconstrictor extracted from the seed. Aside from its powerful anti-inflammatory properties, test-tube studies also indicate that aescin has anticancer effects.



Figure 26. European common horse-chestnut (*Aesculus hippocastanum*) Photo: Tamás Takács

Furthermore, these studies found that aescin could significantly reduce tumour cell growth in certain cancers like liver cancer, leukaemia, and multiple myeloma (Harikumar et.al. 2010; Zhou et.al. 2009) Esculin in the cortex reduces the permeability of the capillaries and makes them more resistant. Thus, horse-chestnut products are recommended for the treatment of venous and capillary circulatory failure (eg hemorrhoids), along with other vascular enhancers. Horse chestnut seed extract is rich in flavonoid compounds, including quercetin and kaempferol, which have potent antioxidant properties (Vašková et.al. 2015).

#### (6) Silver birch also known as warty birch or European white birch (*Betula Pendula*)

Silver birch or warty birch (*Betula pendula*) is a species of birch tree (*Betulaceae*), which is naturally native to Europe and parts of Asia.



At the same time, it also lives in higher-lying areas in southern Europe. It covers substantial territories of Siberia and China, as well as Southwest Asia (Turkey), the Caucasus and the northern part of Iran. Silver birch brought into North America, known as European white birch, which in some states is considered as invasive species. It is also found in temperate areas of Australia. The silver birch is a medium-sized deciduous tree. Its bark is white with occasional black spots, while its branches are drooping, pendulous. The leaves are triangular with serrate margins, which turns yellow in autumn. The flowers are catkins and the light, winged seeds get widely scattered by the wind.



Figure 27. Silver birch (*Betula pendula*), its leaves and catkins and the “warty” bark. Source for the top picture: [https://en.wikipedia.org/wiki/Betula\\_pendula](https://en.wikipedia.org/wiki/Betula_pendula) Photo of the leaves, catkins and the bark: Tamás Takács

In herbal medicine birch is used to cure infections of the urinary tract that affect the kidney, bladder, ureters, and urethra and for its gastroprotective effects (Germanò et.al. 2012). It is also used as a diuretic to increase urine output. Some people take birch along with lots of fluids for “irrigation therapy” to flush out the urinary tract. Birch essential oil prevents bacterial and fungal infections of skin, aids diabetes management. The components responsible for these properties are Salicylic Acid and Methyl Salicylate, both well-known germicides and bactericides. Other uses include treating arthritis, rheumatism, loss of hair, and skin rashes. Birch bark is rich in antioxidants (Shukla et.al. 2017).

#### (7) Common Juniper (*Juniperus communis*)

The common juniper (*Juniperus communis*) is an evergreen plant species of the family *Cypressaceae*. Evergreen shrub growing 3-5 m tall (rarely up to 8 m). Female specimens are

usually supine, while male specimens tend to be upright, sometimes columnar. The bark is greyish-brown, slightly ribbed, fibrous, stripping. Its shoots are upward or crouching; the young shoots are bronze coloured. Juniper prickly leaves have a flat needle shape and have a mixed apple and lemon scent. They have a green back, a silvery colour that makes the plant look like greyish green. The short, cylindrical, male flowers grow from the base of the leaves of the previous year's shoots, and the small, bud-like female flowers grow on the dwarf shoots growing from the base of the leaves. Its fruit is an ash-blue-fleshy, slightly larger-than-black peppercorn (galbulus). In the first year it stays green and only matures in the second, and rarely in the third year, so that ripe and unripe berries are often seen on the same plant. The ripe berry is bright black-blue, 5 to 10 mm in diameter, with a bluish-to-ash, waxy coating.



Figure 28. Common juniper (*Juniperus communis*) Photo: Tamás Takács.

It has long been used as a spice and as medicinal herb, for jam and juniper distillate, and used to flavour gin and jenever. Oil and tar from the distillation of green parts were already used in embalming agents in ancient Egypt and its oil for healing. Today it is the source of many insect repellents and perfumes. Its health benefits in herbal tea blends include diuretic, digestive stimulant, and gallstone dissolving effects, antifungal activity, analgesic activity, hepatoprotective activity, antidiabetic and antihyperlipidemic activity. The juniper has excellent sweating enhancing effect, especially good for rheumatic complaints. It is used as a diuretic and as an appetite enhancer. Berries are also made into jam, which is consumed as a bile and kidney stimulant (Bais et.al. 2014).

#### (8) European elder (*Sambucus nigra*)

The European elder (*Sambucus nigra*) is a large shrub or tree growing 3 to 10 m high and belongs to the family *Adoxaceae* native to most of Europe and North America. Younger shoots are green or light grey then the older outer bark changes to a coarse grey colour with lengthwise furrowing, lenticels prominent. The canes of the voluminous shrub are curved. Its leaves are dark green, facing each other on the branches, singularly winged, with serrated edges. Its creamy-white,



typically fragrant hermaphroditic flowers have five stamens, which are borne in large, flat corymbs 10 – 25 cm diameter in late spring to mid-summer. The fruit is glossy, dark purple to black berry 3–5 mm diameter, produced in drooping clusters in late autumn. Specimens that grow into trees are rare: they are found only in the most favourable production areas (mountainous debris, streams, temperate but sunny areas, nutrient-rich soil). Elder trees of several meters in height are decades old; some are over a hundred years old. Elder can be easily propagated by cuttings and seed.

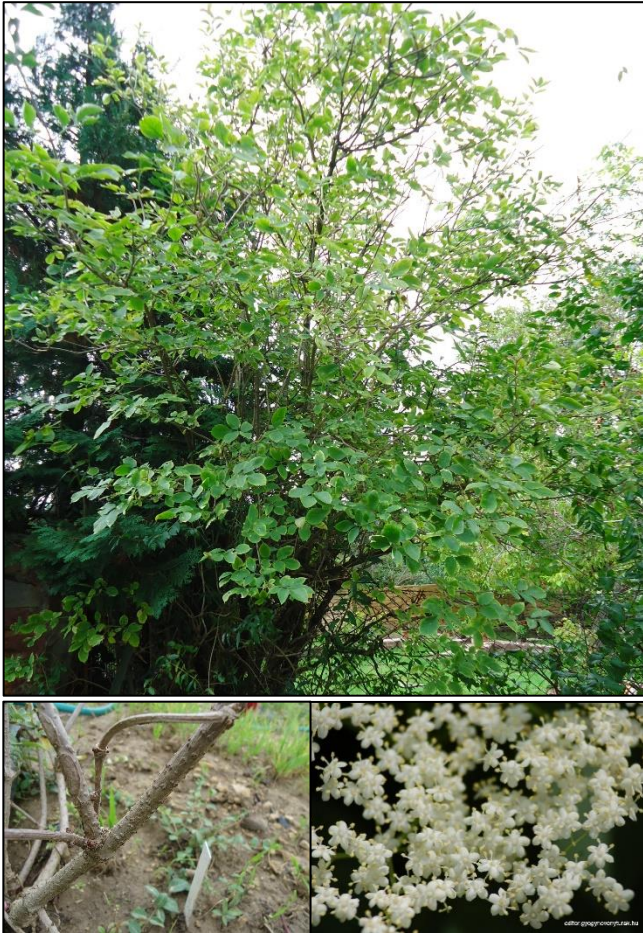


Figure 29. European Elder or elderberry (*Sambucus nigra*)  
Photo: Tamás Takács

According to some evidence elderberry might help treat colds and flu, since it might have antioxidant and antiviral effects. Elderberry fruit contains high levels of flavonoids, which might have anti-inflammatory and antioxidant properties to protect healthy cells from harmful free radicals causing skin problems (Vlachojannis et.al. 2010).

Except for the flowers and ripe berries (but including the ripe seeds), all parts of the plant are poisonous to mammals, containing the cyanogenic glycoside *sambunigrin* (C<sub>14</sub>H<sub>17</sub>NO<sub>6</sub>, Campa et.al. 2000). The bark contains calcium oxalate crystals.

#### (9) Blackthorn or sloe (*Prunus spinosa*)

The blackthorn or sloe (*Prunus spinosa*) is a well-known shrub or small tree species of the rose family *Rosaceae*

growing up to 5 metres tall with blackish bark and dense, stiff, spiny branches. It is a slow-growing, long-lived plant. The short shoots end in thorns. Its roots creep far, forming root colonies. Two flower buds surround one shoot. Its small leaves are scattered, simple, elliptical or lanceolate, their edges serrated, and their back is usually downy. The stalk is up to 1 cm long. Its hermaphroditic flowers are 1-1.5 cm in diameter, white, with five petals and they are produced shortly before the leaves in early spring. The fruit, called a "sloe", is a drupe, 10–12 millimetres in diameter, black with a purple blue epicuticular waxy layer, ripening in autumn and harvested in October or November after the first frosts.

Blackthorn has proven diuretic, laxative, astringent, and anti-inflammatory qualities, which have given this herb scientific



Figure 30. Blackthorn or sloe (*Prunus spinosa*). Photo: Tamás Takács

recognition for its medicinal uses due to its high antioxidant, polyphenol, vitamin and mineral content (Yuksel, 2015). Furthermore, anti-microbial activity of blackthorn (sloe) berries against *Salmonella ssp.* has been demonstrated, which indicates, that this herb has the potential to enhance food safety in food industry as a natural preservative (Gündüz, 2013). Precaution: although in small amounts blackthorn is beneficial, it contains cyanogenic glycosides, which are toxic in large quantities, and long-term consumption is not advised.

#### (10) Common hawthorn (*Crataegus monogyna*)

Common hawthorn is a medium-high, dense branched, shrub or 5 – 8 metres small tree with an irregular, spreading crown. The bark is dull brown with vertical orange cracks, the younger shoots bear approximately 12.5 mm long sharp thorns. Leaves are obovate and deeply lobed, glossy dark green at the top, bluish green at the back.



The peduncle is about 3 cm long, the moderately fragrant, hermaphrodite flowers are white, 8-15 millimetres wide, arranged in corymbs of 5–25 together; each flower is about 10 mm in diameter with five white petals, numerous red stamens, and a single style. The fruit is ovoid or spherical, blood red in colour, with a size of 6 to 10 millimetres, berry-like, but structurally a pome containing a single seed.



Figure 31. Common hawthorn (*Crataegus monogyna*) Photo: Tamás Takács

*Crataegus monogyna* is the most common species in the genus used as the "hawthorn" of traditional herbalism. The parts of the plant used are the sprigs with both leaves and flowers and the fruit. Hawthorn has been investigated by evidence-based medicine for treating cardiac insufficiency such as congestive heart failure (CHF), irregular heartbeat (arrhythmia), blood circulation problems (Tassel et al. 2010), asthma, low blood pressure, high cholesterol, type 2 diabetes, muscle spasms, sedation (Han et al. 2011). The antioxidant activity of *Crataegus* preparations contributes significantly to its therapeutic profile (Gou et al. 2003).

#### (11) Dog rose (*Rosa canina*)

The dog rose (*Rosa canina*) is a deciduous shrub, which can grow up to from 1 – 3 metres, but it doesn't often reach this height as the branches tend to arch over. However, the dog rose may climb even higher in the crowns of taller trees with the aid of its sharp and curved spines, which cover the stems. Due to a vast number of hybrids, there is great morphological variety between different dog rose plants, which makes identification difficult as all forms are very similar. The spiny bark is green on the younger shoots and grey-brown on the

older ones with longitudinal grooves. The alternating, hairless, shiny and dark green leaves are pinnate, with 5–7 leaflets. The hermaphroditic flowers with a diameter of 4 – 6 centimetres have 5 petals, which are usually pale pink, but can vary between a deep pink and white. The fruit is an oval, red – orange coloured hip 1.5–2 centimetres in diameter.



Figure 32. Dog rose (*Rosa canina*) Photo: Tamás Takács

Dog rose hips have a number of health benefits<sup>8</sup> such as antioxidant, astringent, anti-viral, diuretic, anti-carcinogenic, and cholesterol lowering effects due to their key constituents: vitamins A, B, D, E and C (approximately 20-60 times as much vitamin C as oranges); flavonoids; tannins; sugars; acids; pectin; carotenoids (lycopene). Furthermore, GOPO fatty acid found in dog rose has been clinically tested to have anti-arthritis properties. Research has proven, that regular consumption of dog rose in the form of powdered beverage or directly eaten fruit may contribute to lowering blood sugar levels (Selahvarzian et al. 2018).

#### (12) Blackcurrant (*Ribes nigrum*)

Blackcurrant (*Ribes nigrum*) is a spiny shrub growing to a height of 1-1.5 m, which produces more young shoots per year. It develops hermaphroditic flowers from the side buds of branches older than 1 year in racemes known as "strigs" up to 8 cm long, containing ten to twenty flowers, each about 8 mm in diameter, while its 4-5-6-year-old canes produce less and less until they eventually die. Its fruits are very dark purple coloured, almost black berries, with glossy skin and persistent calyx at the apex, each containing many seeds. The berries are shaped like a red currant but with shorter

<sup>8</sup> <https://www.botanical-online.com/en/medicinal-plants/dog-rose-rosa-canina-properties>



peduncles. It blooms in April and May and ripens in June and July. In some varieties, the berries fall off the stalk after ripening or at harvest.



Figure 33. Blackcurrant (*Ribes nigrum*) Source: [https://upload.wikimedia.org/wikipedia/commons/0/05/Ribes\\_nigrum\\_al.JPG](https://upload.wikimedia.org/wikipedia/commons/0/05/Ribes_nigrum_al.JPG)

Among the berries, blackcurrant has the highest vitamin C content, but it is less popular as fresh fruit due to its strong flavour. Conversely, processed into syrup and wine, it is a popular immune-boosting protective drink. It can also be used to make jam. Blackcurrant contains 9 g of protein, 20 g of fat, 95 g of carbohydrate, 6 g of organic salt and 38 g of fibre per kilogram. Blackcurrants have long been regarded as having considerable health benefits, due to their high levels of vitamin C and substantial antioxidant activity (Lister et al. 2002). Recent in vitro study investigated the antispasmodic effects of blackcurrant juice on the gastrointestinal smooth muscle, which may hold promise in the treatment of gastrointestinal disorders (Miladinovic et al. 2018).

#### (13) European (white) mistletoe (*Viscum album*)

European (white) mistletoe (*Viscum album*) is a semi-parasitic evergreen plant in the order *Santalales* native to Europe, North Asia and North Africa. It is mostly found on apples, pears and poplar trees. The white mistletoe on the host plant is spherical in shape, up to 3 metres in diameter. Its height can reach 1 metre, its age is 70 years. The leaves are narrow, oval, yellowish green in colour. The flower, which is at the base of the leaf and at the end of the branch from March to May, is yellow in colour. The fruits are white, pea-sized, sticky, translucent berries, ripening in November-December. The berries are toxic to humans, but edible to many birds. It has one giant seed that does not germinate in water or soil, only on tree branches. However, despite its dangers, the European varieties of mistletoe have been used for centuries



Figure 34. European mistletoe (*Viscum album*) Photo: Tamás Takács

in traditional medicine to treat seizures, headaches, infertility, hypertension and arthritis.

The medicinal applications of white mistletoe are extremely widespread,<sup>9</sup> it is mainly used to treat hypertension, atherosclerosis and heart rate control, improves the permeability of the blood vessels, suitable against dizziness, tinnitus, varicose veins and improves concentration. It also has a diuretic effect. It suppresses all kinds of wound, uterine, lung and nose bleeding. Good for coughs, whooping cough (pertussis), asthmatic and other cramps. Due to its sedative effect it is also used for the prevention of epileptic seizures and for headaches. It improves the functioning of the immune system. It strengthens the muscles of the uterus and increases the chances of oviposition and conception. Slightly lowers blood sugar levels, also recommended for diabetics. Research has confirmed that mistletoes might be promising alternative therapy against colon, oral, lung, and pancreas cancers (Patel

<sup>9</sup><https://www.webmd.com/vitamins/ai/ingredientmono-917/european-mistletoe>



and Panda, 2014, Kienle and Kiene, 2018) and even breast cancer (Marvibaigi et al. 2014).

(14) Goldenrod (*Solidago virga-aurea*, *Solidago Canadensis* and *Solidago gigantea*)

*Solidago* is a Holarctic genus: the overwhelming majority of about eighty species are North American, but also live in North Africa and East Asia. Only four species are native to Europe. Of these, in the Carpathian Basin, the common goldenrod (*Solidago virga-aurea*) is predominant while *Solidago alpestris* and *S. carpatica Schrad* occur in the alpine and sub-alpine regions. In Hungary, the Canadian goldenrod (*Solidago canadensis*) and the tall goldenrod (*Solidago gigantea*), similarly imported from America, invades areas in Western Transdanubia along forests and waters.



Figure 35. Goldenrod (*Solidago virga-aurea*) Photo: Tamás Takács

Goldenrod drugs are mainly saponin, tannin, rutin, nicotinic acid and some essential oils. It is used externally for throat rinsing and used even as tea for high blood pressure, against various bile, kidney, bladder and liver problems, in case of severe menstruation, catarrh, rheumatism and joint pain, and for sweating and diuretic purposes (Metzig, 2004). The tall goldenrod's drug is of better quality and contains more active ingredients than that of the ordinary goldenrod.

(15) Yarrow (*Achillea millefolium*)

Yarrow (*Achillea millefolium*) is a perennial flowering plant in the family *Asteraceae*, produces one to several stems, which grow to 20-80 cm high. The leaves are evenly distributed along the stem, 5–20 cm long, bipinnate or tripinnate, with varying degrees of hairiness (pubescence), almost feathery, cauline, more or less clasping and arranged spirally on the stems. The flowers constitute an inflorescence, which is produced in a flat-topped capitulum cluster. The inflorescence has 4 to 9 phyllaries and contains ray and disk flowers which are white to pink. The generally 3 to 8 ray flowers are ovate to round. The number of disk flowers range from 15 to 40. The small, 2 mm large achene-like fruits are called cypsela. Every part of the plant gives off a pleasant scent. The plant is rich in meadows, pastures, arable land, cracks, forests and roadside ranges from the hills to the bottom of the snow-zone.



Figure 36. Yarrow (*Achillea millefolium*) Source: <http://www.sarvznador-karmentesites.hu/node/1484>

Yarrow has several beneficial health effects. Antioxidant activity of *Achillea* has been scientifically confirmed (Ardestani and Yazdanparast, 2007). Excellent anti-inflammatory can be used for vaginal and uterine inflammation, mucous membranes and gingivitis (Gómez et al. 2014; Kazemi, 2015). Good wound astringent and has wound healing effect. Reduces menstrual bleeding and cramps. It is also excellent for abdominal pain, bloating, and digestive enhancement. It stimulates bile secretion production. Indispensable in urinary tract diseases and respiratory problems. Although common yarrow is primarily known as a medicinal plant, but its leaves can also be used for composting, or more precisely, it accelerates the decomposition of the plants to be composted.

(16) Common nettle (*Urtica dioica*)

*Urtica dioica*, the common nettle, is a dicotyledonous, dioecious, herbaceous perennial flowering plant in the family *Urticaceae*, growing 1 to 2 m tall in the summer and dying down to the ground in winter. Nettle is a common weed, can be found in gardens, waste areas, near farm areas and stables, sites of animal husbandry and around moist areas such as creeks, its preferred soils are rich in nitrogen (grows well at

the bottom of black locust plantations). This plant, originally native to Europe and much of temperate Asia and western North Africa, has conquered the whole world, including New Zealand and North America, where the ecological conditions were favourable. At least six subspecies of *U. dioica* are described, some of these formerly classified as separate species. All organs of the nettle are covered with trichomes, stinging nettle-hairs, and its touch causes a painful, burning and itchy feeling with small rashes because nettle hairs contain formic acid and act as hypodermic syringes. The stems continue underground in widely spreading rhizomes and stolons, which are bright yellow, as are the roots. The leaves are hearty-ovate or lanceolate, long-pointed, roughly serrated. The hollow and rectangular stem with lacunar collenchyma at each corner grows in groups, erect or ascending. The pollen bearing male flowers form drooping axillary inflorescences, the fruiting ones form small knots.



Figure 37. Common nettle (*Urtica dioica*) Photo: T. Takács

The stinging nettle have a long history as a medicinal herb. Stinging nettle's leaves and roots provide a wide variety of nutrients, many of which also act as antioxidants (Upton, 2013):

- Vitamins: Vitamins A, C and K, as well as several B vitamins
- Minerals: calcium, iron, magnesium, phosphorus, potassium and sodium
- Fats: Linoleic acid, linolenic acid, palmitic acid, stearic acid and oleic acid
- Amino acids: all of the essential amino acids

- Polyphenols: kaempferol, quercetin, caffeic acid, coumarins and other flavonoids
- Pigments: beta-carotene, lutein, luteoxanthin and other carotenoids

There are many proven health benefits of nettle such as anti-inflammatory effects (Riehemann et al. 1999; Randall et al. 2000), antioxidant activity, reduction of prostate size and treatment of symptoms of enlarged prostate gland in men with BPH (Nahata and Dixit, 2012) and reduction of hay fever symptoms (Bakshae et al. 2017). Furthermore, there is research supported evidence, that nettle extract has also antihypertensive properties, blood pressure lowering effects by stimulating nitric oxide production, which acts as a vasodilator (Qayyum et al. 2016). Both human and animal studies confirm, that stinging nettle may lower high blood sugar levels, probably due to compounds that may mimic the effects of insulin (Domola et al. 2010; Kianbakht, 2013). Other well-known health benefits of *Urtica dioica* are reduction of bleeding (Eyi et al. 2013), anti-diuretic effects (Tahri et al. 2000). Extract of stinging nettle showed antibacterial, haemostatic and wound healing effects (Zouari Bouassida et al. 2017).

#### (17) Common wormwood (*Artemisia absinthium*)

Common wormwood (*Artemisia absinthium* L.) from the *Asteraceae* family, is an aromatic, perennial small shrub, native to temperate regions of Eurasia and Northern Africa and widely naturalized in Canada and the northern United States. It prefers sunny, dry places and can grow on a wide variety of soils. The stems, woody on the lower part and branching on the upper portion of the plant, can grow up to 1.3 metres. In the first year only leaves are formed, which form a leaf-rose; it only blooms in its second year.



Figure 38. Common wormwood (*Artemisia absinthium*) Photo: Tamás Takács

The basal leaves are long-stemmed, bipinnate or tripinnate, up to 250 mm long, covered with silky-silvery trichomes, with a greenish-grey colour on the top and white on their back. The stem leaves are smaller, 50-100 mm long, have only short petioles and less divided, very hairy. The leaves bear small oil producing glands. The leaves around the inflorescence are lanceolate. The upper part of the stem



passes into a multi-angled inflorescence. Its flowers are very small, yellow in colour and form small globular heads (capitula), which are in turn clustered in leafy and branched panicles. The common wormwood blooms from July to September, has a strong scent, is pollen-rich (one of the most potent allergens), the pollination is anemophilous. Unlike the ragweed, it is unable to bloom after mowing. All its parts are fragrant and have a bitter taste. The dry, one-seeded fruit is a small achene, which is dispersed by gravity.

Common wormwood, known to be the bitterest plant in the world, was already known and used by the antique Egyptians and Greeks for healing. It was found in medieval monastery gardens in the territory of the Kingdom of Hungary, and the monks made various elixirs of it. It is also used as an ingredient in herbal teas for its appetizing effect and treating low blood pressure. The essential oil obtained from it is one of the raw materials of antispasmodic drugs. Wormwood is also used to treat fever, liver disease, depression, muscle pain, memory loss and worm infections, to stimulate sweating (Moacă et al. 2019, Höld et al. 2000). Furthermore, wormwood is suitable to treat Crohn's disease and a kidney disorder called IgA nephropathy (Holleran et al. 2020). It is used externally in antirheumatic preparations. However, despite its numerous health benefits, wormwood should be used with caution, because it is harmful in patients with peptic ulcer and in higher doses may cause intoxication, with symptoms such as vomiting, severe diarrhoea, retention of urine, loss of consciousness, convulsions (Brown, 2017).

#### (18) Common comfrey (*Symphytum officinale*)

Common comfrey (*Symphytum officinale*) is a perennial plant in the family *Boraginaceae* that prefers wet areas and is often found in wet pits on meadows. Its roots are 2.5 to 3 cm in diameter, deep in the soil, dark brown or black in colour, with a white or possibly yellow, mucoid feel when cut inwards.



Figure 39. Common comfrey (*Symphytum officinale*) Photo: Tamás Takács

The stem is heavily branched at the base, the large, oval, hairy leaves terminate in broad, rough, pointed peaks. The inflorescence consists of clusters of drooping, tubular flowers is purple or pink, rarely yellowish-white. It blooms all summer.

Comfrey is used in herbal medicine for treating tendon damage, broken bones, lung congestion, ulcerations in gastrointestinal tract, diarrhoea, heavy menstrual periods, varicose veins, joint inflammation, and to promote wound healing and boost the immune system (Giannetti et al. 2010; Staiger, 2013). Root extracts are used to gargle or mouthwash for gum diseases, strep throat and pharyngitis. Recent research has greatly contributed to the understanding of the molecular mechanisms and genetical regulation of mode of action of comfrey and confirmed herewith its analgesic and anti-inflammatory properties (Seigner et al. 2019).

Caution is advised with the use of raw plant extracts, because comfrey contains toxic pyrrolizidine alkaloids that are easily absorbed in the stomach and through the skin and increase the risk of fatal liver poisoning (Seremet et al. 2018).

#### (19) Common dandelion (*Taraxacum officinale*)

The common dandelion (*Taraxacum officinale*) is a flowering herbaceous lactiferous, perennial herb of the family *Asteraceae*. The thick, branched taproot can be up to 2-3 cm in diameter and grow up to 1-2 m in length. Its upright stems are cylindrical scapes (peduncles), hollow inside and, when broken, let out a white milky latex, which later turns brown and dries to a blackish substance. The runcinate-pinnatifid or lobed oblanceolate leaves, with sparsely pubescent lower surfaces, form a basal, radial rosette in which every sixth leaf overlaps.



Figure 40. Common dandelion (*Taraxacum officinale*) Photo: Tamás Takács

The size and the morphology of leaves is very variable, they grow generally 5-40 cm in length and 0.7-15 cm in width, and taper to a winged, petiolar base. The inflorescences are made up of countless yellow, tubular florets, the inflorescence itself lonely at the end of the stem (it is possible that during development, one or more flowers converge on a common stem). The species is hermaphrodite (has both male and female organs) and is pollinated by insects, apomictic (reproduce by seeds formed without sexual fusion). The fruits, called cypselsae, are oblanceolate in shape and 2-3 mm long with slender beaks. The fruits have 4 to 12 ribs that have sharp edges. Each seed is equipped with a silky pappus, which forms a parachute to spread the seeds over vast areas. The dandelion flourishes around April-May, sometimes covering

whole meadows. In gardens and lawns dandelions are aggressive, fast-spreading weeds.

Although dandelion is considered as a weed, it is fact one of the most valuable and nutritious wild growing plants, which is, from root to flower, loaded with vitamins, minerals and fibre. The most important vitamins in dandelion are vitamins A, C and K, vitamin E, folate and small amounts of other B vitamins. Dandelion greens provide a substantial amount of several minerals, including iron, calcium, magnesium and potassium. The root of the dandelion is rich in inulin, a soluble fibre found in plants that supports the growth and maintenance of a healthy bacterial flora in the intestinal tract (Vandeputte et al. 2017).

Dandelion is rich in beta-carotene and polyphenolic compounds, which are known to have strong antioxidant capabilities (Khoo et al. 2011). Research confirmed that dandelion contain bioactive components with potential anti-diabetic properties (Wirngo et al. 2016).

According to small animal and test tube studies, dandelion may have significant anti-inflammatory capacity due to the presence of polyphenols. These studies have revealed the significant reduction of inflammation markers in cells treated with dandelion compounds (Park et al. 2014).

Dandelion contains chicoric and chlorogenic acid, bioactive compounds that have been shown to reduce blood sugar in animal and test-tube studies (Tusch et al. 2008). One animal study resulted in dramatically reduced cholesterol and triglyceride levels in mice that were treated with dandelion extract (Davaatseren, 2013). Furthermore, dandelion is believed to have diuretic effects, to lower high blood pressure, to promote liver health and to aid weight loss (Davaatseren, 2013).

Probably the most intriguing health claims of dandelion is its anti-carcinogenic properties. According to several test-tube studies dandelion is effective in reducing the growth of cancer cells in various organ tissue cultures (Rehman et al. 2017).

#### (20) Alder buckthorn (*Frangula alnus*)

The alder buckthorn (*Frangula alnus*, formerly *Rhamnus frangula*) belongs to the order *Rosales* and the family *Rhamnaceae*. The buckthorn is native to most of Europe; it is also found in North Africa and, via Siberia, in West China. It was also introduced in eastern North America.

The alder buckthorn is thornless, 1-3 metres tall, loose-branched shrub, with smooth bark, almost horizontally standing and rarely leafy branches, which break easily. The cortex is green at a young age and later grayish brown with long, transverse gray-white cork-warts. The buds are hairy, the bud scales are absent. The leaves are scattered, broad elliptic or inverted egg-shaped, about 2 to 7 centimetres long and 5 centimetres wide, sometimes smaller. The apex is short-pointed or truncated, their edges intact and weakly wavy, with 7-9 pairs of veins strongly inclined towards the edge of the leaf. The flowers of the plant are small, 3–5 mm in diameter, star-shaped with five greenish-white acute triangular petals, solitary or clustered together. The hermaphroditic flowers are

pollinated by insects. It blooms between May and July. The fruit is a small black berry 6–10 mm in diameter, containing two or three pale brown 5-millimetre seeds. The seeds are primarily dispersed by frugivorous birds, which readily eat the fruit.



Figure 41. Alder buckthorn (*Frangula alnus*) Source: Sten P. <https://commons.wikimedia.org/w/index.php?curid=5221121>

Bark tea or extract is used as laxative for chronic atonic constipation due to its 3–7% anthraquinone content, to treat abdominal bloating, hepatitis, cirrhosis, jaundice, liver and gall bladder complaints, as cholagogue (bile expectorant) and as anthelmintic (Kremer et al. 2012). Alder buckthorn bark is also a common ingredient in anti-obesity and bloating tea blends. It is also used for atherosclerosis, hypertension, and menstrual disorders (Brenesel et al. 2015). Prolonged consumption is not recommended as it may cause irritation of the intestines and constipation. Fresh bark is toxic, it should be used only after one year of drying or heat treatment and even in this case caution is recommended (Brkanac et al. 2015).

#### (21) Bear's garlic (*Allium ursinum*)

Bear's garlic (*Allium ursinum*) is a bulbous, perennial herbaceous monocot of the order *Asparagales* and of the family *Amaryllidaceae*. The species name *ursinum* comes from folk tales, that brown bears after awakening from their winter hibernation consume this plant to remove toxins from their body and to gain strength (Rejewski, 1996). The white, elongated, mace-shaped bulbs (45 mm long and 5 mm thick) are usually formed from a single leaf base with two large, ovate, long-stemmed leaves with pointed tips, up to 15-25 cm long and 4-7 cm wide. Its flower buds are protected by two membrane-like brown leaves. The open flowers are snow-white, star-like with six white petals, about 16–20 mm in diameter, with stamens shorter than the perianth. The semi-spherical umbel-like inflorescence of 6 to 20 white flowers lacks the bulbils produced by some other *Allium* species such as *Allium vineale* (crow garlic) and *Allium oleraceum* (field garlic). The seeds are black, subglobose, 2–3 mm wide, gathered in trichotomic capsules (Hermy et al. 1999). The bear's garlic has a very wide culinary use, the whole plant is edible and very rich of vitamins and carotene.



The young leaves appear in March, they are delicious additives to soups, sauces and pesto or as spice in baked scones. The flowers emerge from April to June can add a potent garlic punch to salads and sandwiches, but without the for many people unpleasant smell.



Figure 42. Bear's garlic (*Allium ursinum*) Photo: Tamás Takács

*A. ursinum* contains several compounds, which are responsible for its health benefits. In European traditional medicine bear's garlic has been used as a digestive stimulant, antimicrobial agent, removing toxins from the body, and for prevention of cardiovascular diseases. Undoubtedly, the most important constituents are the sulphur containing compounds such as di-, tri- and tetra-sulphides, glutamyl peptides and sulfoxides, both in terms of chemotaxonomic value and pharmacological activity. Other important compounds are phenolics and steroidal glycosides (Sobolewska et al. 2015). Pharmacological studies on *A. ursinum* bulbs and leaves have demonstrated, that this plant has a wide therapeutic potential, primarily due to its beneficial cardiovascular effects, antimicrobial activity and parasite repellent properties (Sobolewska et al. 2015).

#### (22) Common horsetail (*Equisetum arvense*)

A perennial flowerless plant native to Europe, North America, Asia and Africa. The scientific name *Equisetum* originates from the latin words *equus*, meaning "horse," and *seta*, meaning "bristle." It grows to 40 cm in height and prefers a clayey, wet, shady area where it can develop its underground shoots. Its root trunk reaches up to 6 meters deep and is therefore almost indestructible. From this root strain it develops two types of stems: the early spring fruit stalk, which is 10-25 cm tall, brown in colour, cone-shaped, and appears in March. As soon as its spores are scattered, it quickly disappears and develops into a summer infertile stalk that grows to 20-80 cm in height, pale green, branched, thin.

Primarily used to improve renal function, its diuretic effect has been experimentally proven. It can be used to drive away kidney stones, kidney sand and to eliminate all kinds of urinary tract infections. Due to its silicon and organic mineral content it has an excellent toning and strengthening effect.



Figure 43. Common horsetail (*Equisetum arvense*) Photo: Tamás Takács

#### (23) St John's-wort (*Hypericum perforatum*)

A tall flowering plant in the family *Hypericaceae*, with a height of 30-90 cm (Fig. 42). It has a woody stem, with two opposite longitudinal stripes running along it, and a cylindrical shape [with cross-facing, ovoid-elliptical, translucently dotted leaves due to the essential oil-bearing cells. Its flowers consist of five yellow, ovoid petals and a large number of stamens.



Figure 44. St John's-wort (*Hypericum perforatum*) Photo: Tamás Takács.

The lemon-scented yellow flowers open in a canopy in summer, between July and August. It is easily identifiable

because if we break the flower petals, a purple liquid will stain our fingers. The ripe pods are orange, 6-10 mm long, with egg-shaped, three-compartment, bladder-like glands. It has many seeds, black or dark brown in colour, 1 mm long, cylindrical, pointed at both ends, with slightly rough surface.

St John's-wort was considered an effective “exorcist” in the Middle Ages because of its antidepressant, mild sedative and anti-insomnia effects. Its antidepressant properties have also been proven by scientific experiments. Due to its beneficial effects on mental and physical health, it is now taken by millions worldwide as a medicinal product, available without prescription. Its leaves are also used to flavour salads and liqueurs. The plant has a surprisingly wide range of therapeutic effects: potent wound healing, anti-varicose, anti-haemorrhagic and anti-diarrheal effects, treatment of nervous fatigue, depression and anxiety, insomnia (less side effects than modern antidepressants), cure of gastric ulcer, kidney problems, bile disorders, and antiviral properties (Ng QX et al. 2017).

#### (24) Chamomile (*Matricaria recutita/chamolilla*)

The chamomile is an annual, sometimes two-year-old, 10–40 cm tall, sparsely branched, heat-demanding plant. The leaves are scattered, bald, frantically sliced, the frills are narrow. The nest of the inflorescence is 1.5–2.5 cm wide, the nest scales are greenish with a darker edge. The outermost, lingual flowers are white, with truncated, sometimes pinched tips, bent back when ripe. The tubular flowers are yellow. An important feature of chamomile is that at the end of flowering the inflorescences are conical and hollow inside. The crop is greyish-white achenes. The whole plant has a characteristic scent.



Figure 45. Chamomile (*Matricaria recutita/chamolilla*)

Source: <https://www.thegrowers-exchange.com>

Chamomile is commonly used to improve the following health problems:

1. anxiety and depression
2. natural allergies or hay fever
3. inflammation
4. muscle cramps
5. PMS (premenstrual syndrome) and other menstrual disorders
6. insomnia
7. skin diseases
8. gastric ulcer
9. wounds
10. gastrointestinal disorders
11. arthritis and rheumatism

The main antioxidant components extracted from chamomile flowers are members of the terpenoid group, including chamazulene and acetylene derivatives. Because these delicate compounds are unstable, they are thought to be best preserved in an alcoholic tincture or “essential oil.” Other important components of flowers include phenolic compounds, primarily flavonoids, including apigenin, quercetin, patuletin, and various glucosides (McKay and Blumberg, 2006).

#### (25) Marshmallow (*Althaea officinalis* L.)

The marshmallow (*Althaea officinalis*) is a perennial species with softly hairy, grey-green leaves and stems. The lilac-pink, five-petaled flowers are saucer-shaped and arranged in small clusters, which appear on tall flowering stems from mid-summer to early autumn. *A. officinalis* belongs to the order *Malvales* and the family *Malvaceae*, a Eurasian flora element, but also lives in North Africa and North America. It is indigenous in Hungary and can be found in wet and saline areas.



Figure 46. Marshmallow (*Althaea officinalis*) Photo: Tamás Takács

The name of the genus *Althaea* is a Greek term that means “heal” or “stimulating the body’s own healing abilities”. A confection made from the root since ancient Egyptian times evolved into today’s marshmallow treatment. In the medieval first Charlemagne considered it worth cultivating, and from the 9<sup>th</sup> century it could be found in the garden of every monastery.



In medicine, the leaves, flowers and roots are used. The leaves, collected in summer, have mucolytic, diuretic, and soothing properties. Their decoction is used to treat urethritis and kidney stones. The roots collected in late autumn have an intestinal coating, diuretic, skin soothing (emollient) and wound healing effect. The decoction of the roots is usually used for digestive and skin problems, mainly for the treatment of inflammation of the mouth, gastritis, gastric ulcer, intestinal catarrh, inflammation of the intestine (enteritis) and chronic inflammatory disease of the colon (colitis). It also increases milk secretion and soothes the bronchi.

(26) Common agrimony or sticklewort (*Agrimonia eupatoria*)

*Agrimonia eupatoria* is a hairy, dark green, 15 to 100 cm tall, herbaceous perennial plant in the Rosaceae family. The overwintering organ is a deep rhizome. The complex, unparalleled pinnate leaves have typical serrated edges. The short-stemmed, golden yellow flowers are arranged in long, spike-like, racemose inflorescences. It blooms from June to October. The seed pods are 7–10 mm long, clearly grooved lengthwise with hooked hairs, which aid its dispersal by clinging on passing animals. Widespread throughout Europe, it prefers sunny, dry places: fields, roads and forest edges. The plant has been known and revered in ancient Egypt and in the Middle Ages due to a believed magical power, and it was used to drive away evil spirits.

According to phytochemical analyses, the aerial parts of the plant contain terpenoids, phenolic compounds (flavonoids), glycosides essential oils, 3% to 21% condensed tannins, polysaccharides, triterpenoid compounds ( $\alpha$ -amyrin, ursolic acid, euscaptic acid), silicic acid, salicylic acid, ascorbic acid, nicotinamide complex (about 100-300 pg/g leaf), thiamine (about 2 $\mu$ g/g leaf), palmitic and stearic acids, ceryl alcohol, phytosterols and vitamin K (Al Snafi, 2015).



Figure 47. Common agrimony (*Agrimonia eupatoria*)  
Photo: Tamás Takács

The sticklewort is suitable for the treatment of diarrhoea, gastroenteritis and chronic hepatitis due to its antibacterial effect. In diabetics, it reduces the amount of urine and also reduces thirst and stimulates the digestive system. It can be used for sore throat and stomatitis, hoarseness, tonsillitis due to the anti-inflammatory effect of the active flavonoid

ingredients. This herb also heals wounds in the mouth (such as those caused by dentures) and thrush, which is a common fungal infection in the mouth of infants caused by *Candida albicans*. For this purpose, a mix with sage and strawberry leaves is recommended. The best-known use of agrimony is in the regulation of liver and bile function, treatment of higher uric acid levels, rheumatism and gout. It is a good diuretic and can be used to prevent the formation of kidney stones and kidney sand. Helps with food digestion and improves spleen function (Al Snafi, 2015).

(27) Lady's bedstraw or yellow bedstraw (*Galium verum*)

*Galium verum* is a herbaceous, perennial plant of the family *Rubiaceae*. with straight stems growing to 30–60 centimetres high. The dark green, underneath hairy, shiny leaves are 1–3 cm long and 2 millimetres broad, borne in whorls of 8–12. The bright, golden-yellow flowers are 2–3 mm in diameter, arranged in dense clusters and have a strongly honey-like scent. This plant is widespread across most of Europe, the temperate regions of Asia from Israel and Turkey to Japan and Kamchatka and North Africa, occurs mainly on mountain slopes and drier meadows.



Figure 48. Lady's bedstraw (*Galium verum*) Photo: Tamás Takács

The main medical applications of lady's bedstraw include uses as diuretic as a treatment for skin complaints, wounds, and gastro-intestinal complaints due to its antispasmodic effects. Furthermore, phytochemical analyses showed that the plant contained iridoid glycosides, phenolics and flavonoids, which explained its proven beneficial antioxidant, cytotoxic, antimicrobial, protective and endocrine effects (Al Snafi, 2018).

(28) Valerian (*Valeriana officinalis*)

The Valerian is a perennial, soft-stemmed plant that loves moist soil and grows up to 1.5 m in height. Its habitat is Europe and West Asia, up to 2000 m above sea level. It blooms from May to July, with pink or white flowers breaking down in bulging inflorescences. The symmetry of the flower can be radial or slightly bilaterally proportional, even within the same inflorescence.

Valerian is a very complex herb, well known and has been used for hundreds of years as a sleeping aid and tranquiliser.



Figure 49. Valerian (*Valeriana officinalis*) Source: <https://smiling-sun-gardens.myshopify.com/products/valerian-valeriana-officinalis>

Although over 120 chemical components have been isolated from valerian, no adverse side effects could be identified with moderate use (Sharma et al. 2010). The most important compounds, responsible for sedative and anti-inflammatory effects include valerenic acid, a sesquiterpenoid constituent of the essential oil, which increases levels of GABA<sup>10</sup> and has even anti-inflammatory effects, iridoids with sedative effects, and isovaleric acid, which is able to prevent involuntary muscle contractions. Hesperidin and linarin are important antioxidant flavonoids with sleep-enhancing effects. Hesperidin has also proven anti-seizure effects (Dimpfel, 2006). The roots and rhizome are the most common used parts of the plant, which strengthens the heart and might reduce high blood pressure. Even if valerian is also used against anxiety and psychological stress, there is no conclusive evidence based on clinical trials to support these uses.

#### (29) Ribwort plantain (*Plantago lanceolata*)

The ribwort plantain is a soft-stemmed, perennial plant, belongs to the family *Plantaginaceae*, grows to a height of 20-40 cm. It is characterized by a vertical rootstock, with short, furrowed, fibrous stem shoots with 3 – 5 single, lanceolate, longitudinal, curved-veined, intact-edged basal leaves. The tiny, 1 to 3 cm long, approx. 4 mm wide, whitish flowers stand in a solid cylindrical or spherical garland, opening in order from bottom to top. The yellowish-white stamens are longer than the four-membered party with brown edges, so they stand out conspicuously from the level of the inflorescence. Wind-pollinated, 8-14 pores of its pollen are surrounded by an annulus. It blooms from May to October.

The pollen is moderately allergenic but of small importance, although the number of pollen grains can be 7,700 per anther. Its elongated pods contain boat-shaped seeds sitting in compartments. It is a common plant in fields, meadows and forest edges and widespread throughout Europe and even almost all over the world.



Figure 50. Ribwort plantain (*Plantago lanceolata*) Photo: Tamás Takács

The main active ingredient of ribwort is aucubin glycoside, but it also contains polyphenols, mucus polysaccharides, vitamin C, tannins, silicic acid, potassium and zinc. It has a good bactericidal, anti-inflammatory, and wound healing effects, so its crushed leaves can be a useful remedy for insect bites and minor burns. In inflammatory diseases of the respiratory tract, to relieve cough, it is used as an expectorant. The ribwort extract dissolves sticky mucus, promotes the formation of sputum. By coating the mucous membrane of the throat, it relieves its inflammation and eliminates the cough stimulus. Due to the low swelling capacity of the seeds, it is sometimes used as a laxative. Externally, the fresh leaves of the plant are used in folk medicine for skin injuries, cut and purulent wounds, hard-to-heal ulcers, and hemostasis, because they disinfect, shrink and close the wound, promote blood clotting (European Medicines Agency, 2011).

<sup>10</sup> GABA, gamma-aminobutyric acid, is the main inhibitory neurotransmitter in the mature mammalian central nervous system, which is reducing neuronal excitability.



(30) Peppermint (*Mentha piperita*)

Peppermint is a soft-stemmed, perennial plant, which can grow to a height of 40-90 cm. From its strong rhizome grow the modified ground shoots (stolons) as well as its modified surface shoots, which are suitable for both root and shoot formation. The leaves have short petioles, their plate is lanceolate or elongated elliptical, with a serrated edge, the tip of the leaf is pointed, the shoulders are rounded, the veins are winged, the surface is dark green, the back is lighter green. The leaf vein, or part of the leaf, is often violet in colour from anthocyanins. Inflorescence garland of false bows. The flowers are purple, arranged in a garland inflorescence, opening between July and September. The seeds are rarely germinating, but the plant reproduces vegetatively well and this ability is also used in cultivation.



Figure 51. Peppermint (*Mentha x piperita*) - Photo: Tamás Takács

Peppermint is an important plant, which contains 0.20-0.25% essential oil, of which menthol menthone are the main volatile components. The most important chemical components of peppermint oil are the following:

1. menthol (40.7 percent)
2. menthone (23.4 percent)
3. menthyl acetate
4. 1,8-cineole
5. limonene
6. beta-pinene
7. beta-caryophyllene

The other ingredients are tannins 6-12%, triterpenes and bitter substances. The phenolic constituents of the leaves include rosmarinic acid and a number of flavonoids, such as eriocitrin, luteolin and hesperidin. The essential oil is also used for inhalation purposes, as an ingredient in creams, and to cure rhinitis, bronchitis and rheumatic diseases. Furthermore, peppermint has been successfully used to mitigate or cure irritable bowel syndrome (IBS), nausea, menstrual pains, diarrhoea, skin conditions, headaches, cold, and flu (McKay and Blumberg, 2006). The whole plant, fresh or partly dried, is used before it starts to flower. Although no adverse physiological reactions to peppermint tea have been reported, caution is suggested for peppermint oil therapy for patients with GI reflux, hiatal hernia or kidney stones.

**Herbs consumed by self-medicating wild animals**

The science of natural medicines, pharmacognosy, has been practiced for thousands of years and it is widely recognised even by the modern scientific community (Dhami, 2013). However, natural medicines serve not only highly developed primates and humans, but they are used by a wide range of animals in their survival strategies. Although the self-medication of animals appeared to be somewhat controversial, the study of parasites and pathogens and their possible influence on selective foraging and even mate-selection in the animal world has attracted substantial attention during the last decades. Thus, the term zoopharmacognosy has been coined (Raman and Kandula, 2008), which is an animal behaviour, observed at many species, when animals deliberately select and consume plants, psychoactive drugs, special soils or even certain insects in order to counteract, reduce or prevent the adverse health effects of pathogens, parasites or toxins. Zoopharmacognosy occurs in a very wide range of animal groups (Shurkin, 2014), from tiny insects to large herbivores and even predators, such as cats, bears or omnivorous animals, like wild boars (Nicholson, 2010). The foraging habits of Indian wild boars have been observed and recorded that they dig up and selectively consume the roots of pigweed (*Boerhaavia diffusa*), a well-known herb in the Ayurvedic medicine, which has anticonvulsant, analgesic and laxative properties (Etkin, 2000).

Furthermore, several forms of animal self-medication have been observed according to the function (Fig. 50), such as prophylactic (preventative, which occur before infection or poisoning) or therapeutic (after infection, to combat or mitigate the adverse impact of pathogens or counteract poisoning). Obviously, this behaviour should have a widespread adaptive significance (Raman and Kandula, 2008; Abbott, 2014; Ferreira, 2015).

			Timing of Medication	
			Before infection for prevention	After infection for treatment
Beneficiary of medication	Self		Prophylactic self-medication	Therapeutic self-medication
	Offspring		Prophylactic transgenerational medication	Therapeutic transgenerational medication
	Other members of the species		Prophylactic social medication	Therapeutic social medication

Figure 52. Zoopharmacognosy – animal self-medication. Source: Ferreira, (2015).

Herbs are the most important natural medicines even for the animals, both wild and domestic. There are many examples for deliberate consumption of herbs by animals: medicinal plants constitute a natural part of the diet of woolly spider monkeys (*Brachyteles arachnoides*) in Brazil to regulate their fertility and protect against parasites (Petroni et al. 2016), dogs and cats eat grass to induce vomiting to clean their gastrointestinal tract (Tilford and Wulff, 2009), many ruminants consume herbs with antiparasitic actions to counteract helminths (Villaba et al. 2014), there are lizards, which consume a certain root to counter the venom of poisonous snakes (Shurkin, 2014), fruit flies (*Drosophila melanogaster*) lay their eggs in fermenting fruits, which contain relatively high ethanol levels (over 4%) to protect their offsprings against endoparasitoid wasps (Lynch et al. 2017), ant nests and beehives contain substantial quantities of conifer resin with antifungal and antibacterial properties, demonstrating an amazing preventive strategy of insect societies (Simone-Finstrom and Spivak, 2012).

It is important to emphasize the usefulness of experiences gained from zoopharmacognosy in organic animal farming, which is today a source of premium products, but might be both environmentally and economically viable in a holistic system, where external input of synthetic medicines is avoided or, at least, reduced to minimum and greater emphasis is put on animal welfare, food quality and traceability.

### The lore of herbs – an important part of our intangible cultural heritage

According to the recently accepted definition of UNESCO, intangible (immaterial) cultural heritage embraces all areas of life, traditions and living expressions inherited from our ancestors and preserved by our descendants, including oral traditions, mythologies, performing arts, all kind of visual arts, folk art, poesy and folk music, languages and regional or local dialects, social practices and habits, rituals, festive events, knowledge and practices concerning nature and natural resources or the knowledge and skills to produce traditional crafts.<sup>11</sup>

Herbs and the lore of herbs is a typical multi-faceted area of intangible cultural heritage, including traditional ecological wisdom, special indigenous knowledge concerning location, collection and use of herbs, knowledge about local fauna and flora, traditional experience-based healing systems, rituals, beliefs, cosmologies, different forms of shamanism, exorcism and possession rites, social organisations, festivals, special terminologies and even visual arts and folk art often based on plant motives.

Divine or infernal power, magic and supernatural features have been attributed to a number of herbs due to their medical properties, poisonous or hallucinogenic effects. Herbs were

used in many religions both as tools in the magical arsenal of shamans and priests and as real medicines used by healers (often the shamans themselves) or particularly well-skilled priests and alchemists for thousands of years. There are hundreds of examples, but here we mention only a few to illustrate the role of herbs in religions, mythologies and beliefs (Wigington, 2020).

One of the most widely known examples is mistletoe (*Viscum album*), which occurs in several religions and in different times and historical contexts (Hill, 2018). In Greek and Roman mythology, mistletoe was believed to be The Golden Bough of Aeneas, the mythical ancestor of the Romans. In Druidic Britain, mistletoe might have been used in the solstitial rites as a symbol for immortality. In the Celtic mythology and druid rituals the plant was considered as a remedy for infertility of domestic animals and even as antidote to certain poisons, despite the fact, that the fruits of mistletoes are poisonous if ingested due to their viscotoin content. In the old Norse mythology, the god Balder was killed with an arrow made of mistletoe (Ohlmarks, 1981).

Another interesting plant is Verbena or Vervain (*Verbena officinalis*), a perennial herb native to Europe, which has been used in folk medicine to relieve respiratory and digestive complaints, including liver and bile disorders. It has a good strengthening and appetite-boosting effect. In different cultures, this quite common weed has long been regarded as a medicine with divine and supernatural forces.<sup>12</sup> Although native to Europe, the plant was introduced even to Asia and the north-western parts of Africa during the antique; in ancient Egypt it was called "tears of Isis", and later in the Roman Empire "Juno's tears". The scientific name refers to the Ancient Roman term *verbena*, used as a very powerful sacrificial herb according to Pliny the Elder. In ancient Greece, it was regarded as the holy herb of Eos Erigeneia, the goddess of the dawn. In the early Christian era, it was called holy herb (or Devil's bane) because folk legend stated, that verbena was used to stanch the bleeding of Jesus' wounds after removing his body from the cross. The vervain blossom is also engraved in cimaruta amulets of Italian anti-stregheria charms, to protect against the evil eye (mal'occhio).

The role of a special sort of basil (*Ocimum sanctum L.*) is known in Hinduism, called tulsi, which is worshipped for its medicinal value since the Vedic times and used in Ayurvedic medicine due to its antidepressant and anti-anxiety properties and anti-carcinogenic effects (Cohen, 2014). Many Hindus cultivate Tulsi plants in front of their homes.

In Christianity famous herbs are the myrrh (*Commiphora myrrha*), which is mentioned in the New Testament as one of the three gifts (with gold and frankincense), frankincense (*Boswellia spp*), the resin of the Boswellia tree, aromatic oil for perfume, or crushed and burned as incense and the ague root or unicorn root (*Aletris farinosa*), the root of a perennial

<sup>11</sup> <https://ich.unesco.org/en/what-is-intangible-heritage-00003>

<sup>12</sup> <http://www.angelfire.com/journal2/flowers/v.html>



from the lily family native to the mossy woodlands of North-eastern America and Southern Canada, used in hex-breaking and uncrossing rituals.

In the partially christianized Anglo-Saxon pagan traditions the Nine Herbs Charm is widely known, an Old English charm, which was used for the treatment of poisoning and infection by a preparation of nine herbs. The poem is an intressant mixture of Christian and English Pagan elements (Gordon, 1962), including a mention of Woden, the chief god of the Germanic pantheon (in the old Norse mythology Odin).

The story of magic herbs could be much longer, filling several volumes and creating many lifetime-long research projects. Here we intended only to illustrate the spiritual history of herbal medicine, its connections to religion, mythology, poesy and folklore. As outlined above, the science and the craft of herbs and spices is one of the most important parts of this conservation project, because of its ecological, social and economic benefits, which strengthen the participatory approach of the ecomuseum and provide a new source for the welfare of local communities.

## Conclusions

The collection, cultivation and use of herbs and spices in the conservation of intangible cultural heritage is of great importance. Important to remember, that conservation of cultural heritage is far more than preservation: conservation can be defined as preservation and sustainable use of heritage resources from an evolutionary perspective, taking into consideration the continuous changes of the physical and cultural environment, the evolution of cultural landscapes. In the vast area of the planned Balaton Ecomuseum, which is based on the whole cultural landscape, the rich flora of herbs and spices offer a unique opportunity to develop and revitalize the science and crafts of herbal medicine, which can become a very important constituent of local products and a particular branch of rural tourism, increasing the economic, social and ecological viability of rural settlements.

The cultivation of herbs may facilitate the development of organic agriculture and even permaculture systems, since it offers a new possibility to develop agro-ecosystems with greater biodiversity, through combining cultivation of herbs with other agricultural products, such as fruit orchards where herbs are used as cover crops, or crop rotation where herbs may be included. Regarding the future of organic animal husbandry, the knowledge and skills of practical use of herbs in livestock production should be completed with experiences and research results gained from zoopharmacognosy, the self-medication of animals, where herbs can replace artificial antibiotics and anti-parasitic medicines, improving herewith the quality of meat and other animal products.

The lore of herbs and crafts, the herbal medicine is a valuable area of both informal and formal education in use of natural resources and ecologically sustainable living, which can be organised within the Balaton Ecomuseum, often connected to other areas such as wildlife conservation, landscape types, cultural history, ethnography, viticulture and winemaking, gastronomy, etc. Furthermore, there are several interesting research areas including the physiological effects of herbal medicines, ethnic traditions of pharmacognosy, animal etology linked to zoopharmacognosy, the self-medication of animals and development of permacultural systems.

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The purpose of the project is the conservation (i.e. preservation, revival and use) of intangible cultural heritage such as traditions, knowledge, and handicrafts through ecomuseums, which have a great potential for preserving the identity of places and people. An important aim of the project to develop innovative solutions for a wider audience, including local citizens and tourists.

## References

- Abbott, J. (2014): Self-medication in insects: current evidence and future perspectives. *Ecological Entomology* 39, 273-280.
- Allio, A., Calorio, C., Franchino, C., Gavello, D., Carbone, E., Marcantoni, A. (2015): Bud extracts from *Tilia tomentosa* Moench inhibit hippocampal neuronal firing through GABAA and benzodiazepine receptors activation. *J. Ethnopharmacol.* 172:288-96.  
<https://doi.org/10.1016/j.jep.2015.06.016>
- Al Snafi, A.E. (2015): The pharmacological and therapeutic importance of *Agrimonia eupatoria* – a review. *Asian Journal of Pharmaceutical Science & Technology*; Vol 5, Issue 2, 2015. pp. 112-117. e-ISSN: 2248 – 9185; Print ISSN: 2248 – 9177 [www.ajpst.com](http://www.ajpst.com)
- Al Snafi, A.E. (2018): *Galium verum* – a review. *Indo American Journal of Pharmaceutical Sciences*, 2018; 05(04).

<sup>13</sup> <https://www.interreg-central.eu/Content.Node/CULTURECOVERY.html>

<https://doi.org/10.5281/zenodo.1214980>

Aluyen, J.K., Ton, Q.N., Tran, T., Yang, A.E., Gottlieb, H.B., and Bellanger, R. A. (2012): Resveratrol: potential as anticancer agent. *J Diet Suppl* 2012; 9 (1): 45-56.

Ardestani, A. and Yazdanparast, R. (2007): Antioxidant and free radical scavenging potential of *Achillea santolina* extracts. *Food Chemistry*, Volume 104, Issue 1, Pages 21-29. <https://doi.org/10.1016/j.foodchem.2006.10.066>

Bagchi, D., Swaroop, A., Preuss, H.G., Bagchi, M. (2014): Free radical scavenging, antioxidant and cancer chemoprevention by grape seed proanthocyanidin: an overview. *Mutation Research*, 768:69-73. <https://doi.org/10.1016/j.mrfmmm.2014.04.004>

Bais, S., Gill, N. S., Rana, N. and Shandil, S. (2014): A Phytopharmacological Review on a Medicinal Plant: *Juniperus communis*. *International Scholarly Research Notices*; <https://doi.org/10.1155/2014/634723>

Bakhshae, M., Mohammad Pour A.H., Esmaceli, M., Jabbari Azad, F., Alipour Talesh G., Salehi, M., Noorollahian Mohajer, M. (2017): Efficacy of Supportive Therapy of Allergic Rhinitis by Stinging Nettle (*Urtica dioica*) root extract: a Randomized, Double-Blind, Placebo- Controlled, Clinical Trial. *Iran J Pharm Res*. 16 (Suppl):112-118. <https://www.ncbi.nlm.nih.gov/pubmed/29844782>

Brenesel, M. Đ., Pilija, V., Popović, T., Arsić, A., Milić, M., Kojić, D., Milić, N., Mišan, A. (2015): Antihyperlipidemic, antioxidant and weightlowering effects of “Vitalplant”. *Open Life Sci*. 2015; 10: 291–298 <https://doi.org/10.1515/biol-2015-0030>

Brkanac, S.R., Gerić, M., Gajski, G., Vujčić, V., Garaj-Vrhovac, V., Kremerc, Domijan, A-M. (2015): Toxicity and antioxidant capacity of *Frangula alnus* Mill. bark and its active component emodin. *Regulatory Toxicology and Pharmacology*, Volume 73, Issue 3, Pages 923-929 <https://doi.org/10.1016/j.yrtph.2015.09.025>

Brown, A.C. (2017): Kidney Toxicity Related to Herbs and Dietary Supplements: Online Table of Case Reports. Part 3 of 5 Series. *Food Chem Toxicol*, 107 (Pt A), 502-519 <https://doi.org/10.1016/j.fct.2016.07.024>

Calzada, F., Juárez, T., García-Hernández, N., Valdes, M., Ávila, O., Mulia L.Y., Velázquez, C. (2017): Antiprotocol, Antibacterial and Antidiarrheal Properties from the Flowers of *Chiranthodendron pentadactylon* and Isolated Flavonoids. *Pharmacogn. Mag.* 13(50):240-244. <https://doi.org/10.4103/0973-1296.204564>

Campa, C., Schmitt-Kopplin, P., Cataldi, T.R., Bufo S.A., Freitag, D., Kettrup, A. (2000): Analysis of cyanogenic glycosides by micellar capillary electrophoresis. *Journal of Chromatography B*. 739: –100. [https://doi.org/10.1016/S0378-4347\(99\)00375-8](https://doi.org/10.1016/S0378-4347(99)00375-8)

Castillo-Pichardo L, Rivera-Rivera A, Dharmawardhne S. (2013): Potential of grape polyphenols as breast cancer therapeutics. *Alternative Medicine* 2013 Apr 01;1(1):9.

Cohen, M.M. (2014): Tulsi - *Ocimum sanctum*: A herb for all reasons. *J. Ayurveda Integr. Med.* PMID: 25624701 5(4): 251–259. <https://doi.org/10.4103/0975-9476.146554>

Davaatseren, M., Hur, H.J., Yang, H.J., Hwang, J.T., Park, J.H., Kim, H.J., Kim, M.J., Kwon, D.Y., Sung, M.J. (2013): *Taraxacum officinale* (dandelion) leaf extract alleviates high-fat diet-induced nonalcoholic fatty liver. *Food Chem Toxicol*. 58:30-6. <https://doi.org/10.1016/j.fct.2013.04.023>

Dhami, N. (2013): Trends in Pharmacognosy: A modern science of natural medicines. *Journal of Herbal Medicine*. 3 (4): 123–131. <https://doi.org/10.1016/j.hermed.2013.06.001>

Dimpfel, W. (2006): Different anticonvulsive effects of hesperidin and its aglycone hesperetin on electrical activity in the rat hippocampus in-vitro. *J Pharm Pharmacol*. 2006 Mar;58(3):375-9. <https://doi.org/10.1211/jpp.58.3.0012>

Domola, M.S., Vu, V., Robson-Doucette, C.A., Sweeney, G., Wheeler, M.B. (2010): Insulin mimetics in *Urtica dioica*: structural and computational analyses of *Urtica dioica* extracts. *Phytotherapy Research; Suppl.* 2:S 175 – 182. <https://doi.org/10.1002/ptr.3062>

Etkin, N. (2000): *Eating on the Wild Side: The Pharmacologic, Ecologic and Social Implications of Using Noncultigens* (Arizona Studies in Human Ecology). University of Arizona Press; ISBN-10: 0816520674 ISBN-13: 978-0816520671

European Medicines Agency (2011): Assessment report on *Plantago lanceolata* L., folium. Based on Article 16d (1), Article 16f and Article 16h of Directive 2001/83/EC as amended (traditional use). EMA/HMPC/437859/2010 Committee on Herbal Medicinal Products (HMPC)

Eyi, E.G., Engin-Ustün, Y., Kaba, M., Mollamahmutoğlu, L. (2013): Ankaferd blood stopper in episiotomy repair. *Clin Exp Obstet Gynecol*. 2013; 40 (1):141-143. <https://www.ncbi.nlm.nih.gov/pubmed/23724529>

Ferreira, F. (2015): Insect Zoopharmacognosy: Finding medicine where you least expect it. *SITN*, 2015. <http://sitn.hms.harvard.edu/flash/2015/insect-zoopharmacognosy-finding-medicine-where-you-least-expect-it/>

Germanò, M.P., Cacciola, F., Donato, P., Certo, G., D’Angelo, V., Mondello, L., Rapisarda, A. (2017): *Betula pendula* Roth leaves: gastroprotective effects of an HPLC-fingerprinted methanolic extract. *Natural Product Research*, 27:17, 1569-1575, <https://doi.org/10.1080/14786419.2012.740036>

Giannetti, B.M., Staiger, C., Bulitta, M. (2010): Efficacy and safety of a comfrey root extract ointment in the treatment of acute upper or lower back pain: results of a double-blind, randomised, placebo controlled, multicentre trial. *Br J Sport Med*; 44:637–41. <https://doi.org/10.1136/bjsm.2009.058677>



- Gómez, M., Sáenz, M., García, M., et al. (2014): Study of the Topical Anti-Inflammatory Activity of *Achillea ageratum* on Chronic and Acute Inflammation Models. *Zeitschrift für Naturforschung C*, 54(11), pp. 937-941. Retrieved 7 Feb. 2020, from <https://doi.org/10.1515/znc-1999-1113>
- Gordon, R. K. (1962). *Anglo-Saxon Poetry*. Everyman's Library #794. M. Dent & Sons, LTD. ASIN: B00M9D1ANM
- Guo C., Yang, J., Yun, W., Li, J., Xu, J., Jiang, Y. (2003): Antioxidant activities of peel, pulp and seed fractions of common fruits as determined by FRAP assay. *Nutrition Research* 2003; 23:1719–1726. <https://doi.org/10.1016/j.nutres.2003.08.005>
- Gündüz, G.T. (2013): Antimicrobial activity of sloe berry purees on *Salmonella* spp. *Food Control* 32(2):354–358 <https://doi.org/10.1016/j.foodcont.2013.01.005>
- Han, J.Y., Tan, D.H., Liu, G-C. (2011): Hawthorn - A Health Food. *Applied Mechanics and Materials* 140(2):350-354 <http://doi.org/10.4028/www.scientific.net/AMM.140.350>
- Harikumar, K.B., Sung, B., Pandey, M.K., Guha, S., Krishnan S., Aggarwal, B.B. (2010): Escin, a pentacyclic triterpene, chemosensitizes human tumor cells through inhibition of nuclear factor-kappaB signaling pathway. *Mol. Pharmacol.* 77(5):818-27. <https://doi.org/10.1124/mol.109.062760>
- Hermy, M., Honnay, O., Firbank, L., Grasfot-Bokdam, C., Lawenson, J.E. (1999): An ecological comparison between ancient and other forest plant species of Europe, and the implications for forest conservation. *Biol Conserv.* 91(1): 9–22. [https://doi.org/10.1016/S0006-3207\(99\)00045-2](https://doi.org/10.1016/S0006-3207(99)00045-2)
- Hill, V. (2018): The magic of mistletoe: the myths and benefits for wildlife. The Wildlife Trusts, blog 2018.12.17. <https://www.wildlifetrusts.org/blog/guest/magic-mistletoe-myths-and-benefits-wildlife> Accessed: 2020.04.26.
- Holleran, G., Scaldaferrri, F., Gasbarrini, A., Currò, D. (2020): Herbal medicinal products for inflammatory bowel disease: A focus on those assessed in double-blind randomised controlled trials. *Phytotherapy Research* 34 (1): 77-93. <https://doi.org/10.1002/ptr.6517>
- Höld, K. M., Sirisoma, N. S., Ikeda, T., Narahashi, T., & Casida, J. E. (2000): Alpha-thujone (the active component of absinthe): gamma-aminobutyric acid type A receptor modulation and metabolic detoxification. *Proceedings of the National Academy of Sciences of United States of America*, 97(8), 3826–3831. <https://doi.org/10.1073/pnas.070042397>
- Kazemi, M. (2015): Chemical composition and antimicrobial, antioxidant activities and anti-inflammatory potential of *Achillea millefolium* L., *Anethum graveolens* L., and *Carum copticum* L. essential oils. *Journal of Herbal Medicine*, Volume 5, Issue 4, December 2015, Pages 217-222 <https://doi.org/10.1016/j.hermed.2015.09.001>
- Khoo, H.E., Prasad, K.N., Kong, K.W., Jiang, Y., Ismail, A. (2011): Carotenoids and their isomers: color pigments in fruits and vegetables. *Molecules*. 2011 Feb 18;16(2):1710-38. <https://doi.org/10.3390/molecules16021710>
- Kianbakht, S., Khalighi-Sigaroodi, F., Dabaghian, F.H. (2013): Improved glycemic control in patients with advanced type 2 diabetes mellitus taking *Urtica dioica* leaf extract: a randomized double-blind placebo-controlled clinical trial. *Clin Lab.* 2013; 59 (9-10):1071-1076. <https://doi.org/10.7754/clin.lab.2012.121019>
- Kienle, G.S. and Kiene, H. (2018): Review Article: Influence of *Viscum album* L (European Mistletoe) Extracts on Quality of Life in Cancer Patients: A Systematic Review of Controlled Clinical Studies. *Integrative Cancer Therapies* <https://doi.org/10.1177/1534735410369673>
- Koulivand, P.H., Khaleghi Ghadiri, M., Gorji, A. (2013): Lavender and the Nervous System. *Evid Based Complement Alternat Med.* 2013; 2013: 681304. Published online 2013 Mar 14. <https://doi.org/10.1155/2013/681304>
- Kovács, A., Forgó, P., Zupkó, I., Réthy, B., Falkay, Gy., Szabó, P., Hohmann, J. (2006): Phenanthrenes and a dihydrophenanthrene from *Tamus communis* and their cytotoxic activity. *Phytochemistry*, 68(5), pp. 687 – 691. <https://doi.org/10.1016/j.phytochem.2006.10.028>
- Kremer, D., Kosalec, I., Locateli, M., Epifanos, F., Genovese, S., Garlucci, G., Zovko and Končić, M. (2012): Anthraquinone profiles, antioxidant and antimicrobial properties of *Frangula rupestris* (Scop.) Schur and *Frangula alnus* Mill. bark. *Food Chemistry*, Volume 131, Issue 4, Pages 1174-1180. <https://doi.org/10.1016/j.foodchem.2011.09.094>
- Kruk, J., Baranowska, I., Buszewski, B., Bajkacz, S., Kowalski, B. and Ligor, M. (2019): Flavonoids enantiomer distribution in different parts of goldenrod (*Solidago* (*Phacelia tanacetifolia* Benth.)) Chirality. 2019 Feb;31(2):138-149. <https://doi.org/10.1002/chir.23041>
- Li, M., Lu, C., Zhang, L., Zhang, J., Du, Y., Duan, S., Wang, T., Fu, F. (2015): Oral Administration of Escin Inhibits Acute Inflammation and Reduces Intestinal Mucosal Injury in Animal Models. *Evid Based Complement Alternat Med.* 2015:503617. <https://doi.org/10.1155/2015/503617>
- Lister, C.E., Wilson, P.E., Sutton, K.H., Morrison, S.C. (2002): Understanding the health benefits of blackcurrants. *Acta Horticulturae*, pp. 443 – 449. AGRIS, International Society for Horticultural Science, ISSN: 0567-7572
- Lynch, Z.R., Schlenke, T.A., Levi, T.M., and de Roode, J.C. (2017): Ethanol confers differential protection against generalist and specialist parasitoids of *Drosophila melanogaster*. *PLOS ONE* 12(7): e0180182. <https://doi.org/10.1371/journal.pone.0180182>
- McKay, D.L. and Blumberg, J.B. (2006): A Review of the bioactivity and potential health benefits of chamomile tea (*Matricaria recutita* L.) *Phytotherapy Research*, 20, 519–530 <https://doi.org/10.1002/ptr.1900>
- McKay, D.L. and Blumberg, J.B. (2006): A review of the bioactivity and potential health benefits of peppermint tea (*Mentha piperita* L.). *Phytotherapy Research*, 20(8): 619-633. <https://doi.org/10.1002/ptr.1936>

- Marvibaigi, M., Supriyanto, E., Amini, N., Majid, F.A.A. and Jaganathan, S.K. (2014): Preclinical and Clinical Effects of Mistletoe against Breast Cancer. *Biomed Res Int.* 2014: 785479. <https://doi.org/10.1155/2014/785479>
- Metzig, M.F. (2004): Goldenrod--a classical exponent in the urological phytotherapy. *Wien Med Wochenschr.* 2004 Nov;154(21-22):523-527. <https://doi.org/10.1007/s10354-004-0118-4>
- Miladinovic B., Brankovic S., Kostic M., Milutinovic M., Kitic N. Šavikin K. and Kitic D. (2018): Antispasmodic Effect of Blackcurrant (*Ribes nigrum* L.) Juice and Its Potential Use as Functional Food in Gastrointestinal Disorders. *Medical Principles and Practice*, 2018;27:179–185 <https://doi.org/10.1159/000487202>
- Moacă, E.A., Pavel, I.Z., Danciu, C., Crăniceanu, Z., Minda, D., Ardelean, F., Antal, D.S., Ghiulai, R., Cioca, A., Derban, M., Simu, S., Chioibaş, R., Szuhaneck, C., Dehelean, C.A. (2019): Romanian Wormwood (*Artemisia absinthium* L.): Physicochemical and Nutraceutical Screening. *Molecules.* 24 (17); pii: E3087 <https://doi.org/10.3390/molecules24173087>
- Nahata, A., Dixit, V.K. (2012): Ameliorative effects of stinging nettle (*Urtica dioica*) on testosterone-induced prostatic hyperplasia in rats. *Andrologia.* 2012 May;44 Suppl. 1:396-409 <https://doi.org/10.1111/j.1439-0272.2011.01197.x>
- Ng QX, Venkatanarayanan, N., Ho, C.Y. (2017): Clinical use of *Hypericum perforatum* (St John's wort) in depression: A meta-analysis. *J Affect Disord*; 210:211-221. <https://doi.org/10.1016/j.jad.2016.12.048>
- Némethy, S., Walas, B., Lagerqvist, B., and Dinya, L. (2016): Oenotourism and conservation: a holistic approach to special interest tourism from a cultural heritage perspective – The Azienda Agricola Model. *ECOCYCLES*, 2(1) pp. 9 – 17 DOI: <https://doi.org/10.19040/ecocycles.v2i1.39>
- Némethy, S., Wałas, B. and Lagerqvist, B. (2017): The role of ecosystem services in rural tourism: evaluation of carrying capacity of touristic destinations in ecologically sensitive rural areas to prevent over-exploitation. *Jorunal of Central European Green Innovation* 13-29; HU ISSN: 2064-3004
- Nicholson D. (2010): Monarch butterflies and humans both utilize milkweed's medical properties. Available at: <https://www.healthleadsuk.com/parasites/monarch-butterflies-and-humans-both-utilize-milkweeds-medical-properties.html/> Accessed: 2020.04.25.
- Ohlmarks, Å. (1981): *Asasagan. LTs*, Stockholm, 206 p. ISBN 9136018473
- Park, C.M., Cho, C.W. and Song, Y.S. (2014): TOP 1 and 2, polysaccharides from *Taraxacum officinale*, inhibit NFκB-mediated inflammation and accelerate Nrf2-induced antioxidative potential through the modulation of PI3K-Akt signaling pathway in RAW 264.7 cells. *Food Chem Toxicol.* 66:56-64. <https://doi.org/10.1016/j.fct.2014.01.019>
- Patel, S. and Panda, S. (2014): Emerging roles of mistletoes in malignancy management. *3 Biotech.* 4(1): 13–20. <https://doi.org/10.1007/s13205-013-0124-6>
- Petroni, L.M., Huffman, M.A. and Rodrigues, E. (2016): Medicinal plants in the diet of woolly spider monkeys (*Brachyteles arachnoides*, E. Geoffroy, 1806) – a bio-rational for the search of new medicines for human use? *Revista Brasileira de Farmacognosia*, ISSN 1981-528X <https://doi.org/10.1016/j.bjp.2016.09.002>
- Qayyum, R., Qamar, H.M., Khan, S., Salma, U., Khan, T., Shah, A.J. (2016): Mechanisms underlying the antihypertensive properties of *Urtica dioica*. *J Transl Med.* 14:254. <https://doi.org/10.1186/s12967-016-1017-3>
- Raman, R. and Kandula, S. (2008): Zoopharmacognosy. *Resonance* 13(3):245-253 <https://doi.org/10.1007/s12045-008-0038-5>
- Randall, C., Randall, H., Dobbs, F., Hutton, C., Sanders, H. (2000): Randomized controlled trial of nettle sting for treatment of base-of-thumb pain. *J R Soc Med.*; 93(6): 305-309. <https://doi.org/10.1177/014107680009300607>
- Rayne, S. (2007): High-Value Phytochemicals from Grape Cane Waste: Potential Value-Added Viticultural Sources of Trans-Resveratrol and Trans-ε-Viniferin with Medicinal and Anti-Phytopathogenic Applications. *Nature Precedings*: hdl:10101/npre.2007.636.1: Posted 7 Aug 2007
- Rehman, G., Hamayun, M., Iqbal, A., Khan, S.A., Khan, H., Shehzad, A., Khan, A.L., Hussain, A., Kim, H.Y., Ahmad, J., Ahmad, A., Ali, A., Lee, I.J. (2017): Effect of Methanolic Extract of Dandelion Roots on Cancer Cell Lines and AMP-Activated Protein Kinase Pathway. *Front Pharmacol*; 8:875. <https://doi.org/10.3389/fphar.2017.00875>
- Rejewski, M. (1996): Rejewski M. Origin of Latin names of Polish plants. Botanical guide (in Polish: Pochodzenie łacińskich nazw roślin polskich. Przewodnik botaniczny. Warszawa: Książka i Wiedza; 1996.) Warsaw: Book and Knowledge; 1996.
- Riehemann K., Behnke, B., Schulze-Osthoff, K. (1999): Plant extracts from stinging nettle (*Urtica dioica*), an antirheumatic remedy, inhibit the proinflammatory transcription factor NF-κappa B. *FEBS Lett.* 1999 Jan 8;442(1):89-94. [https://doi.org/10.1016/s0014-5793\(98\)01622-6](https://doi.org/10.1016/s0014-5793(98)01622-6)
- Ros, E., Izquierdo-Pulido, M., Sala-Vila, A. (2018): Beneficial effects of walnut consumption on human health - role of micronutrients. *Current Opinion in Clinical Nutrition & Metabolic Care*: November 2018 - Volume 21 - Issue 6 - p 498-504. <https://doi.org/10.1097/MCO.0000000000000508>
- Seigner, J., Junker-Samek, M., Plaza, A., D'Urso, G., Masullo, M., Piacente, S., Holper-Schichl, Y.M., and de Martin, R. (2019): A *Symphytum officinale* Root Extract Exerts Anti-inflammatory Properties by Affecting Two Distinct Steps of NF-κB Signaling. *Front. Pharmacol.*, 26 April 2019 | <https://doi.org/10.3389/fphar.2019.00289>
- Selahvarzian, A., Alizadeh, A., Baharvand, P.A., Eldahshan, O.A., Rasouljan, B. (2018): Medicinal Properties of *Rosa canina* L. *Journal of Herbal Medicine* 3. <https://doi.org/10.22087/hmj.v0i0.615>



- Seremet, O. C., Olaru, O. T., Gutu, C. M., Nitulescu, G. M., Ilie, M., Negres, S., Zbarcea, C. E., Purdel, C. N., Spandidos, D. A., Tsatsakis, A. M., Coleman, M. D., Margina, D. M. (2018): "Toxicity of plant extracts containing pyrrolizidine alkaloids using alternative invertebrate models". *Molecular Medicine Reports* 17.6 (2018): 7757-7763. <https://doi.org/10.3892/mmr.2018.8795>
- Simone-Finstrom, M.D., and Spivak, M. (2012): Increased Resin Collection after Parasite Challenge: A Case of Self-Medication in Honey Bees? *PLoS One* v.7(3); PMC3315539 <https://doi.org/10.1371/journal.pone.0034601>
- Shurkin, J. (2014): News Feature: Animals that self-medicate. *Proc Natl Acad Sci U S A*. 111(49): 17339–17341. <https://doi.org/10.1073/pnas.1419966111>
- Sobolewska, D., Podolak, I., Makowska-Wąs, J. (2015): *Allium ursinum*: botanical, phytochemical and pharmacological overview. *Phytochem Rev*. 2015; 14(1): 81–97. <https://doi.org/10.1007/s11101-013-9334-0>
- Sharma, M., Jain, U. K., Patel, A. and Gupta, N. (2010): A comprehensive pharmacognostic report on valerian. *International Journal of Pharmaceutical Sciences and Research*, Vol. 1, Issue 7. [http://dx.doi.org/10.13040/IJPSR.0975-8232.1\(7\).6-40](http://dx.doi.org/10.13040/IJPSR.0975-8232.1(7).6-40)
- Shukla, S., Mishra, T.I., Pal, M., Meena, B., Singh Rana, T., Kumar Upreti, D. (2017): Comparative Analysis of Fatty Acids and Antioxidant Activity of *Betula utilis* Bark Collected from Different Geographical Region of India. *Free Radicals and Antioxidants*, 2017; 7(1): 1-10
- Sithranga, B.N., Hwang, J-W., Kim, Y-S., Kim, E-K. and Park, P-J. (2017): Ocular promoting activity of grape polyphenols — A review. *Environmental Toxicology and Pharmacology*, Volume 50, March 2017, Pages 83-90. <https://doi.org/10.1016/j.etap.2016.12.004>
- Staiger, C. (2013): Comfrey root: from tradition to modern clinical trials. *Wien Med Wochenschr*. 163 (3-4): 58–64. <https://doi.org/10.1007/s10354-012-0162-4>
- Szalay, J. (2016): Grapes: Health Benefits & Nutrition Facts. *Live Science*, <https://www.livescience.com/54581-grapes-nutrition.html>
- Szaszin, E. (2018): Gyula Bittera, the wizard of herbs (in Hungarian); *Márkamonitor*, 2018.09.20. <https://markamonitor.hu/2018/09/20/bittera-gyula-a-gyogyovenyek-varazsloja/> Accessed: 2020.04.27.
- Tahri, A., Yamani, S., Legssyer, A., Aziz, M., Mekhfi, H., Bnouham, M., Ziyat, A. (2000): Acute diuretic, natriuretic and hypotensive effects of a continuous perfusion of aqueous extract of *Urtica dioica* in the rat. *J. Ethnopharmacol*. 73 (1-2): 95-100. [https://doi.org/10.1016/S0378-8741\(00\)00270-1](https://doi.org/10.1016/S0378-8741(00)00270-1)
- Tassell, M.C., Kingston, R., Gilroy, D., Lehane, M., Furey, A. (2010): Hawthorn (*Crataegus* spp.) in the treatment of cardiovascular disease. *Pharmacogn Rev*. 2010 Jan-Jun; 4(7): 32–41. <https://doi.org/10.4103/0973-7847.65324>
- Tian, F, and McLaughlin, J.L. (2000): Bioactive Flavonoids from the Black Locust Tree, *Robinia Pseudoacacia*. *Pharmaceutical Biology* 38(3):229-34. [https://doi.org/10.1076/1388-0209\(200007\)3831-SFT229](https://doi.org/10.1076/1388-0209(200007)3831-SFT229)
- Tilford, G.L. and Wulff, M.L. (2011): *Herbs for Pets: The Natural Way to Enhance Your Pet's Life*. Kindle Edition, Companion House Books; ISBN: 1933958782
- Tousch, D., Lajoix, A.D., Hossy, E., Azay-Milhau, J., Ferrare, K., Jahannault, C., Cros, G., Petit, P. (2008): Chicoric acid, a new compound able to enhance insulin release and glucose uptake. *Biochem Biophys Res Commun*. 377(1):131-5. <https://doi.org/10.1016/j.bbrc.2008.09.088>
- Upton, R. (2013): Stinging nettles leaf (*Urtica dioica* L.): Extraordinary vegetable medicine. *Journal of Herbal Medicine* Volume 3, Issue 1, March 2013, Pages 9-38 <https://doi.org/10.1016/j.hermed.2012.11.001>
- Yuksel, A.K. (2015): The Effects of Blackthorn (*Prunus Spinosa* L.) Addition on Certain Quality Characteristics of Ice Cream. *Journal of Food Quality*, 38/6, pp. 413-421 <https://doi.org/10.1111/jfq.12170>
- Vandeputte, D., Falony, G., Vieira-Silva, S., Wang, J., Sailer, M., Theis, S., Verbeke, K., and Raes, J. (2017): Prebiotic inulin-type fructans induce specific changes in the human gut microbiota. *Gut*. 66 (11): 1968–1974. <https://doi.org/10.1136/gutjnl-2016-313271>
- Vašková, J., Fejerčáková, A., Mojžišová, G., Vaško, L., Patlevič, P. (2015): Antioxidant potential of *Aesculus hippocastanum* extract and escin against reactive oxygen and nitrogen species. *Eur. Rev. Med. Pharmacol. Sci*. 2015; 19(5):879-86. <https://www.ncbi.nlm.nih.gov/pubmed/25807442>
- Villalba, J. J., Miller, J., Ungar, E. D., Landau, S. Y. and Glendinning, J. (2014): Ruminant self-medication against gastrointestinal nematodes: evidence, mechanism, and origins *Parasite*. 21: 31. <https://doi.org/10.1051/parasite/2014032>
- Vlachojannis, J.E., Cameron, M., Chrubasik, S. (2010): A systematic review on the sambuci fructus effect and efficacy profiles. *Phytotherapy Research*, Volume 24, Issue1, 2010. pp. 1-8. <https://doi.org/10.1002/ptr.2729>
- Whitlock, N.C., Baek, S. J. (2012): The anticancer effects of resveratrol: modulation of transcription factors. *Nutr Cancer* 2012; 64(4): 493-502. <https://doi.org/10.1080/01635581.2012.667862>
- Wigington, P. (2020): 9 Magic Healing Herbs for Rituals. *Learn Religions*, <https://www.learnreligions.com/healing-herbs-gallery-2562026> Accessed: 2020.04.25.
- Wirngo, F.E., Lambert, M.N. and Jeppesen, P.B. (2016): The Physiological Effects of Dandelion (*Taraxacum officinale*) in Type 2 Diabetes. *Rev Diabet Stud*. 13 (2-3): 113–131. <https://doi.org/10.1900/RDS.2016.13.113>

Zhou, X.Y., Fu, F.H., Li, Z., Dong, Q.J., He, J., Wang, C.H. (2009): Escin, a natural mixture of triterpene saponins, exhibits antitumor activity against hepatocellular carcinoma. *Planta Med.* 75(15):1580-5. <https://doi.org/10.1055/s-0029-1185838>.

Zouari Bouassida, K., Bardaa, S., Khimiri, M., Rebaï, T., Tounsi, S., Jlaïel, L., Trigui, M. (2017): Exploring the *Urtica dioica* Leaves Hemostatic and Wound-Healing Potential. *Biomed Res Int.* 2017:1047523. <https://doi.org/10.1155/2017/1047523>



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