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Plants supporting the treatment of Lyme disease

Introduction

Lyme disease (= tick-borne spirochete, Lyme disease; Latin *borreliosis*, *morbus Lyme*) is a chronic multi-system disease caused by spirochaetes (order Spirochaetes) of the species *Borrelia burgdorferi* s.l. (in a broad sense of this taxon) (LoGiudice et al., 2003; Stanek, Reiter, 2011). Transmitted by ticks of the genus *Ixodes* Latreille, from the tick family Ixoidae. *B. burgdorferi* is a complex taxon, divided into a number of species that have pathogenic properties and operate in different regions of the world (Tab. 1).

A larva *Ambylomma* tick containing spirochete-like cells was discovered in Dominican amber by the American biologist George Poinar in 2014 (Nuwer, 2014). The age of this specimen was estimated at 15–20 million years. Poinar also suspected that the first humans, who appeared on Earth about 200,000 years ago, suffered from ailments caused by the bites of these invertebrates. However, he did not compare this fossil genetic material with currently known forms of Lyme disease, as this would have destroyed his precious specimen. Poinar (2014) noted that the route of infection probably took place in a similar way as at present – during food intake by a tick burrowing into the host's body. The earliest documented case of Lyme disease dates back to 5,300 years ago and was discovered in an ice mummy. The genus name of the *Borrelia* bacteria was given from the name of the researcher who discovered it in 1905 – Amandee Borrela (Koperwas, 2013). Arvid Afzelius, a Swedish dermatologist, was the first to associate the occurrence of *erythema migrans* with a tick bite. In 1909, he undertook to study this relationship. He was followed by others – Charles Garin and Antoine

Bujadoux, who in 1922 described the symptoms of neuroborreliosis. In 1941 and 1944, Alfred Bannwarth linked the neurological syndrome of *erythema migrans* with tick bites (Nuwer, 2014).

Tab. 1. Transmission of selected species of Borrelia burgdorferi s.l. (according to Sinski, Welc-Faleciak, 2012 – updated)

Species of *B. burgdorferi* s.l.	**Vector tick species**	**Animal reservoir**	**Occurrence area**
Borrelia burgdorferi Johnson et al. 1984 emend. Baranton et al. 1992 s.str.	*Ixodes pacificus*, *I. ricinus*, *I. scapularis*	birds, rodents	Europe, North America
B. afzelii Manuela Marin Canica et al. 1994	*I. persulcatus*, *I. ricinus*	rodents, other small mammals	Europe, Asia
B. garinii Baranton et al. 1992	*I. persulcatus*, *I. ricinus*	birds, rodents	Europe a, Asia
B. lusitaniae Le Fleche et al. 1997	*I. ricinus*	rodents	Europe, North America, North Africa
B. spielmanii Richter et al. 2006	*I. ricinus*	rodents	Europe
B. valaisiana Wang et al. 1997	*I. ricinus*, *I. columnae*	birds	Europe Asia
B. bavariensis Margos et al. 2013	*I. ricinus*	rodents	Europe
B. bissettii = *B. bissettiae* Gupta 2019	*I. ricinus*, *I. scapularis*, *I. pacificus*	birds, rodents	Europe, Asia, North America
B. lusitaniae Le Fleche et al. 1997	*I. ricinus*	lizards	Europe, North Africa

Quite late, Lyme disease began to be associated with non-specific symptoms. The year 1975 was a breakthrough because in that year Lyme disease was diagnosed in the city of Lyme (hence the common name of this disease). At that time, 12 cases of arthritis in children were described and associated with skin lesions that occurred after a tick bite (Fraser et al., 1997; Long, Cohn, 2018). Since then, the number of patients has been steadily increasing (Magnarelli 2009; Koperwas, 2013; Stone et al., 2017). Based on the most recent data from 2010–2018, approximately 476,000 people are diagnosed and treated with Lyme disease in the United States each year (*Centers for Disease Control and Prevention*). In 1982, Wilhelm Burgdorfer isolated Borrelia spirochetes, which were named after him – *B. burgdorferi*; it is one of the most common *Borrelia* species in North America (Tab. 1). Thanks to this, he also proved the relationship between tick bites and Lyme disease (Fraser et al., 1997).

Infection occurs when an infected tick burrows into the skin to collect food – human blood, and releases saliva or the contents of the midgut, in other words, "vomit". Spirochetes are present in the digestive tract of the tick, after multiplication they pass into the salivary glands and then penetrate the skin, later migrating to distant human systems and organs, causing disease symptoms (Sobieszczańska et al., 1998; Cuningham 2005).

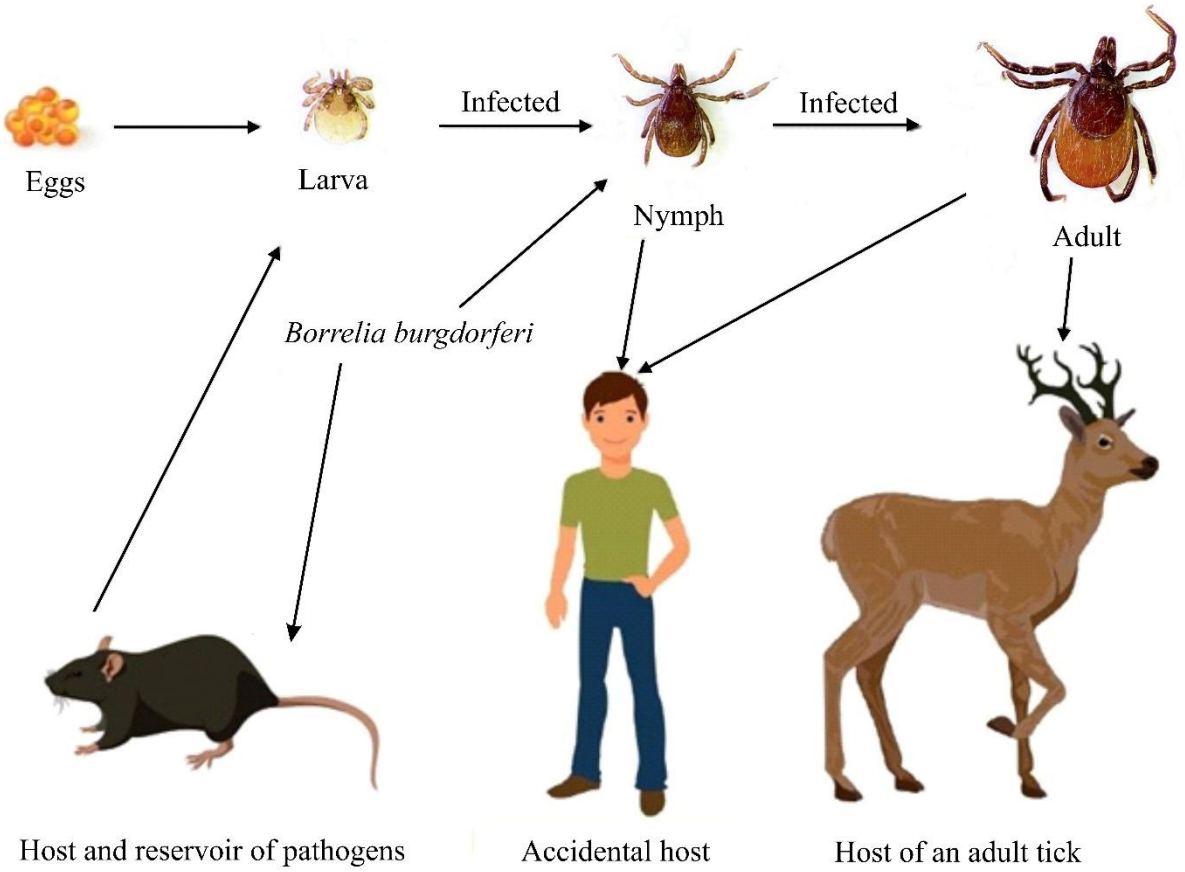

Fig. 1. The main ways of spread of *Borrelia burgdorferi* s.l. (according to Matysiak, 2018 – changed)

The bacterial dissemination cycle can be divided into several stages. Ticks acquire the disease by biting into and coming into contact with bacteria from their host. The bacteria are then transferred by the tick into the blood or body fluids of the next host, which is a warm-blooded animal (mammal). In the third stage, the bacteria live in the cells of the mammal, and in the fourth, the infected cells die and release the bacteria into the blood, where the tick can pick them up again (Dumler, Bakken, 1998; Brochocka et al., 2018; Matysiak, 2018). Ticks have four stages of development – egg, larva, nymph and adult (Fig. 1).

Lyme disease is a disease in which the symptoms are non-specific (ambiguous). The presence of *erythema migrans* on the skin is characteristic, but it does not appear in all infected people. It is estimated that *erythema migrans* occur in about 50–80% of patients. Erythema is a circular skin rash with a pale rim between the centre of the rash and the outer circle. *Erythema migrans*, as the name suggests, does not have to appear at the site of the bite, but it can wander all over the body (Cameron et al., 2014). It also happens that patients do not experience any symptoms at first, and the untreated disease takes various forms. The most common symptoms of Lyme disease include fatigue, headaches, migraines, dizziness, fever,

muscle and joint pain, general weakness, memory disorders, numbness of the limbs, muscle spasms, chills, sweats, visual disturbances, hair loss and the above-mentioned *erythema migrans*. Less common symptoms include difficulty breathing, sinusitis, diarrhoea, nausea, constipation, enlargement of the spleen and liver, weight loss, cystitis, impotence, libido disorders, psoriatic lesions, lymphocytic infiltrates on the skin, etc. Lyme disease also imitates mental disorders, it can cause severe anxiety attacks, combined with panic attacks (Matysiak, 2018).

In the case of Lyme disease, patients reach for plant therapies when the disease has become chronic (late phase) and suffers from complications after antibiotic terapy, in the hope of improving their health (Cianciara, Juszczyk, 2012; Adrion et al., 2015; Aucott, 2015; Middelveen et al., 2018; Adams, 2022). However, according to the recommendations of scientific societies, such as the Polish Society of Epidemiologists and Doctors of Infectious Diseases (Polskie Towarzystwo Epidemiologów i Lekarzy Chorób Zakaźnych), antibiotics should be used in the treatment of Lyme disease and neuroborreliosis, which, depending on the form of the disease, can be administered orally or intravenously. Antibiotic treatment is not replaced by other therapies. Taking any preparations (whether they are herbs or supplements) that have not undergone clinical trials carries the risk of poisoning or allergies. This is only supportive treatment. There is no conclusive evidence for the effectiveness of treating Lyme disease other than antibiotics, as it is a bacterial infection. Taking herbs or supplements often mobilizes patients to a more healthy lifestyle, which in turn brings an improvement in well-being. This way of taking care of health after antibiotic therapy is considered by specialists to be appropriate and less harmful.Therefore, more and more different herbal preparations are commercially available for to support the treatment cycle and completed antibiotic therapy of Lyme disease.

The main aim of this study is to make a list of plants, contained in herbal preparations and dietary supplements used to support Lyme disease therapy, available for sale without a prescription in Poland.

Analysis methods

The research consisted in analysing the composition of herbal preparations supporting the treatment of Lyme disease (supplements and herbal medicines without a prescription). Materials for the inventory were obtained from stationary in pharmacies and herbal shops in Krakow (southern Poland) and through a review of commercial offers of online herbal shops.

In total, 77 preparations available for sale were collected for analysis: stationary 29, online 48. Among the preparations, capsules and herbs for brewing prevailed. Other forms of preparations were less common (Fig. 2).

The plant species obtained based on the above-mentioned analysis are summarised in a table, with the Latin name of the species and family affiliation, origin, type of herbal raw material and trade names of preparations in which they were recorded.

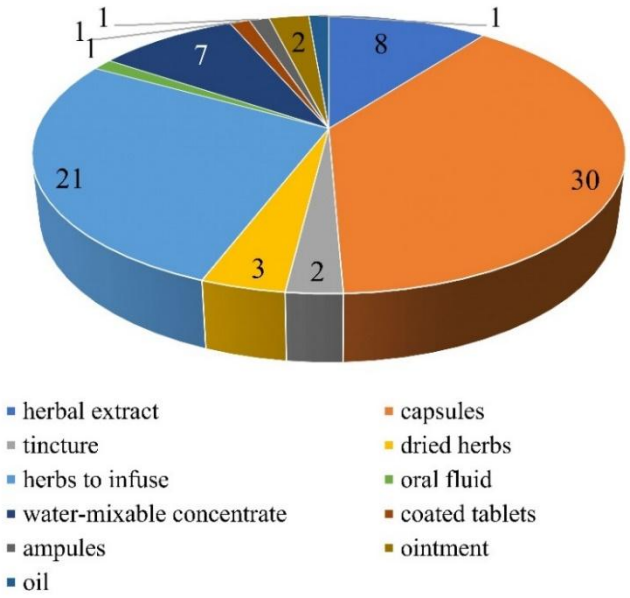

Fig. 2. The forms of the analysed group of herbal medicines and supplements available in trade

The origin of species was assumed mainly according to Podbielkowski, Studnik-Wójcikowska (2003), while the names of raw materials were taken from product packaging and the *Internet Atlas of Vascular Plants of Poland* (https://atlas-roslin.pl/rosliny-lecznicze.htm), with additions from various other Internet sources. A list of species whose raw materials are most often used in the treatment and supplementation of Lyme disease, the most numerously represented families and types of herbal raw materials used in the analysed group of preparations was also made.

Nomenclature and belonging to families of European species and acclimatised in Europe were taken from the *Internet Atlas of Vascular Plants of Poland* (www.atlas-roslin.pl) and the *Internet Atlas of Mushrooms* (www.grzyby.pl), and exotic species from *World Flora Online* (https://wfoplantlist.org/plant-list/). The systematic arrangement of the families and their nomenclature was used according to Reveal (2007).

Results

The conducted analysis showed that 77 preparations used in the treatment and supplementation of Lyme disease contain herbal raw materials of 101 plant species and one fungus (Tab. 2 – Appendix 1). The most common species in the studied group of preparations include *Reynoutria japonica*, *Dipsacus sylvestris*, *Uncaria tomentosa*, *Cistus ×incanus*, and *Andrographis paniculata* (Fig. 3).

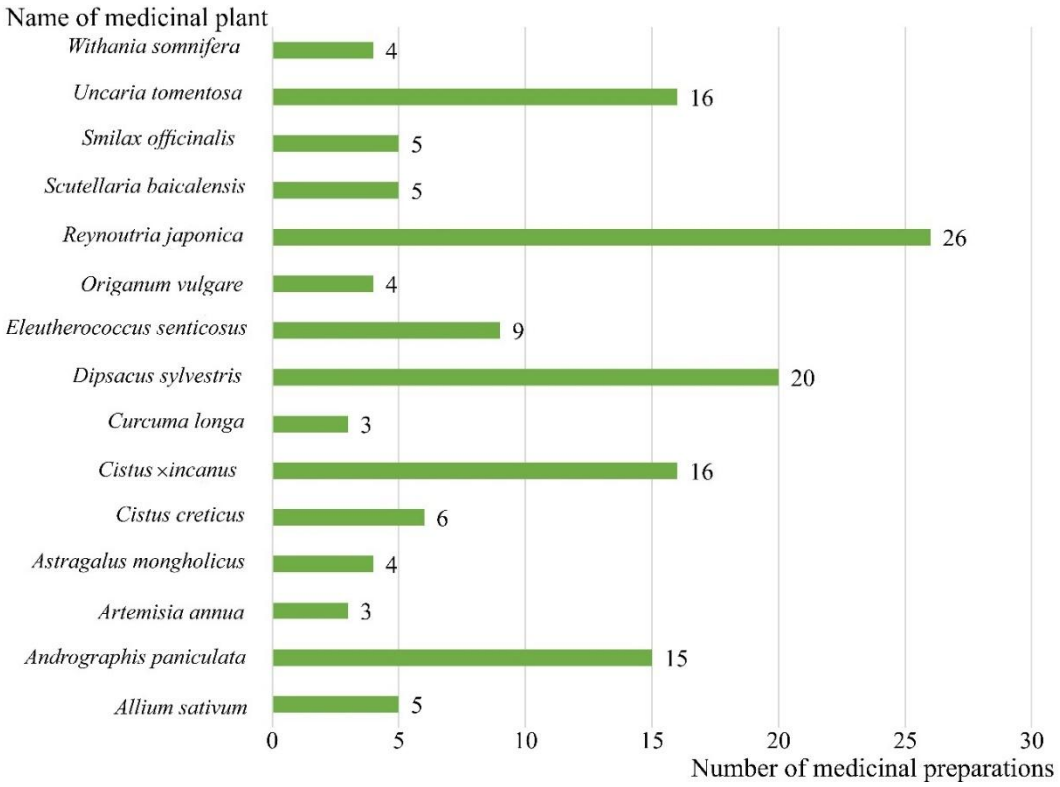

Fig. 3. The comparison of the most common species in the study group of herbal medicines and supplements

Among the recorded species, most are native to areas of Asia, Europe and Africa (Fig. 4). Fewer species are native to the Americas (a total of 18 have been recorded). Some species are native to Eurasia – e.g. *Chelidonium majus* L., *Angelica archangelica* L., and others occur virtually everywhere and can be considered cosmopolitan, e.g. *Trametes versicolor* (L.) Lloyd, *Equisetum arvense* L., or *Polygonum aviculare* L. One species of unknown origin was also recorded – *Citrus bergamia* Risso (Risso) & Poit.

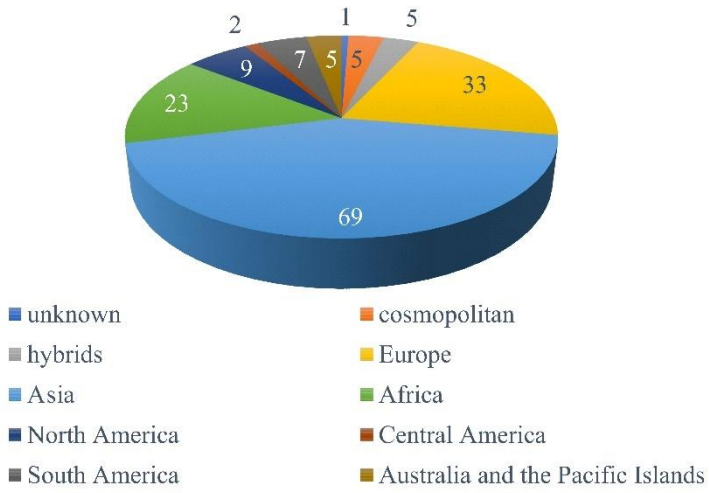

Fig. 4. The comparison of the number of species found in the study group of herbal medicines and supplements due to their origin

In total, these species belong to 53 families (Tab. 3). The most numerous families are Lamiaceae and Rosaceae. Most families (as many as 34) are represented by one species.

Tab. 3. The comparison of the share of medicinal species recorded in the analysed group of preparations within families (fungus, horsetails, gymnosperms, angiosperms: monocotyledonous, dicotyledonous); the most represented families are distinguished in grey

No.	Name of the family	Number of species	No.	Name of the family	Number of species
1.	Polyporaceae Fr. ex Corda	1	28.	Rosaceae Juss.	8
2.	Equisetaceae Michx. ex DC	1	29.	Hydrangeaceae Dumort.	1
3.	Pinaceae Spreng. ex F. Rudolphi	2	30.	Crassulaceae J. St.-Hil.	1
4.	Asparagaceae Juss.	1	31.	Saxifragaceae Juss.	1
5.	Amaryllidaceae J. St.-Hil.	2	32.	Fabaceae Lindl.	3
6.	Smilacaceae Vent.	1	33.	Rutaceae Juss.	4
7.	Zingiberaceae Martinov	4	34.	Geraniaceae Juss.	1
8.	Bromeliaceae Juss.	1	35.	Polygalaceae Hoffmanns. & Link	1
9.	Poaceae Barnhart	5	36.	Combretaceae R. Br.	3
10.	Annonaceae Juss.	1	37.	Onagraceae Juss.	1
11.	Menispermaceae Juss.	2	38.	Myrtaceae Juss.	4
12.	Berberidaceae Juss.	1	39.	Zygophyllaceae R. Br.	1
13.	Papaveraceae Juss.	1	40.	Araliaceae Juss.	1
14.	Lauraceae Juss. 1789	1	41.	Apiaceae Lindl	4
15.	Piperaceae Giseke	1	42.	Vitaceae Juss.	1
16.	Juglandaceae DC.	1	43.	Santalaceae R. Br.	1
17.	Urticaceae Juss.	1	44.	Oleaceae Hoffmanns. & Link	1
18.	Polygonaceae Juss.	2	45.	Apocynaceae Juss.	1
19.	Theaceae Mirb. ex Ker Gawl.	1	46.	Rubiaceae Juss.	2
20.	Cistaceae Juss.	2	47.	Adoxaceae E. Mey.	1

21.	Moringaceae Martinov.	1	48.	Dipsacaceae Juss.	1
22.	Caricaceae Dumort.	1	49.	Solanaceae Juss.	2
23.	Cucurbitaceae Juss.	1	50.	Acanthaceae Juss.	1
24.	Brassicaceae Burnett	3	51.	Pedaliaceae R. Br.	1
25.	Malvaceae Juss.	1	52.	Lamiaceae Martinov	9
26.	Phyllanthaceae Martinov.	1	53.	Asteraceae Bercht. & J. Presl	4
27.	Ericaceae Juss.	2			

Among the herbal raw materials, fruits, roots, herbs, oils, leaves and rhizomes are usually used in the analysed group of preparations, while fruiting bodies, tubers, and others. are used the least often (Fig. 5).

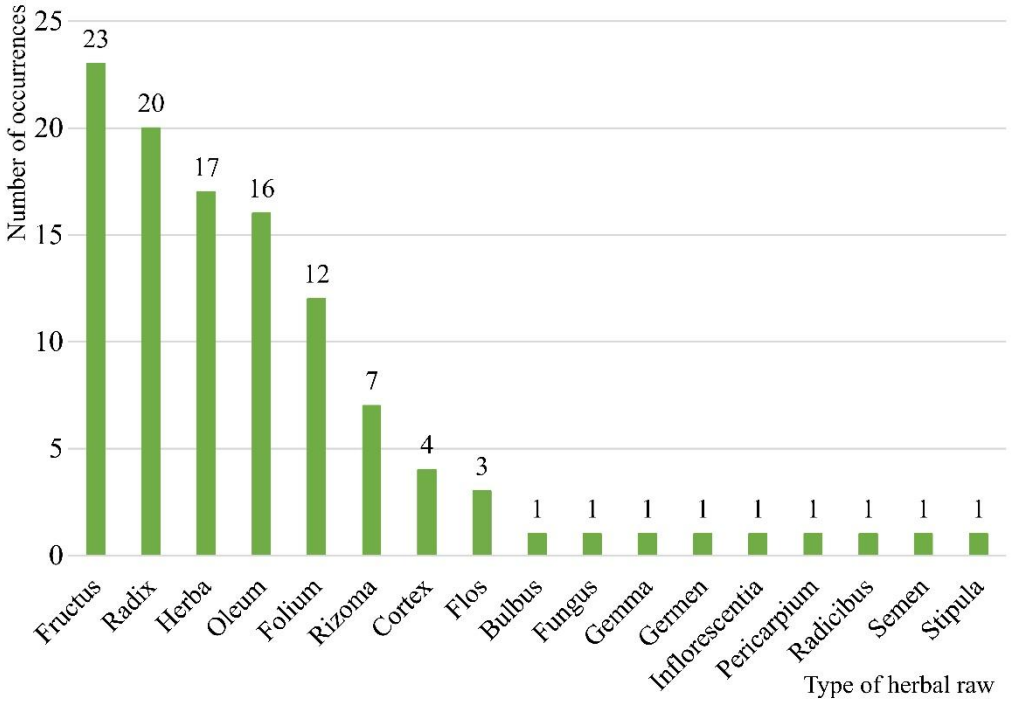

Fig. 5. The comparison of the number of occurrences of various types of herbal raw materials in the analysed preparations

Discussion

Phytotherapy supporting the treatment of Lyme disease

Early diagnosis of Lyme disease increases the chance of its complete recovery (Hinckley et al., 2014). When it is not possible to get a diagnosis early enough, the disease begins to pass into various forms that are difficult to treat and very debilitating for the body. Therefore, in later supportive therapies, herbal medicine is often used to help the body weakened by antibiotics (Buhner, 2005, 2015a, b; Cianciara, Juszczyk, 2012; Smoleńska et al., 2016; Feng

et al., 2020). Herbal regimens to support the treatment of Lyme disease include various protocols. Below are three examples of herbal protocols to support the treatment of Lyme disease. The Buhner protocol is a herbal supportive therapy known all over the world, while the protocols of Oruba and Różański are known mainly in Poland. When describing these three selected herbal protocols, it should be noted that there are no clinically proven studies of their effectiveness so far.

Stephen Harrod Buhner is one of the most famous American herbalists. He is the author of many books on herbal medicine and Lyme disease (e.g. Buhner, 2005, 2015a, b). According to him, herbal therapy is a very good substitute for synthetic drugs used in the treatment and elimination of the effects of Lyme disease (however, this is not clinically proven). The Buhner procedure is divided into basic protocol and extended protocol. The basic protocol consists of three herbs: *Reynoutria japonica*, *Uncaria tomentosa*, and *Andrographis paniculata*. The extended protocol covers five medicinal species: *Stephania tetrandra*, *Eleutherococcus senticosus*, *Astragalus mongholicus*, *Dipsacus sylvestris*, *Smilax officinalis.* In his books, Buhner describes exact instructions for taking and combining herbs with each other in order to obtain the best therapeutic effects (Buhner, 2015a, b).

Jan Oruba, Polish herbalist and author of the protocol supporting the treatment of Lyme disease with liposomal herbs (liposomes are very small, water-lipid structures in the shape of a sphere/vesicle; discovered in the 1960s by the haematologist and biophysicist Alec Bangham). They are carriers of active compounds from herbs or oils and are the safest form of delivering these substances to the body. According to Oruba, there is no one specific herb that treats Lyme disease, as Lyme disease can present differently in everyone and involve multiple systems. His supporting therapy consists of using of liposomal herbs, selected according to the dominant symptoms, characteristic of Lyme disease, babesiosis, bartonella, mycoplasma. According to Oruba, our immune system is able to prioritise itself and choose the dominant infection that is the greatest threat to it at a given moment (Oruba, 2018).

Henryk Różański is a long-term Polish scholarship holder of the Swiss Büchner Foundation (1993-2000), the author of many publications in the field of botany, phytopharmacology, phytotoxicology, and pharmaceutical biology (e.g. Różański, H., Petryja, 2021, 2022). According to Różański, herbs supporting the treatment of Lyme disease are divided into basic ones (*Uncaria tomentosa*, *Dipsacus sylvestris*), immunising (mud extracts, *Aloe* sp., *Nigella sativa* L. oil, *Artemisia absinthium* L., *Echinacea purpurea* (L.) Moench root and herb, *E. pallida* (Nutt.) Nutt. and *E. angustifolia* DC.), anti-inflammatory (*Harpagophytum procumbens* root, *Melampyrum* sp. herb, *Rhinanthus alectorolophus* herb

(Scop.) Pollich and *R. serotinus* (Schönh.) Oborný), *Odontites verna* herb (Bellardi) Dumort., *Angelica archangelica* root combined with *Filipendula ulmaria* flower, buds or bark *Populus alba* L., *P. nigra* L. or *P. ×canescens* (Aiton) Sm., *P. tremula* L. and the bark of *Salix alba* L. or *S. purpurea* L.), antibacterial/disinfectant (bark, twigs, buds and leaves of *Padus avium* Mill., herb and root of *Sanguisorba officinalis* and *S. minor* Scop., rhizome of *Curcuma longa* L. and flower and herb of *Tanacetum vulgare* L.). They should be used in the right order to get the best phytotherapy results.

Herbal preparations commercially available

During the collection of materials for this study, most preparations were obtained via the Internet and in herbal shops. However, in most pharmacies, pharmacists recommended only dried herbs from *Cistus* sp. for brewing, and this was usually the end of the commercial offer of preparations supplementing the treatment of Lyme disease. Many species are traditionally used in this type of supporting therapy (Tokarski, Denys, 2018), although their effects are not fully confirmed (Tab. 4; Fig. 6 – Appendix 2).

Tab. 4. Plants supporting the Lyme disease treatment cycle and completed antibiotic therapy

No.	Latin name	Common name
1.	*Andrographis paniculata*	creat, green, chiretta
2.	*Astragalus mongholicus*	Mongolian milkvetch
3.	*Cistus creticus*	pink rock-rose, hoary rock-rose
4.	*C. ×incanus*	hoary rock-rose
6.	*Dipsacus silvestris*	wild teasel, fuller's teasel
7.	*Eleutherococcus senticosus*	devil's bush, Siberian ginseng, eleuthero
12.	*Reynoutria japonica*	Japanese knotweed, Asian knotweed
13.	*Rhodiola rosea*	golden root, rose root, roseroot
14.	*Scutellaria baicalensis*	Baikal skullcap, Chinese skullcap
15.	*Smilax officinalis*	Sarsaparilla plant
16.	*Stephania tetrandra*, *S. cepharantha*	Fen Fang Ji
17.	*Uncaria tomentosa*, *U. rhynchophylla*	cat's claw, uña de gato, fish hook vine

You can buy both ready-made preparations in various forms, from various raw materials (Fig. 2, 5), as well as books with recipes for individual forms of Lyme disease and other tick-borne diseases. In some shops, it is also possible to order mixtures created on the spot for specific symptoms of this disease.

In the analysed 77 preparations, as many as 101 plants and one species of fungus were recorded (Tab. 2 – Appendix 1). Most of the tested preparations contain species described in the Buhner Protocol (Buhner, 2005, 2015a, b) and plants with a general effect, supporting the

proper functioning of the body. The most common plants are *Reynoutria japonica*, *Dipsacus sylvestris*, *Cistus ×incanus* oraz *Uncaria tomentosa* (Fig.3.). The first two species belong to the ingredients obtained in Europe easily from the wild, which certainly affects the lower price and better quality of their raw materials. In addition, these plants have a proven effect against Lyme spirochetes (in cell line studies), and this determines the effectiveness of preparations based on them. For example, ethanol extracts from *Reynoutria japonica* show strong activity against the growing *B. burgdorferi* as well as its non-growing stationary phase (Feng et al., 2020). The main active ingredient of *R. japonica* is the polyphenol – resveratrol, which, according to Goc and Rath (2016), has a bacteriostatic and bactericidal effect against Borrelia sp. spirochetes. However, it is less effective against rounded forms and has no significant effect against biofilm. Another active ingredient here is Emodin (6-methyl-1,3,8-trihydroxyanthraquinone), which has documented activity against *B. burgdorferi* stationary phase cells (Feng et al., 2015). *R. japonica* eliminates the symptoms of this disease in most people (Buhner, 2015a, b), and has the closest effect to the cytokine dynamics caused by Lyme bacteria. In herbal medicine, it is most often found as an ingredient in capsules, but also as a powdered root, dried leaves, dried rhizomes and in the form of tinctures. It grows naturally in Japan, Taiwan, China and Korea (Tab. 2 – Appendix 1). It was brought to Europe, where it spread quickly and is now considered an invasive plant (Chmura et al., 2013).

Liebold et al. (2011) showed that ethyl acetate and dichloromethane extracts from the roots of *Dipsacus sylvestris*, of lipophilic nature, have an inhibitory effect on *B. burgdorferi*, while the hydroethanolic extract does not inhibit the growth of spirochetes. According to Saar-Reisma et al. (2022), extracts from *D. sylvestris* leaves also show activity against *B. burgdorferi*. However, due to their cytotoxicity, the authors indicated the need to isolate the most active and less cytotoxic fractions. They also found that the highest cytotoxicity came from polyphenols. The iridoid-glycoside fraction, containing two main bioactive substances – sylvestrosides III and IV, has reduced cytotoxicity and an effective effect against *Borrelia* in the stationary phase.

Cistus ×incanus, on the other hand, has anti-inflammatory effects, inhibits the growth of Lyme spirochetes, and its regular consumption helps the body produce a smell that is repellent to ticks (Buhner, 2015a, b). It is found in Europe and Asia Minor (Tab. 2 – Appendix 1). Other species of the genus *Cistus*, e.g. *C. creticus* L., also have an inhibitory effect on the proliferation of *Borrelia* (Hutschenreuther et al., 2010). Two other species – *Uncaria tomentosa* and *Cryptolepis sanguinolenta* are foreign plants in Europe, whose herbal raw material is imported. *U. tomentosa* is the strongest immunostimulating herb used in Lyme

disease and its co-infections. It increases the amount of CD57 leukocytes, which are crucial in the body's fight against Lyme disease. It soothes muscle and joint pain and inflammation. According to Feng et al. (2020), *U. tomentosa* shows strong activity against non-growing *B. burgdorferi* stationary phase cells and weaker activity against growing ones. It naturally occurs in Central and South America and the Caribbean (Tab. 2 – Appendix 1). In herbal medicine, it is mainly used in tablets, powders, infusions and tinctures.

Native to Africa, *Cryptolepis sanguinolenta* has anti-inflammatory, antibacterial, antifungal, antiamoeba and antimalarial properties. Includes, e.g. the alkaloid cryptolepine, with bactericidal and bacteriostatic properties (Paulo, Gomes 1995; Osafo et al., 2017). Cryptolepin causes morphological changes and cell lysis as well as DNA intercalation and inhibition of poisomerase II. It shows strong activity against *B. burgdorferi* and is also highly effective against even its aggregated forms (Feng et al., 2020). Despite the proven effectiveness, this species was found in only two of the studied preparations (Tab. 2 – Appendix 1). Other plant species, showing according to Feng et al. (2020) strong activity against *B. burgdorferi*, are also present in a few analysed preparations: *Juglans nigra* in one, *Artemisia annua* in three, and *Scutellaria baicalensis* in five.

Most species belong to the Rosaceae and Lamiaceae families (Tab. 3). These are families rich in common species and well-documented in European native flora (Mederska, 2021; Mederska, Mederski, 2021). On the other hand, it seems very interesting that in the analysed group of preparations, there are also quite often species from families that are not very representative or completely exotic in Central Europe flora, e.g. Myrtaceae, Rutaceae, Zingiberaceae, Combretaceae. Lyme disease is still poorly understood, as are the properties of many plant species. Not all plants supporting the treatment cycle and completed antibiotic therapy have a confirmed effect in this respect, as mentioned earlier. Producers of preparations willingly use plant materials used in traditional Far Eastern medicine (Fig. 4), although they are not sure about their effectiveness in this disease. The addition of raw materials known in the Far East also greatly affects the commercial attractiveness of the products offered, because people prefer natural traditional herbal medicine (Anczyk, 2021).

A somewhat similar explanation may apply to a very large group of species native or cultivated in Europe, which have been recorded here, e.g. garlic, onion, pine, horsetail, currant, cabbage, apple tree, rose, elderberry, hawthorn, etc. (Tab. 2 – Appendix 1). Many of them have a general-strengthening effect, and some simply improve the functioning of the immune system (Van Wyk, Wink, 2017; Bigoś, 2019). These premises are already recognised by producers of herbal preparations as a sufficient reason for their use in Lyme disease

supplements. For example, Thompson et al. (2023) analysed 18 herbs commonly used by patients to treat Lyme disease symptoms, seven of which had proven *in vitro* activity against *B. burgdorferi*, thirteen of which had proven in vitro antimicrobial activity, and 15 had documented anti-inflammatory properties. Therefore, when buying herbal preparations that relieve the symptoms of Lyme disease, it is worth checking their composition for the presence of species with proven therapeutic properties (at least in cell line studies), such as herbs from the basic or extended Buhner protocol. Many dishonest manufacturers, taking advantage of the poor knowledge of the average citizen about this disease, will unfortunately continue to offer supplements with poor healing properties. Therefore, in addition to prophylaxis (Nowak-Chmura, Siuda, 2012; Sinski, Welc-Faleciak, 2012; Nieto et al., 2018; Hussain, 2021), the effectiveness of Lyme disease detection and thorough examination of the course of the disease itself (Hinckley et al., 2014), it is also worth promoting the knowledge already existing in this area about its herbal supplementation (Feng et al., 2017; Feng et al., 2020). However, it should always be remembered that so far the only effective and clinically proven method of treating Lyme disease is antibiotic therapy.

Conclusions

Summing up the whole analysis, the following conclusions can be drawn: [1] herbal preparations used in Lyme disease supplementation usually have the form of capsules, herbs for infusion or extract, and the most commonly used raw materials are fruit, root, herb, oil, leaf; [2] the species most commonly used in the preparations are *Reynoutria japonica*, *Dipsacus sylvestris*, *Cistus ×incanus* and *Uncaria tomentosa* – other species from the Buhner protocol are also quite common (most preparations contained at least one of the ingredients from this group); [3] many plants contained in the preparations have an effect that generally supports the proper functioning of the body or targets a specific form of this disease; [4] most species belong to the Rosaceae and Lamiaceae families; representatives of other families appear quite often: Myrtaceae, Rutaceae, Zingiberaceae, Combretaceae; [5] the most of species used in Lyme disease supplementation come from Asia, Europe and Africa.

Alphabetical list of Polish trade names of 77 analysed preparations:

Andrographis – magiczny ogród, Andrographis 10% Ekstrakt, Andrographis Paniculata nalewka – Nanga, Andrographis Paniculata ziele cięte – Nanga, Astragalus Root – Swanson, Bolleriocaps – Herbapol, Bolleriofix – Herbapol, Borelfix – Herbarium św. Franciszka, Borelia Med – Berg Life, Borelio herbs – Inwent Herbs, Borelio mieszanka ziołowa, Boreliol, Borelioza max, BorelissPro, Borelix forte – Produkty Bonifraterskie, Borellvit,

Borelyma – Herbal Monasterium, Borrelia protect extra, Borreliosis tea – Everest ayuverda, Cat's Claw Koci Pazur – Swanson, Cryptolepis – Magiczny ogród, Czystek – sekrety zielnika, Czystek Altermedica laboratories, Czystek fix – zielnik apteczny, Czystek kreteński – Magiczny ogród, Czystek – Natura Wita, EKO czystek liść – Natura Wita, Eleuthero Ginseng Royal Jelly, Kłącze rdestowca japońskiego – Flos, Koci Pazur (Vilcacora) – rozdrobniona kora, Korzeń szczeci – Flos, Liposomalny rdest japoński, Lyme Protector, Maść arnikowa elissa, Maść szałwiowa elissa, Mielona Ashwagandha, Nanobab – B&M, Nanobarto – B&M, Nanoborrel – B&M, Nanomyko – B&M, Now Foods Andrographis Extract, Now Foods Black Walnut Hulls, Now Foods Cat's Claw Koci Pazur, OEPAROL – Adamed, Olejek z drzewa herbacianego – Herbapol, OptiBorelia, Probio Borelio, Rdest japoński – B&M Research, Rdestowiec – Magiczny ogród, Rdestowiec 500+ Nanga suplements, Rdestowiec japoński kłącze cięte – Nanga, Rdestowiec japoński kłącze – Herbapol, Rdestowiec japoński kłącze mielone – Nanga, Rdestowiec japoński korzeń mielony – Plantago, Rdestowiec japoński liść, Rdestowiec japoński liść – Nanga, Rdestowiec japoński susz – Astron, Rdestowiec japoński ziele suszone – Dary Podlasia, Resweratrol – Medica Herbs, Rhodiola – Magiczny ogród, Sarsaparilla 400, Sarsaparilla Root – Swanson, Stephania – Magiczny ogród, Stop Borelia herbatka ziołowa, Szczeć – Altermedica laboratories, Szczeć pospolita kapsułki – Futunatura, Szczeć pospolita kapsułki – Medica herbs, Szczeć pospolita korzeń – Natura wita, Tarczyca bajkalska – Magiczny ogród, Traganek – Magiczny ogród, Yango Borrelin, Yango czystek, Yango szczeć, Zimnotłoczony olej z nasion wiesiołka – Gal, Żeń-szeń syberyjski – korzeń cięty, Żeń-szeń syberyjski – Magiczny ogród, Żeń-szeń syberyjski 400.

Conflict of interest

The authors declare no conflict of interest related to this article.

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Appendix 1

Tab. 2. List of all taxa (fungi, horsetails, gymnosperms and angiosperms: monocotyledonous, dicotyledonous) used as support in the treatment of Lyme disease and improving immunity

No.	Family, Latin name of a plant/fungus	Origin	Herbal raw material	Polish trade names of medicinal preparations
1.	Polyporaceae Fr. ex Corda *Trametes versicolor* (L.) Lloyd	cosmopolitan	*Fungus Trametes*	Lyme Protector
2.	Equisetaceae Michx. ex DC. *Equisetum arvense* L.	cosmopolitan	*Equiseti herba*	Probio Borelio
3.	Pinaceae Spreng. ex F. Rudolphi *Cedrus atlantica* (Endl.) G. Manetti ex Carrière	North Africa	*Oleum cedri*	Nanobarto – B&M
4.	*Pinus sylvestris* L.	Europe, Northern zone of Asia	*Folium et gemma Pini*	Borelfix – Herbarium św. Franciszka; Borelioza max
5.	Asparagaceae Juss. *Asparagus officinalis* L.	Mediterranean area, Western Siberia	*Rhizoma Asparagi*	BorelissPro
6.	Amaryllidaceae J. St.-Hil. *Allium cepa* L.	West Asia	*Allium cepa folium*	BorelissPro
7.	*A. sativum* L.	Central Asia	*Allii sativi bulbus*	BorelissPro; Borelioza max; OptiBorelia; Probio Borelio; Yango Borrelin
8.	Smilacaceae Vent. *Smilax officinalis* Kunth	Central America and Northwest part of South America	*Smilax officinalis Radix/Radix sarsaparillae*	Borelio mieszanka ziołowa; Borelix forte – Produkty Bonifraterskie; Borrelia protect extra; Sarsaparilla 400; Sarsaparilla Root – Swanson
9.	Zingiberaceae Martinov *Curcuma longa* L.	India, Malaysia	*Curcumae longae rhizoma*	Borreliosis tea – Everest ayuverda; Nanobab – B&M; Probio Borelio
10.	*C. zedoaria* (Christm.) Roscoe	South-East Asia	*Rhizoma Zedoariae*	Nanobab – B&M
11.	*Hedychium spicatum* Buch.-Ham. ex Sm.	China, Himalayas, Burma, Ethiopia, Thailand	*Hedychium spicatum rhizoma*	Nanoborrel – B&M

12.	*Zingiber officinale* Rosc.	Malaysia, India	*Zingiberis rhizoma*	Probio Borelio
	Bromeliaceae Juss.			
13.	*Ananas comosus* (L.) Merr	Brazil	*Ananas comosus fructus*	BorelissPro
	Poaceae Barnhart (Gramineae) Juss.			
14.	*Cymbopogon citratus* Stapf	India	*Cymbopogon citratus Folium*	Borelfix – Herbarium św. Franciszka
15.	*C. flexuosus* (Nees ex Steud.) W.Watson	India, Sri Lanka, Burma, and Thailand	*Oleum Cymbopogon flexuosus*	Nanobab – B&M
16.	*C. martinii* (Roxb.) W.Watson	India and Indochina	*Oleum Cymbopogoni martinii*	Nanobarto – B&M
17.	*C. winterianus* Jowitt ex Bor	western Malesia	*Oleum cytronellae indicum*	Nanoborrel – B&M
18.	*Triticum vulgare* L.	cosmopolitan	*Triticum vulgaris germen*	BorelissPro
	Annonaceae Juss.			
19.	*Cananga odorata* (Lam.) Hook.f. & Thom.	South-East Asia	*Oleum Cananga odorata*	Nanobab – B&M
	Menispermaceae Juss.			
20.	*Stephania tetrandra* S.More	China and Taiwan	*Radix Stephaniae tetrandrine*	Stephania – magiczny ogród
21.	*Tinospora cordifolia* (Willd.) Hook. f. & Thom.	Indian subcontinent	*Tinospora cordifolia radix and stipula*	Borreliosis tea – Everest ayuverda
	Berberidaceae Juss.			
22.	*Berberis thunbergii* DC.	Japan and eastern Asia	*Radix Berberidis*	Borelioza max
	Papaveraceae Juss.			
23.	*Chelidonium majus* L.	Eurasia	*Chelidonii herba*	Borelioza max
	Lauraceae Juss. 1789			
24.	*Cinnamomum verum* J.Presl	Sri Lanka	*Cinnamomi cortex*	Nanoborrel – B&M

25.	*Litsea cubeba* Pers.	Southern China	*Oleum Litsea cubeba*	Nanoborrel – B&M
	Piperaceae Giseke			
26.	*Piper nigrum* L.	Malabar Coast (India)	*Fructus Piperis nigri*	Borellvit; Probio Borelio
	Juglandaceae DC.			
27.	*Juglans nigra* L.	North America	*Pericarpium Juglandis*	NOW FOODS Black Walnut Hulls
	Urticaceae Juss.			
28.	*Urtica dioica* L.	Eurasia, North Africa, North and South America	*Herba Utricae dioicae*	Czystek – sekrety zielnika
	Polygonaceae Juss.			
29.	*Polygonum aviculare* L.	cosmopolitan	*Polygoni avicularis herba*	Probio Borelio
30.	*Reynoutria japonica* Houtt.	South-East Asia	*Polygoni cuspidati rhizoma et radix*	Bolleriocaps – Herbapol; Borelia Med – Berg Life; Borelio herbs – Inwent Herbs; Borelio mieszanka ziołowa; Boreliol; Borelioza max; BorelissPro; Borelix forte – Produkty Bonifraterskie; Borellvit; Borelyma – Herbal Monasterium; Borrelia protect extra; Kłącze rdestowca japońskiego – Flos; Liposomalny rdest japoński; OptiBorelia; Rdest japoński – B&M Research; Rdestowiec – magiczny ogród; Rdestowiec 500+ Nanga suplements; Rdestowiec japoński kłącze cięte – Nanga; Rdestowiec japoński kłącze – Herbapol; Rdestowiec japoński kłącze mielone – Nanga; Rdestowiec japoński korzeń mielony – Plantago; Rdestowiec Japoński liść; Rdestowiec japoński liść – Nanga; Rdestowiec japoński susz – Astron; Rdestowiec japoński ziele suszone – Dary Podlasia; Yango Borrelin
	Theaceae Mirb. ex Ker Gawl.			
31.	*Camellia sinensis* (L.) Kuntze	South-East Asia	*Folium Theae*	BorelissPro; Lyme Protector
	Cistaceae Juss.			
32.	*Cistus creticus* L.	North Africa, West Asia, South and East Europe	*Cistus creticus Herba*	Borelfix – Herbarium św. Franciszka; Borrelia protect extra; Czystek kreteński – Magiczny ogród; Lyme Protector; Yango Borrelin; Yango czystek
33.	*C.* ×*incanus* L.	hybrids	*Cistus folium/ herba/ oleum*	Bolleriocaps – Herbapol; Bolleriofix – Herbapol; Borelia Med – Berg Life; Borelio herbs – Inwent Herbs; Borelio mieszanka ziołowa; BorelissPro, Borelix forte – Produkty Bonifraterskie; Borelyma – Herbal Monasterium; Czystek – sekrety zielnika; Czystek altermedica

				laboratories; Czystek fix – zielnik apteczny; Czystek – Natura Wita; EKO czystek liść – Natura Wita; OptiBorelia; Probio Borelio; Stop Borelia herbatka ziołowa
34.	Moringaceae Martinov. *Moringa oleifera* Lam.	Indian subcontinent	*Moringa herba*	Probio Borelio
35.	Caricaceae Dumort. *Carica papaya* L.	South America, South regions of North America	*Fructus Caricae*	BorelissPro
36.	Cucurbitaceae Juss. *Cucumis sativus* L.	India, South China	*Cucumis sativus fructus*	BorelissPro
37.	Brassicaceae Burnett *Brassica oleracea* L. var. *capitata* (L.) Duchesne	Europe, cultivar	*Brassicae oleraceae Folium*	BorelissPro
38.	*B. oleracea* L. var. *italica* Plenck	Europe, cultivar	*Brassica oleracea Inflorescentia*	BorelissPro
39.	*Isatis tinctoria* L.	Southeast Europe, West Asia	*Isatidis radix*	Nanomyko – B&M
40.	Malvaceae Juss. *Hibiscus syriacus* L.	Korea, south-central, southeast China, India	*Flos Hibisci syriacus*	Bolleriofix – Herbapol; Czystek – sekrety zielnika
41.	Phyllanthaceae Martinov. *Phyllanthus emblica* L.	South Asia	*Emblica officinalis fructus*	Borreliosis tea – Everest ayuverda
42.	Ericaceae Juss. *Gaultheria procumbens* L.	Northeastern North America	*Oleum Gaultheriae*	Nanoborrel – B&M
43.	*Vaccinium myrtillus* L.	Asia, Europe, North America	*Fructus Vaccinii*	BorelissPro
44.	Rosaceae Juss. *Armeniaca vulgaris* Lam.	Central Asia	*Armeniacae fructus*	BorelissPro
45.	*Aronia melanocarpa* (Michx.) Elliott	Eastern North America	*Aroniae fructus*	Bolleriofix – Herbapol
46.	*Cerasus avium* (L.) Moench	Europe, Western Asia, Asia Minor	*Pruni aviae Fructus*	BorelissPro
47.	*Crataegus* sp.	temperate zone of the	*Crataegi fructus*	Probio Borelio

48.	*Filipendula ulmaria* (L.) Maxim.	northern hemisphere Asia, Northern and Central Europe	*Filipendulae ulmariae herba*	Borelioza max
49.	*Fragaria ×ananasa* Duchesne	hybrids	*Fructus Fragariae ananssae*	BorelissPro
50.	*Malus sylvestris* (L.) Mill.	Europe	*Fructus Malus sylvestris*	BorelissPro
51.	*Rosa canina* L.	Europe, North Africa, Asia Minor	*Fructus Rosae*	Bolleriofix – Herbapol; Czystek – sekrety zielnika
	Hydrangeaceae Dumort.			
52.	*Hydrangea febrifuga* (Lour.) Y.De Smet & C.Granados	Asia?	*Radix Dichroae*	Nanobab – B&M
	Crassulaceae J. St.-Hil.			
53.	*Rhodiola rosea* L.	North America, Europe, Asia	*Rhodiolae roseae rhizoma cum radicibus*	Rhodiola – Magiczny ogród
	Saxifragaceae Juss.			
54.	*Ribes nigrum* L.	Europe, Asia	*Fructus Ribis nigri*	Bolleriofix – Herbapol; BorelissPro
	Fabaceae Lindl. (Leguminosae Juss., Papilionaceae Giseke)			
55.	*Astragalus mongholicus* Bunge	temperate Asia	*Radix Astragali*	Borellvit; Lyme Protector; Traganek – Magiczny ogród; Astragalus Root – Swanson
56.	*Glycyrrhiza glabra* L.	South-East Europe, Asia Minor	*Liquiritiae radix*	Borreliosis tea – Everest ayuverda
57.	*Pterocarpus marsupium* Roxb.	India, Nepal, Sri Lanka	*Pterocarpus marsupium herba*	Borreliosis tea – Everest ayuverda
	Rutaceae Juss.			
58.	*Citrus bergamia* Risso (Risso) & Poit.	unknown	*Oleum Citrus bergamia*	Nanomyko – B&M
59.	*C. ×paradisi* Macfad.	hybrids	*Citrus paradisi Fructus*	BorelissPro
60.	*C. ×sinensis* (L.) Osbeck	hybrids	*Fructus Citrus sinensis*	BorelissPro
61.	*Phellodendron amurense* Rupr.	Eastern Asia	*Cortex Phellodendri*	Nanobab – B&M; Nanomyko – B&M

	Geraniaceae Juss.			
62.	*Pelargonium sidoides* DC.	South Africa	*Pelargonii radix*	Borelix forte – Produkty Bonifraterskie
	Polygalaceae Hoffmanns. & Link			
63.	*Polygala tenuifolia* Willd.	Asia	*Radix Polygalae*	Nanobarto – B&M
	Combretaceae R. Br.			
64.	*Terminalia arjuna* (Roxb. ex DC.) Wight & Arn.	Indian Subcontinent	*Terminaliae arjunae cortex*	Borreliosis tea – Everest ayuverda
65.	*T. bellirica* (Gaertn.) Roxb.	South and south-west Asia	*Terminalia bellirica fructus*	Borreliosis tea – Everest ayuverda
66.	*T. chebula* Retz.	South Asia	*Fructus Chebulae*	Borreliosis tea – Everest ayuverda
	Onagraceae Juss. (Oenotheraceae C. C. Robin)			
67.	*Oenothera biennis* L.	North America	*Oleum Oenotherae*	OEPAROL – Adamed; Zimnotłoczony olej z nasion wiesiołka – Gal
	Myrtaceae Juss.			
68.	*Eucalyptus globulus* Labill.	South-eastern Australia	*Eucalypti folium*	Nanomyko – B&M
69.	*Melaleuca alternifolia* Cheel	Australia	*Melaleucae aetheroleum*	Nanomyko – B&M; Olejek z drzewa herbacianego herbapol
70.	*M. viridiflora* Sol. ex Gaertn.	Northern Australia, New Guinea	*Oleum Melaleuca viridiflora*	Nanobab – B&M; Nanoborrel – B&M
71.	*Syzygium aromaticum* (L.) Merr. & Perry	Moluccas (Indonesia)	*Oleum caryophylli*	Nanobarto – B&M
	Zygophyllaceae R. Br.			
72.	*Tribulus terrestris* L.	Southern Eurasia and North Africa	*Tribulus terrestris herba et fructus*	Borreliosis tea – Everest ayuverda
	Araliaceae Juss.			
73.	*Eleutherococcus senticosus* Maxim.	East Asia, China, Japan, Russia	*Eleutherococci radix*	Borelio herbs – Inwent Herbs; Borelix forte – Produkty Bonifraterskie; Borellvit; Borrelia protect extra; Eleuthero Ginseng Royal Jelly; Probio Borelio; Żeń-szeń syberyjski – korzeń cięty; Żeń-szeń syberyjski – magiczny ogród; Żeń-szeń syberyjski 400
	Apiaceae Lindl. (Umbelliferae Juss.)			
74.	*Angelica archangelica* L.	Eurasia	*Angelicae archangelicae radix*	Probio Borelio
75.	*A. dahurica* (Hoffm.) Benth. & Hook.f. ex Franch. & Sav.	Siberia, Russia Far East, Mongolia, north-eastern China, Japan,	*Radix Angelicae dahuricae*	Nanomyko – B&M

		Korea, Taiwan		
76.	*Centella asiatica* (L.) Urb.	Africa, Asia, Australia, islands in the western Pacific Ocean	*Centellae asiaticae herba*	Borreliosis tea – Everest ayuverda
77.	*Daucus carota* L.	Eurasia, South Africa	*Daucus carota radix*	BorelissPro
	Vitaceae Juss.			
78.	*Vitis vinifera* L.	Mediterranean region, Central Europe, South-western Asia	*Fructus Vitis veniferae, Vitis vinifera Semen*	BorelissPro; Yango Borrelin
	Santalaceae R. Br.			
79.	*Santalum album* L.	Indian Subcontinent	*Oleum Santali*	Borreliosis tea – Everest ayuverda
	Oleaceae Hoffmanns. & Link			
80.	*Olea europaea* L.	Mediterranean Basin (Europe, Asia, Africa)	*Olea europaea fructus*	BorelissPro
	Apocynaceae Juss.			
81.	*Cryptolepis sanguinolenta* (Lindl.) Schltr., *C. dubia* (Burm.f.) M.R.Almeida	Africa; South, Southeast Asia	*Radix Cryptolepis sanguinolentae*	Cryptolepis – Magiczny ogród; Nanobab – B&M
	Rubiaceae Juss.			
82.	*Galium aparine* L.	cosmopolitan	*Herba Galii aparinis*	Borelioza max
83.	*Uncaria tomentosa* DC.	South and Central America, Caribbean	*Uncariae tomentosae cortex*	Borelia Med – Berg Life; Bolleriocaps – Herbapol; Borelio herbs – Inwent Herbs; Borelio mieszanka ziołowa; Boreliol; Borelioza max; Borelix forte – Produkty Bonifraterskie; Borellvit; Borelyma – Herbal Monasterium; Borrelia protect extra; Cat's Claw Koci Pazur – Swanson; Koci Pazur (vilcacora) – rozdrobniona kora; Now Foods Cat's Claw Koci Pazur; OptiBorelia; Probio Borelio; Yango Borrelin
	Adoxaceae E. Mey.			
84.	*Sambucus nigra* L.	Europe	*Flos Sambuci*	Probio Borelio
	Dipsacaceae Juss.			
85.	*Dipsacus sylvestris* Huds.	Europe, West Asia, South Africa	*Dipsacus fullonum Radix*	Bolleriofix – Herbapol; Borelfix – Herbarium św. Franciszka; Borelia Med -Berg Life; Borelio herbs – Inwent Herbs; Borelio mieszanka ziołowa; Borelix forte – Produkty Bonifraterskie; Borellvit; OptiBorelia; Probio Borelio Stop Borelia herbatka ziołowa; Szczeć – altermedica laboratories; Szczeć

				pospolita korzeń – Natura Wita; Bolleriocaps – Herbapol; Borelioza max; BorelissPro; Borelyma – Herbal Monasterium; Korzeń szczeci – Flos; Szczeć pospolita kapsułki – futunatura; Szczeć pospolita kapsułki – Medica herbs; Yango szczeć; Yango Borrelin
	Solanaceae Juss.			
86.	*Lycopersicon esculentum* Mill.	Peru, Ecuador (South America)	*Lycopersicon esculentum fructus*	BorelissPro
87.	*Withania somnifera* (L.) Dunal	Africa, Asia	*Radix et fructus Withaniae*	Borelix forte – Produkty Bonifraterskie; Borelyma – Herbal Monasterium; Borreliosis tea – Everest ayuverda; Mielona Ashwagandha
	Acanthaceae Juss.			
88.	*Andrographis paniculata* (Burm.f.) Wall.	India, Sri Lanka	*Herba Andrographitis*	Andrographis – Magiczny ogród; Andrographis 10% Ekstrakt; Andrographis paniculata nalewka – Nanga; Andrographis paniculata ziele cięte – Nanga; Bolleriocaps – Herbapol; Borelia Med – Berg Life; Borelio mieszanka ziołowa; Boreliol; Borelix forte – Produkty Bonifraterskie; Borelyma – Herbal Monasterium; Borrelia protect extra; Borreliosis tea – Everest ayuverda; Lyme Protector; Now Foods Andrographis Extract; OptiBorelia
	Pedaliaceae R. Br.			
89.	*Harpagophytum procumbens* DC. ex Meisn.	Southern Africa	*Harpagophyti radix*	Probio Borelio
	Lamiaceae Martinov (Labiatae Juss.)			
90.	*Betonica officinalis* L.	Europe, western Asia, northern Africa	*Betonicae herba*	Borelfix – Herbarium św. Franciszka
91.	*Mentha ×citrata* Ehrh.	hybrids	*Menthae citratae folium*	Nanomyko – B&M; Czystek – sekrety zielnika
92.	*Ocimum tenuiflorum* L.	Indian subcontinent	*Ocimum Sanctum folium*	Borreliosis tea – Everest ayuverda
93.	*Origanum vulgare* L.	Mediterranean Basin, Siberia, Himalayas	*Origani herba*	BorelissPro; Nanoborrel – B&M Probio Borelio; Yango Borrelin
94.	*Rosmarinus officinalis* L.	Mediterranean Basin	*Rosmarinus officinalis folium*	Borelfix – Herbarium św. Franciszka
95.	*Salvia officinalis* L.	Mediterranean Basin, Asia Minor, Syria	*Salviae folium*	Maść szałwiowa elissa
96.	*S. sclarea* L.	northern Mediterranean Basin, north Africa, Central Asia	*Oleum Salviae sclarea*	Nanobarto – B&M
97.	*Satureja montana* L.	southern Europe, the	*Satureja montana*	Nanoborrel – B&M

		Mediterranean, Africa	*oleum*	
98.	*Scutellaria baicalensis* Georgi	China, Korea, Mongolia, Russian Far East, Siberia	*Radix Scutellariae baicalensis*	Bolleriocaps – Herbapol; Borelio mieszanka ziołowa; Nanoborrel – B&M OptiBorelia; Tarczyca bajkalska- magiczny ogród
	Asteraceae Bercht. & J. Presl (Compositae Giseke)			
99.	*Arnica montana* L.	Europe	*Arnicae flos*	Maść arnikowa elissa
100.	*Artemisia annua* L.	southeastern Europe, western Asia	*Artemisiae annuae herba*	Borelioza max; Lyme Protector; Nanobarto – B&M
101.	*Solidago virgaurea* L. s.str.	Eurasia, North Africa	*Herba Solidaginis*	Borelioza max
102.	*Stevia rebaudiana* Bertoni	Brazil, Paraguay	*Steviae rebaudianae folium*	Nanoborrel – B&M

Fig. 6. Selected plants traditionally used in the supporting treatment of Lyme disease: *Andrographis paniculata* – A, *Astragalus mongholicus* – B, *Cistus creticus* – C, *C. ×incanus* – D, *Dipsacus silvestris* – E, *Eleutherococcus senticosus* – F, *Gaultheria procumbens* – G, *Harpagophytum procumbens* – H, *Rhodiola rosea* – I, *Juglans nigra* – J, *Reynoutria japonica* – K, *Scutellaria baicalensis* – L, *Stephania tetrandra* – M, *Uncaria tomentosa* – N, *U. rhynchophylla* – O (Source: Public domen – https://pl.wikipedia.org/wiki/Wikimedia_Commons)

Rośliny wykorzystywane w leczeniu boreliozy

Streszczenie

Borelioza z Lyme jest chorobą bakteryjną przenoszoną przez kleszcze zakażone bakteriami z grupy *Borrelia burgdorferi*. Posiada nieswoiste objawy, takie jak: bóle głowy, gorączka, bóle mięśni, czy stawów, dlatego bywa często mylona z innymi chorobami. W jej przebiegu wyróżnia się 3 stadia: wczesne (rumień wędrujący), wczesne rozsiane (dolegliwości układu kostno-stawowego, ośrodkowego nerwowego) oraz późne (dolegliwości mięśniowo-szkieletowe, arytmia, jednostronne porażenie twarzy, stany zapalne mózgu, rdzenia kręgowego, bóle głowy itd.). Leczenie polega na antybiotykoterapii. Po zakończeniu leczenia, pacjenci mogą zastosować protokoły ziołolecznicze, które wspomagają organizm i mogą poprawić samopoczucie.

Celem głównym tego opracowania było sporządzenie wykazu roślin wykorzystywanych we wspomaganiu terapii boreliozy po zakończonej antybiotykoterapii, w oparciu o preparaty ziołowe i suplementy diety występujące w sprzedaży bez recepty na terenie Polski. Analizie poddanych zostało 29 preparatów dostępnych stacjonarnie oraz 48 preparatów roślinnych dostępnych przez Internet (łącznie 77 leków i suplementów bez recepty). W składzie preparatów odnotowano 101 roślin i jeden gatunek grzyba. Wiele roślin wykorzystywanych w tego rodzaju fitoterapii wspomagającej, nie wykazuje bezpośredniego działania przeciwko krętkom boreliozy i posiada działanie ogólnie wspierające prawidłowe funkcjonowanie organizmu. Niektóre natomiast mają udowodnione właściwości bakteriobójcze (u większości nie zostało udowodnione bezpośrednie działanie w walce z boreliozą), wirusobójcze, wspierające prawidłowe działanie układu nerwowego oraz dostarczające wiele witamin i składników mineralnych potrzebnych dla zdrowia.

Słowa kluczowe: *Borrelia burgdorferi*, fitoterapia wspomagająca, rośliny lecznicze, suplementacja ziołowa

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