THERAPEUTIC PROPERTIES OF EPIGAEIC LICHENS FROM SOWIA GORA

Abstract: One of the aim of nature protection should be improving the knowledge of society about properties of observed organisms. It can be helpful in creating the properly ecological conspicuous. Some species of lichens, eg genus Usnea, Ramalina, Pseudevernia, Cetraria, were commonly used in medicine from antiquity time. Their therapeutic properties are connected with the presence of secondary metabolites, eg cetraric acid, furmarprotocetraric acid, usnic acid. Nowadays few of the lichens have still application in producing some pills, tablets, syrups, toothpastes.

During field trips in Sowia Gora (Puszcza Notecka) some epigaeic lichens known from therapeutic properties were recorded. Suggestion of necessity of putting some information connected with therapeutic properties of species in the didactic table along the road of nature complexes characterized by high diversity of lichens is given. It permits to increase the level of interest in this group of species and ipso facto contribute to protection of lichens.

Keywords: Cetraria, Cladonia, Peltigera, secondary metabolites, nature protection

Introduction

Among premises accompanying the process of taking action connected with nature protection, health motives are also distinguished. Maintenance of suitable quality of environment can be important in relation with sanity and physical health of human. Biodiversity of fungi, plants and animals matter eg in acquisition of natural compounds with potential biological activity. Carrying out of research on these organisms do not have to lead to destroying their stands of occurrence. Progress in organic syntheses and achievements in biotechnology caused that natural compounds, previously obtained...
only with use of substrates extractions, are nowadays both available in bigger amount and without influencing the environmental balance.

**Methodology**

During field trips to Sowia Gora (central Poland) some lichens which are known from their therapeutic properties were recorded. Specimens which determination was not carried in the field, were collected and identified using methodological procedures. Morphological features of species were checked and analyzes of chemical reaction were made. Thin Layer Chromatography (TLC) of some specimens was carried out according to Culberson and Amann [1]. Nomenclature followed Faltynowicz [2]. Analyzes of lichens compound in the aspect of their therapeutic properties were based on the available literature.

**List of special interest species recorded in Sowia Gora**

Sowia Gora is located in the south part of Miedzyrzecze Warty and Noteci [3], ca 12 km far away to north from Miêdzychód town. Pine forests are the most common communities growing here. In previous forest of Puszcza Notecka were often destroyed during some insects invasion and fires. Until now there are a few information about occurrence if epigaeic lichens observed in Puszcza Notecka [4–8]. Analyzes of species composition of plants and fungi in the community of Sowia Gora confirmed the presence of characteristic lichens both for Leucobryo-Pinetum and Cladonio-Pinetum forest [8].

During field trip in autumn 2008 species from three genus whose are known from their therapeutic properties were recorded:

I. Cladonia (Cl. arbuscula ssp. squarrosa, Cl. arbuscula ssp. mitis, Cl. ciliata ssp. tenuis, Cl. coccifera, Cl. coniocraea, Cl. chlorophaea, Cl. cornuta, Cl. deformis, Cl. furcata, Cl. gracilis, Cl. grayi, Cl. meroclorophaea, Cl. pleurota, Cl. portentosa, Cl. pyxidata, Cl. rangiferina, Cl. subulata, Cl. squamosa, Cl. uncialis);

II. Cetraria (C. aculeata, C. islandica);

III. Peltigera (P. rufescens).

**Therapeutic properties of recorded lichens**

Curing properties of plants are known since ancient time. In the Ebers’ papyrus (1550 BC) list of ca 900 prescription of different drug, 877 suggestions of treatment of injury and a few hundreds of name of medicinal plants were given. Hippocrates suggested some therapies with using of natural substances, and unusual rich in plants drug medicine of East (Chinese, Indian) believed in their unlimited curing potential [9, 10]. According to some ancient opinion, shape of plants and fungi could influence the efficiency of the treatment of ill organs [10].
Related to lichen substances first studies come from the middle of 19th century. A big contribution in the developing of this part of photochemistry had German botanist and chemist Wilhelm Zopf [11]. In his work “Die Flechtenstoffe” 150 lichens substances were described [12]. Another available contribution to the recognition of lichens chemistry has Japanese researchers Yasuhiko Asahina and Shoji Shibata. They defined structures of many lichens secondary compounds, and also developed the technique that allowed identification of lichens substances by using of microcrystalography [11]. Attention was also given to the biological activity of secondary compounds. The antibacterial properties were observed as one of the first ones. Further studies brought also other precious advantageous to the light, eg antivirus, antitumour, antioxidative, fotoprotected and properties of enzymes inhibitions [11, 13].

Fund near Sowia Gora some epigaeic species represent genus Cladonia, Cetraria and Peligera whose therapeutic protection are known for a long time. Discovery concerns Cetraria islandica known under many names (eg Iceland moss) [14]. Species is still used to the receiving of extraction which help in treatment of illness of the respiratory system. Studies proved that discussed drug contained so-called acidic lichens (compounds included in the different chemical group characteristic for lichens). According to the literature data cetraric acid, furmarprotocetraric acid (aromatic compounds belonged to β-ordinol depsidones), protolichesterinic acid (an aliphatic γ-lacton), usnic acid (reported in the small amount or not detected, a dibenzofuran derivate) [15] can be distinguished. Moreover, polysaccharides, principally lichenan (lichenin), isolichenan (isolichenin), and galactomannans were also mentioned in the article. Above that some other constituents were discovered: naphtoquinone (naphthazarin) [13, 16], minerals (iron, magnesium, calcium, lead, arsenic, cadmium, mercury), carotenoids, [14], fatty acids (linoleic, oleic and linolenic acids), sterols (ergosterol, ergosterol peroxide), triterpenes (lupel, α-amyrin), the sesquiterpene lactone bakkenolide and monoterpenes (carvone, camphor, borneol) [15]. Thanks to that research it was proved that compounds belonging to polysaccharide group, isolated from higher plant, fungi, and lichens [17] have immunomodulatory, antiviral, radioprotective, anti-ulceric and anti-atherosclerotic properties [17, 19]. The experiments carried out on rats proved that polysaccharides decrease number of infections after operation. The results obtained difference in biological activity depending on place of this activity (pro-inflammatory or anti-inflammatory) [18]. Researches on polysaccharides of C. islandica conducted on human dendritic cells confirmed immunomodulating lichenin effect. Tests based on similar method of izolichenin, and also two other secondary metabolites (protolichesterinic acid, furmarprotocetraric acid) didn’t revealed the similar activity [19].

In Poland, a drug (thallus of C. islandica) is an imported product and it its used to prepare the mixtures and extracts, element of complex drug (Pectosol – drops used in the inflammation of respiratory tract, Isla-moos and Isla-mint – pills for suction used in cough and hoarseness, Activ-angidín, Junior-angin, Fiorda, Herbitussin – for sore throat and inflammatory of oral cavity, Padma 28 – pills used to reinforce the immune system). Also toothpaste from BlanX series combines the extraction from Iceland moss is available which gives additional antibacterial effect on the tooth. Because of bitter
taste of compounds of the material, *C. islandica*, is also used to improve the digestion, and to increase appetite. Antibacterial activity comes out from presence protolichesterinic and protocetraric acid in the material [20]. Interesting may appear the fact that *C. islandica* as pulmonary tuberculosis (tuberculosis) drug was given also to F. Chopin [19]. Moreover, researches proved immunomodulating, anti-inflammatory, antiviral, antioxidant [19, 21] properties of extract. The gastroprotective activity of *C. islandica* is related to presence of protolichesterinic acid in its thallus. The research demonstrated that this element is active against *Helicobacter pylori*, bacterium responsible for development of gastric and duodenum ulcer [13].

*Cetraria aculeata* was the next species found in Sowia Gora. According to the literature species reveals antibacterial [22], antigenotoxic in bacterial systems and cytotoxic properties of extraction [23]. The research did not confirm antifungal properties [22].

*Peltigera rufescens* is representative of lichens from *Peltigera* genus in the investigated region. The extract prepared from thallus of mentioned above lichens revealed antioxidative properties in *in vitro* research. Although there is a lack of information concerning its use in traditional medicine, some sources shows that other species of this genus were used for the certain disorders. *Exempli gratia* *Peltigera canina* can be given which powdered thallus was use in order to prepare antirabies drug [18, 24]. In India and Ireland, *P. canina* was used to cure liver disease, this is also know for its laxative effect. Other species from discussed genus – *Peltigera aphthosa* was traditionally used as vermifuge [24].

In the vicinity of Sowia Gora was also recorded an important presence of species from genus *Cladonia*. Traditionally, some of them (*eg* *Cladonia rangiferina*, *Cl. pyxidata*) were used to remove fevers, colds, coughs, whooping cough, and other problems such as: arthritis, constipation, convulsions or tuberculosis [24]. One of the often occurring secondary metabolites in *Cladonia* genus is usnic acid [25]. Universality of usnic acid favors of development researches on its biological properties.

The compound was used in many countries as antibacterial medication in skin diseases. First mention about antibacterial properties of usnic acid come from fifty years of 20th century [26], also antiprotozoal, antivirus, anti-inflammatory, analgesic, antipyretic, antimyototic (inhibition of cell division), and antitumour activity of usnic acid was proved [27, 28]. Research conducted on rats showed also protection activity for mucous membrane of stomach [29]. The extract containing of usnic acid can protect against harmful radiation UVB. Moreover, they may reduce inflammatory reaction of skin connected with UV radiation, inflammatory reaction of skin [30]. Nowadays other formula of an usnic acid – “Usno” is known, medicament used in clinical bacterial infection. Usnic acid is also use as compound of toothpastes and toothrinses [31]. Above those curative properties, it is important to emphasize that the occurrence of allergic reaction to usnic acid is very unlikely, and furthermore this process is normally weak [28]. Some other results of research also show that hepatotoxicity properties can be observed while taking bog doses (it may damage or influence functioning of liver) [32].
Conclusion

Epigeic species recorded in Sowia Gora represent a few genus of lichens known from their therapeutic properties. One of the observed species – *Cetraria islandica* is well-known in traditional medicine, and also matters in modern phototherapy. One of the important lichens substances possessing of biological activity confirmed by research is presented in the text usnic acid (extracted eg from some *Cladonia* species).

In order to develop people awareness about therapeutic properties of lichens, some information should be given on the notice board, putting them especially where many species of lichens can be found, may increase interest in those organisms, till now commonly used mainly as bioindicators [33–35].

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References

Abstrakt: Jednym z celów ochrony przyrody powinno być poszerzanie wiedzy społeczeństwa na temat właściwości obserwowanych organizmów. Może to być pomocne w kreowaniu właściwej świadomości prośrodowiskowej. Niektóre gatunki porostów, np. z rodzaju *Usnea*, *Ramalina*, *Pseudevernia*, *Cetraria*, były powszechnie wykorzystywane w medycynie od czasów starożytnych. Ich lecznicze właściwości powiązane są z obecnością metabolitów wtórnych, takich jak kwas cetrarowy, kwas furmaprotocetrarowy, kwas usninowy. Obecnie istnieje grupa porostów, która jest wykorzystywana przy produkcji tabletek, syropów, past do zębów.

Podczas badań terenowych w okolicach Sowiej Góry (Puszcza Notecka) udało się zaobserwować interesujące porosty naziemne wykazujące właściwości lecznicze. W artykule zasygnalizowano konieczność umieszczania informacji na temat właściwości leczniczych porostów na tablicach w kompleksach przyrodniczych cechujących się duzym bogactwem gatunkowym porostów. Pozwoli to zwiększyć zainteresowanie tą omówioną grupą organizmów i tym samym przyczynić się do ochrony porostów.

Słowa kluczowe: Cetraria, Cladonia, Peltigera, metabolismy wtórne, ochrona przyrody