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Traditional Medicinal Uses of Mosses

Atakan BENEK[1*], Kerem CANLI[2,3], Ergin Murat ALTUNER[4]

[1] Kastamonu University, Graduate School of Natural and Applied Sciences, Kastamonu, TÜRKİYE
[2] Dokuz Eylül University, Faculty of Arts and Science, İzmir, TÜRKİYE
[3] Dokuz Eylül University, Research and Application Center for Fauna Flora (FAMER), İzmir, TÜRKİYE
[4] Kastamonu University, Faculty of Arts and Science, Kastamonu, TÜRKİYE

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Abstract

The use of plants by people has a history as old as the existence of humanity. From ancient times to the present, humanity has sought solutions to diseases by making use of plants in nature. Plants that were beneficial against diseases by trial and error in the old times were recognized, used, and passed on to future generations. This process, which has been going on for centuries between plants and humans, continues as an ethnobotanical science that has been accepted worldwide today and where great resources are transferred and important researches are carried out. One of the plant groups used in the treatment of diseases is Bryophytes. Approximately 150 ethnobotanical bryophyte species are known worldwide. One of the important groups in the bryophyte division is mosses, which can live on wet grounds, in humid environments, sometimes completely submerged in water or on soil, rocks, and tree trunks in wide areas from swamps to alpine and arctic regions. Although the general characteristics of mosses vary according to different systematic schools, they are included in the Bryophyta division, which includes 1036 genera and approximately 18.409 species. Chinese and Native Americans discovered centuries ago that moss is effective in healing wounds and reducing infections in wounds. Since this discovery, mosses have been extensively studied and used in various fields. The majority of the species used are generally listed in Traditional Chinese Medicine and by Native North Americans. In this study, the use of mosses in traditional medicine is explained.

Keywords: Moss, Traditional Medicine, Ethnobotany, Ethnobryology

Karayosunlarının Geleneksel Tıbbi Kullanımları

Öz

Bitkilerin insanlar tarafından kullanılması, insanlık tarihi kadar eski bir geçmişe sahiptir. Antik çağlardan günümüze insanlık, doğada bulunan bitkilerden yararlanarak hastalıklara çare aramıştır. Eski zamanlarda deneme yanılma yoluyla hastalıklara karşı faydalı olan bitkiler tanındı, kullanıldı ve gelecek nesillere aktarıldı. Bitkiler ve insanlar arasında yüzyıllardır devam eden bu süreç, günümüzde dünya çapında kabul görmüş, büyük kaynakların aktarıldığı ve önemli araştırmaların yapıldığı bir etnobotanik bilimi olarak devam etmektedir. Hastalıkların tedavisinde kullanılan bitki gruplarından biri de Briyofitlerdir. Dünya çapında yaklaşık 150 etnobotanik briyofit türü bilinmektedir. Briyofit bölümünde önemli gruplardan biri, bataklıklardan alpin ve arktik bölgelere kadar geniş alanlarda, ıslak zeminlerde, nemli ortamlarda, bazen tamamen suya veya toprağa, kayalara ve ağaç gövdelerine yayılmış olarak yaşayabilen karayosunlarıdır. Karayosunları genel özellikleri farklı sistematik ekollere göre değişmekle birlikte 1036 cins ve yaklaşık 18.409 tür içeren Bryophyta bölümünde yer alırlar. Çinliler ve Yerli Amerikalılar, karayosunlarını yaraları iyileştirmede ve yaralardaki enfeksiyonları azaltmada etkili olduğunu yüzyıllar önce keşfettiler. Bu keşiften bu yana, karayosunları kapsamlı bir şekilde incelenmiş ve çeşitli alanlarda kullanılmıştır. Kullanılan türlerin çoğu genellikle Geleneksel Çin Tıbbında ve Yerli Kuzey Amerikalılar tarafından listelenmiştir. Bu çalışmada yosunların geleneksel tıpta kullanımı anlatılmıştır.

Anahtar kelimeler: Karayosunu, Geleneksel Tıp, Etnobotanik, Etnobriyoloji,

* Corresponding author: atakan.benek@hotmail.com

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1. Introduction

Humanity has used different methods and drugs to combat diseases from the day they existed to the present day. The main ingredients of drugs that have been used in the fight against diseases that have been going on for centuries usually consist of natural products (Arslan, 2005). The natural products used in the raw materials of the drugs used or in use are generally obtained from various plant groups in the world and one of these plant groups is mosses.

1.1 General Characteristics of Mosses

Although the bryophyte division, which includes mosses, varies according to many different systematics, it consists of 1036 genera and 18.409 species. Mosses constitute a large part of this division with approximately 13.000 species. The bryophytes are studied in three divisio: mosses (*Bryophyta*), hornworts (*Anthoceratophyta*), and liverworts (*Marchantiophyta*) (Goffinet et al., 2009). As a result of the research that started in 1829 in Turkey and continues today, our bryophyte flora consists of 1047 taxa, 844 moss, 4 hornwort, and 199 liverwort (Abay et al., 2021). Mosses are one of the important members of the ecosystems around the world, especially the forest ecosystem. Many species of mosses are resistant to extreme conditions, such as cold at low temperatures and hot at high temperatures. Even if some mosses lose large amounts of water due to the dry and harsh weather conditions in their living environment, they can be revived when they regain water. Thanks to these features, mosses have been maintaining their existence in the ecosystem they are in for a very long time (Canlı, 2012).

After a forest fire in a region, mosses are the first to invade the area where the fire took place. By forming colonies in the burned area, they increase the declining soil quality and moisture and provide suitable conditions for life in the region again. The most important feature of mosses that allows them to increase the amount of moisture in the soil is that they can hold water up to 12 times their dry weight in their structure. Thanks to the mosses, the plant seeds that fall on the soil in the humid environment germinate and as a result, the continuity of the forest existence is ensured (Altuner, 2008). Mosses can continue to live on wet grounds, in humid environments, sometimes completely submerged in water or on soil, rocks, and tree trunks in very large areas from swamps to alpine and arctic regions. In addition, being a source of food for some animal species, storing minerals in their structures, and creating a spawning and shelter environment for many insect species are important features of mosses (Çetin, 1998).

Mosses have a life cycle consisting of haplodiplont progeny exchange. In mosses, sexual reproduction takes place in the form of oogamy and they show heterophasic (antithetic) intergenerational alternation. Gametophyte progeny can be monoic or dioecious. The male organs are cylindrical and are called antheridium, while the female organs are bottle-shaped and called archegonium. The spermatozoids formed in the antheridium carry double flagella and reach the female organ by rainwater or chemotaxis. As a result of fertilization, a diploid (2n) sporophyte plant is formed, which continues its development on the gametophyte and is called a spore capsule. The sporophyte is in the form of a single stem (seta) without leaves and lives as if it were a parasite, providing its nutritional needs with a foot that grows right in the gametophyte. The sporogenic tissue (*Archeospore*) formed as a result of the differentiation of the inner tissue of the sporophyte undergoes meiosis and gives haploid (n) spore tetrads. These spores germinate to form protonema. The protonema also develops to form the gametophyte plant. In most mosses, the operculum at the tip of the capsule, peristome teeth, and annulus under the operculum play a role in the dispersal of spores from the capsule (Çetin, 1989).

1.2 Classification of Mosses

The term Bryophyte is used to describe the large plant group that includes mosses (*Musci*), hornworts (*Anthocerotae*), and leafy liverworts (*Hepaticae*). Comparing the bryophyte division with ferns, algae, fungi, and flowering plants, it is accepted that bryophytes are more complex than algae and fungi, and more primitive than flowering plants and ferns, from an evolutionary point of view edilmektedir (Erdağ and Kürschner, 2017). The first fossil identified within the division of bryophytes belongs to the genus *Hepaticies devonicus* and is the tallus of the small leafy liverwort that lived approximately 400 million years ago. Although the ancestor of the present-day bryophytes is not certain, when evaluated in other fossil records identified, it is thought that they evolved about 450 million years ago. There are three different hypotheses about the emergence of bryophytes (Şimşek et al., 2016).

According to the first hypothesis, it is thought that the bryophytes existing today share a common ancestor with green algae. Green algae show two evolutionary lines, and they are *Chlorophyceae* and *Charophyceae*. According to this hypothesis, it is suggested that bryophytes and other plants showing archegonium structure are descended from the *Chlorophycean* line. The basis of the hypothesis is

that the protonemas of bryophytes are structurally similar to algae (Turmel et al., 2020). The second hypothesis of the emergence of bryophytes predicts that a green unicellular alga may evolve into a plant adapted to a moist soil environment and that plants with archegonium may also be ancestors of the *Charophyta* algae (Altuner, 2008). According to the third and last hypothesis, it is suggested that bryophytes evolved from primitive vascular plants. This hypothesis also expresses the possibility of ancestral archaegonates from evolutionary lines with both leafy and thallus from which the radially symmetrical upright gametophore is derived (Schofield, 2001).

The mosses families that exist today emerged at the end of the Mesozoic era. According to the fossils found, flowering plants were emerged 135 million years ago during the Create period. As a result, it was understood that ancestral mosses existed on earth approximately 264 million years before flowering plants (Altuner, 2008).

1.3 Uses of Mosses

Mosses have been used in many areas since ancient times, thanks to their different properties. The areas of use of mosses are mainly examined under two headings as their use due to their antimicrobial activities against bacteria and their use not due to their antimicrobial activities.

The basis of the use of mosses due to their antimicrobial activities are their use in the treatment of various diseases. For example, in the treatment of various diseases such as acne, hemorrhoids, and skin diseases, the active substance called Sphagnol, which is found in the Sphagnum genus moss, is used. The antimicrobial activity of the obtained substance is also used in different fields (Altuner, 2008). Apart from being used as medicine, they were also used in bandages obtained from moss during the First World War. Another use of mosses is the biofilters obtained from mosses, which have been preferred recently in Europe, especially in the USA and Canada, because they do not harm the environment (Canlı, 2009).

Non-antimicrobial activities of mosses are classified according to their different properties in various fields such as horticulture and agriculture, animal husbandry, fuel, food, construction industry, cosmetics industry, household, clothing making, and ecological uses of moss. In addition, the ecological use of mosses is classified in more detail by subheading the use of mosses as an indicator plant, for erosion control purposes, for enriching the soil with nitrogen, and for cleaning pollutants (Canlı, 2009).

2.Traditional Medicinal Uses of Mosses

For centuries, people have benefited from plants in almost every aspect of their lives. One of the most important areas where people have benefited from plants throughout history has been in the fight against diseases. From past to present, people in many different parts of the world have discovered the effects of plants against diseases by trial and error. Today, this accumulation of knowledge has been accepted by everyone around the world and has formed the branch of ethnobotany, on which important researches on which serious resources are transferred (Kendir and Güvenç, 2010).

In addition to the term ethnobotany, which encompasses all plants, the term "Ethnobryology" was coined in 1957 by the bryologist Seville Flowers, denoting the medical uses of bryophytes. Flowers used the term ethnobryology to describe the use of bryophytes as medicine by the Gosiute people of Utah (Flowers, 1957). There is less information in the literature about the medicinal use of bryophytes than about the medicinal uses of seed plants. The reason for this is that bryophytes have less medical use today and researchers working in the field of ethnobotany direct their priorities to seed plants.

The term ethnobryology includes all three divisio of Bryobiotina, namely mosses (*Bryophyta*), hornworts (*Anthoceratophyta*), and leafy liverworts (*Marchantiophyta*). To date, about 150 enthnobryological species have been listed. The vast majority of listed species have reported their use in Traditional Chinese Medicine (27%) and by Native North Americans (28%). It is known that *Sphagnum*, *Marchantia*, and *Polytrichum* are the genera that have the most common medical use among bryophytes (Harris, 2008). In this study, the traditional medicinal uses of mosses were examined under four headings: their use in China, America, India, and Europe.

2.1 Use of Mosses in Traditional Chinese Medicine

One of the oldest civilizations in the world, China is also one of the nations with the oldest medical practices. Many of the basic principles of traditional Chinese medicine were formed from the philosophical foundation that led to the development of Taoism and Confucianism. Ancient Chinese scientists classified all phenomena found in nature as Yin and Yang, which were complimentary but opposite to each other. They stated that everything in nature consists of five basic elements, namely fire, water, earth, air, and metal, and that nature constantly moves in the direction of balance and harmony. Applying all this knowledge to

identify, treat and prevent diseases, they created Chinese medicine (Tang et al., 2008).

Yin, one of the concepts of Yin and Yang, which forms the basis of traditional Chinese medicine, refers to the physical characteristics of the living thing, and Yang refers to its physiological functions. Supporting these two concepts, the concept of Qi describes energy and blood circulation. The organs in the body ensure the living of the creature by regulating and protecting the Qi, that is, the blood, through the veins. In the living, the disease occurs after a disorder in Yin-Yang or Qi. The treatment applied after this point aims to eliminate the cause of the disease and restore the balance in the body (Tang et al., 2008).

In Traditional Chinese medicine, many different methods and materials are used, and plants are the most used materials. According to different pharmacopeias, more than 11.000 plant species are mentioned in Traditional Chinese Medicine, and about 700 of them are widely used. Thousands of drugs have been created by using plants alone or in combination in the treatment of diseases. Since the prepared drugs have more than one plant and more than one effective substance, they can affect different targets in the cells at the same time and can cure diseases (Li, 2015; Ye et al., 2010). One of the plant groups used in Traditional Chinese Medicine, where thousands of plants are used, is moss. The Chinese have widely used mosses to treat fever, pain, wounds, burns, tooth decay, poisonous snake bites, tuberculosis, epilepsy, pneumonia, convulsions, neurasthenia, and various diseases such as heart disease. Mosses used in Traditional Chinese Medicine and their areas of use are listed in Table 1 (Ding, 1982; Asakawa, 1998; Harris, 2008; Asakawa and Ludwiczuk, 2017).

Table 1. Use of Mosses in Traditional Chinese Medicine

FAMILY/SPECIES	DISEASE	SOURCE
Bryum argenteum	Antidote, Antipyretic, Antifungal	Asakawa, 2007
Climacium dendroides	In rheumatism and bone pain, Muscle relaxant	ZhongHuaBenCao, 1999
Cratoneuron filicinum	Heart diseases	Ding, 1982
Conocephalum conicum	Eczema, Cuts, Snake Bites	Ando ve Matsuo, 1984
Dicranum majus	Cough suppressant	ZhongHuaBenCao, 1999
Ditrichum pallidum	Used for convulsions in babies	Harris, 2008
Entodon compressus	Diuretic, Sedative	Ding, 1982
Fissidens nobilis	Diuretic, Hair growth stimulant	Harris, 2008
Fontinalis antipyretica	Antipyretic	Wu ve Jia, 2003
Funaria hygrometrica	Hemostatic, Sedative	Asakawa, 1990
Haplocladium microphyllum	Tonsillitis, Bronchitis, Cystitis	Ding, 1982
Leptodictyum riparium	Antipyretic, Urinary tract infections	Pant, 1998
Leucodon secundus	Hemostatic, Analgesic	ZhongHuaBenCao, 1999
Meteoriella soluta	Hemostatic, Sedative, Anti-inflammatory	Ding, 1982
Mnium cuspidatum	Hemostatic	Asakawa, 1990
Oreas martiana	Hemostatic, Analgesic, Neurasthenia	Asakawa, 2007
Philonotis sp	Bone fractures, Burns	Saxena, 2004
Philonotis fontana	Tonsillitis	Pant, 1998
Plagiopus oederi	Heart diseases, Epilepsy	Asakawa, 1990
Pogonatum sp.	Diuretic, Hair growth stimulant	Pant, 1998
Pogonatum cirratum	Heart diseases	Harris, 2008
Pogonatum inflexum	Heart diseases, Wounds, Hemostatic	ZhongHuaBenCao, 1999
Pogonatum microstomum	Gallstone treatment	ZhongHuaBenCao, 1999
Polytrichastrum alpinum	Cough suppressant, Hemostatic, Sedative	Luo, 2000
Polytrichum commune	Hemostatic, Uterine prolapse	Cheng ve ark., 2012
Polytrichum juniperinum	In the treatment of prostate, Diuretics, Burns	Hart, 1981
Polytrichum piliferum	Diuretic, Hair growth stimulant	Karpinski ve Adamczak, 2017
Rhodobryum giganteum	Antipyretic, Diuretic, Cuts	Asakawa, 2008
Rhodobryum roseum	Heart diseases	Wu, 1982
Sphagnum (Sphagnaceae)	Eye diseases, Skin diseases	Bland, 1971
Sphagnum sericeum	Acne, Hemorrhoids, Eye diseases	Ding, 1982
Sphagnum teres	Eye diseases	Ding, 1982
Taxiphyllum taxirameum	Hemostatic, Anti-inflammatory	Du, 1997
Tetraplodon mnioides	Sedative, Stroke treatment	Ding, 1982
Weissia controversa	Sinus inflammation, poisoning	ZhongHuaBenCao, 1999
Weissia viridula	Sinus inflammation	Ding, 1982

2.2 Uses of Mosses in Traditional American Medicine

The American continent, which was isolated from other societies in the world until the 16th century, consisted of different peoples until the time it was discovered. It is known that the Inca people were the dominant people in South America until the 16th century and had good medical knowledge. In Central America, there are Aztec and Maya peoples whose medical knowledge can compete with the Inca people. In the same period, there were Native American peoples in North America (Pedersen and Baruffati, 1985).

Information about the traditional medicine methods and medicines of the Native American peoples has been transmitted to the present day through an oral tradition that usually includes ceremonial practices. Indigenous peoples learn and respect these treatment methods and materials under the guidance of their elders of the younger generations. It is known that much more of what is known today remains a secret among indigenous peoples since the vast majority of information transmission is in oral traditions and does not contain a written record (Redvers and Blondin, 2020).

Mosses have an important place in traditional American medicine where many bryophytes are used. The Gasuite Indians living in the Utah region of America used various types of caracals such as Philonotis, Bryum, Mnium to reduce the pain in the burned area (Ando and Matsuo, 1984; Sabovljevic et al., 2016). The antibiotic properties of *Sphagnum* moss were discovered by Native Americans living in Alaska and mixed with oil and used as an ointment (Schofield, 1969; Miller and Miller 1979). *Lunularia cruciata* species moss has been used by natives living in Peru by boiling and in the form of tea in the treatment of kidney diseases (Franquemont et al., 1990). *Marchantia polymorpha* moss has been used in the treatment of tuberculosis and tuberculosis in Cuba, in the removal of stones in the bladder, and in the treatment of liver diseases in Colombia (García, 1992; Roigy, 1945). The mosses used in traditional American medicine are listed in Table 2.

Table 2. Uses of Moss in Traditional American Medicine

FAMILY/SPECIES	DISEASE	SOURCE
Bryum argenteum	Antidote, Antipyretic, Antifungal	Asakawa, 2007
Bryum capillare	Burns, Fungal Infections	Sturtevant, 1954
Conocephalum conicum	Mouth sores, Rash, Itching	Boas, 1966
Eurhynchium oreganum	Wound and hand cleaning	Turner and Efrat, 1982
Fissidens adianthoides	Diuretic, Hair growth stimulant	Sabovljević et al.., 2016
Fissidens flexinervis	In digestive problems	Boom, 1996
Hylocomium splendens	Wounds	Turner et al., 1990
Isopterygium tenerum	In rheumatic pains	Boom, 1996
Isothecium stoloniferum	Hand cleaning	Turner and Efrat, 1982
Lunularia cruciata	Kidney diseases	Franquemont et al., 1990
Marchantia polymorpha	Tuberculosis, Tuberculosis, Kidney stone	Pinheiro et al., 1989
Mnium punctatum	Swelling	Compton, 1993
Octoblepharum albidum	Headache, Antipyretic	Boom, 1996
Oreas martiana	Hemostatic, Analgesic, Neurasthenia	Asakawa, 2007
Orthostichopsis tortipilis	Cuts, Snake bites, Stomach pain	Kohn, 1992
Philonotis sp	Bone fractures, Burns	Saxena, 2004
Polytrichum commune	Wounds	Herrick, 1995
Polytrichum juniperinum	In the treatment of prostate, Diuretics, Burns	Hart, 1981
Rhytidiadelphus loreus	Boils, Abscess, Wounds	Turner, 1973
Rhytidiadelphus triquetrus	Pains	Herrick, 1995
Sphagnum sp	Burns	Blackwell, 1990
Thuidium schistocalyx	Headache	Boom, 1996
Trichosteleum papillosum	Rheumatic pains	Boom, 1996

2.3 Uses of Moss in Traditional Indian Medicine

India is a country with more diversity in terms of geography, language, religion, climate, and culture than any other country in the world. Today, it is divided into 9 states and 7 regions and more than 2000 different ethnic groups live together (Rahman et al., 2019). The Indian healthcare system remains inadequate due to its high population, which continues to increase, and the vast majority of the population still uses traditional medical methods. The World Health Organization states that 80% of people living in developing countries rely only on traditional medicine for primary health care (Kumar and Navaratnam, 2013).

It covers thousands of different plants in traditional Indian medicine, which covers the medicinal methods of many countries and hundreds of different communities in its region. One of the different approaches to the use of plants in traditional Indian medicine is the concept of Paracelsus, which deals with the shape and structure of an organ in the body of a human or animal that is expected to heal and the similarity of plant parts (Chandra et al., 2017). According to this philosophy, *Polytrichum commune* bears hairy calyptra and because it resembles hair, the oil extracted from this moss was used by women for hair treatment in ancient times (Glime, 2007).

If the use of mosses in traditional Indian medicine is examined, *Mnium* have been used in burns, wounds, and stopping bleeding, and *Philonotis* species have been used as antipyretics (Singh et al., 2011; Asakawa et al., 2013). The mosses used in traditional Indian medicine which use thousands of different types of plants are listed in Table 3.

Table 3. Uses of Moss in Traditional Indian Medicine

FAMILY/SPECIES	DISEASE	SOURCE
Aerobryum lanosum	Burns	Lubaina et al., 2014
Barbula indica	Antipyretic	Lubaina et al., 2014
Brachythecium rutabulum	Cuts, Burns, Wounds	Pant and Tewari 1989
Cratoneuron filicinum	Heart diseases	Asakawa et al., 2013
Entodon flavescens	Earache	Lubaina et al., 2014
Entodon myurus	Antibacterial	Singh et al., 2011
Hyophila attenuata	Cough suppressant, Neck pain	Lubaina et al., 2014
Hyophila involuta	Cuts, Burns	Dagar and Dagar, 1999
Leucobryum bowringii	Pain treatment	Mitra et al., 2019
Leptodictyum riparium	Urinary tract inflammation	Asakawa et al., 2013
Marchantia polymorpha	Liver ailments	Miller and Miller, 1979
Mnium sp.	Burns, Wounds, Hemostatic	Singh et al., 2011
Mnium cuspidatum	Hemostatic	Pant and Tewari, 1998
Philonotis sp.	Antipyretic, Adeno Pharyngitis	Asakawa et al., 2013
Philonotis fontana	Antipyretic, Adeno Pharyngitis	Flowers, 1957
Plagiochasma appendiculatum	Skin diseases	Kumar et al., 2000
Plagiopus oederi	Epilepsy treatment, Antipyretic	Pant and Tewari, 1998
Pogonatum macrophyllum	Anti-inflammatory, Antipyretic, Laxative	Alam, 2012
Polytrichum commune	Hair care	Glime, 2007
Polytrichum juniperinum	Burns, Diuretic, Prostate treatment	Karpinski and Adamczak, 2017
Rhodobryum giganteum	Heart diseases, Diuretic	Pant and Tewari, 1998

2.4 Uses of Mosses in Traditional European Medicine

The first medicinal uses of bryophytes in Europe were recorded in the first century, and the majority of those in the Bryophyta division have been described as having medicinal use since the 16th century (Drobnik and Stebel, 2014). Galen, who lived in the 1st century, mostly listed Italian medicinal plants, and the plants on this list were collected and used by the people living later (Cooper, 2010). The historical medical applications of the bryophyte species in the list are in line with the pharmacological knowledge of bryophytes currently available (Asakawa, 2007; Asakawa et al., 2013; Drobnik and Stebel, 2014).

The earliest records of the use of bryophytes in traditional European medicine are based on the publication by Schwenckfeld (1600). This publication is of great importance as the author is recognized as one of the first local floras from the 1600s, and Schwenckfeld corresponded with other European scientists C. Bauhin and the Silesian, thus learning about the medicinal applications of plants. Schwenckfeld made use of Fuchs, who defined 2-3 bryophyte taxa in his explanations about the medical uses of bryophytes (Drobnik and Stebel, 2015).

Regarding the use of mosses in traditional European medicine, it is known that *Polytrichum formosum*, *Funaria hygrometrica* and *Polytrichum commune* species were used in Europe between 1530 and 1600 (Drobnik and Stebel, 2015). The mosses used in traditional European medicine are listed in Table 4.

Table 4. Uses of Moss in Traditional European Medicine

FAMILY/SPECIES	DISEASE	SOURCE
Bryum argenteum	Fungal infections	Frahm, 2004
Ceratodon purpureus	Fungal infections	Frahm, 2004
Dicranum scoparium	Antimicrobial	Pavletic and Stilinovic, 1963
Fontinalis antipyretica	Antipyretic	Drobnik and Stebel, 2014
Funaria hygrometrica	Diuretic, Epilepsy, Kidney stone reducer	Pant and Tewari, 1998
Polytrichastrum alpinum	Runny nose, Tearing eyes	Agalet and Valles, 2003
Polytrichum commune	Diuretic, Urinary tract infections	Grieve, 1970

3.Conclusion

Mosses have been used by many different peoples in many different regions of the world throughout history. As seen in this study, it has effects against many different diseases. Considering the increasing world population, epidemic diseases, and antibiotic resistance, it is seen that the mosses are an important source for new pharmaceutical agents.

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