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A COMPARATIVE STUDY OF EPIPHYTIC LICHENS
MENTIONED BY IBN SINA AND IBN AL-BAYTAR

MUSTAFA YAVUZ

History of Science Department

Istanbul Medeniyet University, Istanbul, Turkey, TR

SUMMARY

Lichens are symbiotic organisms consisting in a mycobiont and at least a photobiont partner. Producing unique secondary metabolites, they have been used in medicine, pharmacy and dyeing from antiquity to modern times. The purpose of this study is to investigate and compare the uses of lichens in the medicinal works of Ibn Sina and Ibn al-Baytar in Arabic, based on the term used to describe epiphytic lichens. Two manuscripts of Ibn Sina and Ibn al-Baytar preserved at Süleymaniye Manuscript Library in Istanbul have been examined in order to make a comparison of the data in the chapter entitled Ushnah. In addition, contemporary studies have been consulted to illustrate contemporary knowledge of lichens and their therapeutic properties and uses. On the basis of a systematic comparison, it appears that both physicians mention lichens under two different terms, with one dedicated to saxicolous lichens and the other to epiphytic lichens, with more precise information on the latter.

Introduction

Lichens

Lichens are unique organisms of a symbiotic association between fungal (mycobionts) and photoautotrophic algal partners (photobionts). Since the mycobiont in this symbiotic association usually

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dominates, lichens are traditionally classified as a lifeform of fungi¹. The mycobionts of about 18,500 lichen species described around the world mostly (98 %) belong to Ascomycota and the remaining (2 %) belong to Basidiomycota and Deuteromycota².

A lichen thallus usually consists of layers such as an upper and lower cortex, algal layer and medulla as given in Fig. 1. The layers differ in thickness and are better developed in some species than in others. Fungal hyphae make up most of the thallus; photobionts are cells of only a small percentage (about 7 %) of the total volume³. There are three main types of thalli: crustose, foliose and fruticose. A crustose thallus is generally considered to be the most primitive type since it lacks a lower cortex and consists only of powdery granules, but not layers. Many crustose lichens stick tightly to the substrata and appear to be painted on it.

A foliose thallus has an upper and lower cortex, a medulla of algal layer, and it is usually attached loosely to the substrate by hair-like structures called rhizines. Some foliose lichens have thalli that are attached to the substrate by only one central point. Fruticose thalli

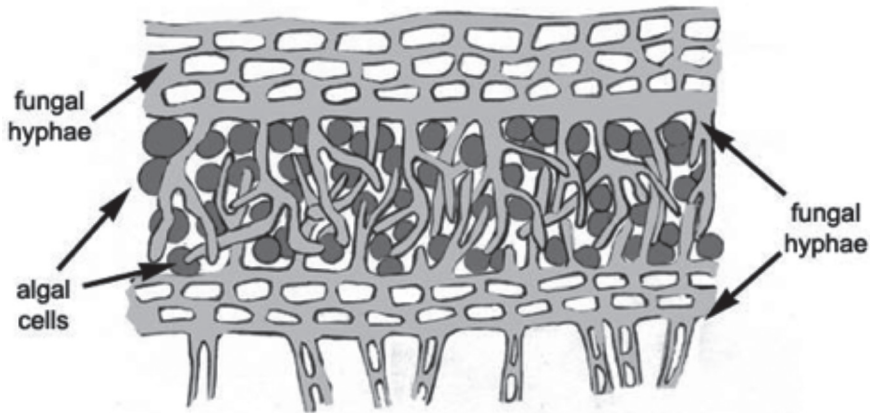


Fig. 1. Homeomeric Lichen Thallus. © www.suboptimist.wordpress.com

are upright or hanging, round or flat and often highly branched. The layers of a fruticose thallus may surround a central thick cord, as in *Usnea*, or a hollow space as in some *Cladonia* species⁴.

Lichens produce unique secondary metabolites, which explain their uses in the Antiquity, the Middle Ages, and in present day. The specific conditions in which lichens live, explain why they produce many metabolites that protect against various negative physical and biological factors. Metabolites synthesised by lichens are divided into two groups: primary (intracellular) and secondary (extracellular)⁵.

The primary metabolites include proteins, amino acids, carotenoids, polysaccharides and vitamins. They are generally soluble in water and can be easily isolated from the lichens by boiling water. Some of the primary metabolites are produced by fungi and some by algae. Polysaccharides and related compounds are present in the lichen in an amount of 3–5 % dry weight of the thallus⁶. Lichens contain ascorbic acid, biotin, α -tocopherol, nicotinic acid, pantothenic acid, riboflavin, thiamine, and folic acid among vitamins, which were identified as metabolic products of algal biosynthesis, since the mycobionts are poor sources of these compounds⁷.

The majority of organic compounds found in lichens are secondary metabolites. More than 800 secondary metabolites are known from lichens. Most are unique to these organisms and only a small minority occurs in the other fungi or higher plants. All of the secondary substances in lichens are of fungal origin. These substances are the crystals deposited on the surface of the hyphae, which are poorly soluble in water, and usually can be isolated from the lichens by organic solvents⁸. Secondary metabolites are not essential for the survival and growth of lichens⁹, and the functions of these compounds in the lichen symbiosis are still poorly understood¹⁰. However, they may help to protect the thalli against herbivores, pathogens, competitors and external abiotic factors, such as high UV irradiation¹¹. Lichens also have intensive interactions with the environment in which they

grow. Lichens can grow on bark, wood, soil, and rocks among many other substrates¹².

Materials & Methods

The purpose of this study is to investigate and compare the uses of lichens in the medical works of Ibn Sina and Ibn al-Baytar, on the basis of the term used to describe epiphytic lichens in medieval Arabic terminology. The text of the chapter on Ushnah (اشنة) (that is, epiphytic lichens) by these two physicians has been consulted in two manuscripts now preserved at the Süleymaniye Manuscript Library in Istanbul, which are identified below. Modern studies have been consulted to understand the uses of lichens in today's pharmacy and medicine.

Current state of knowledge on the history of lichens

Lichens are among the many plant materia medica used in medicine, pharmacy and dyeing from antiquity to modern times¹³. There is an article¹⁴, which focuses on the history of lichens and their uses in medicine and pharmacy on the basis of some medieval Arabic (e.g. *Kitab al Mansuri* of Razi, *Adwiyyat al Qalbiyya* of Ibn Sina) and Turkish manuscripts (e.g. *Mujarrabnama* of Şarafaddin Sabunjuoghlu and *Kitab al Nabat* of Osman b. Abd al Mannan). Some studies in Turkey have approached the question of the differences and similarities of mosses and algae in manuscripts like *Kitab al Haşaiş* of Hunayn b. Ishaq, *al Qanun fi't Tibb* of Ibn Sina and *Jami al Mufradat al Adwiyyat wa al Aghdiyyat* of Ibn al-Baytar¹⁵, ethnological uses of some lichens in *Liber Almansoris* of Abu Bakr Muhammad b. Zakariyya al Razi (Rhazes)¹⁶, and the Arabic translations of Dioscorides' *Materia Medica* from a lichenological point of view¹⁷.

Etymology

The etymology of the term "lichen" goes back to antiquity. In *De causis plantarum*, the Greek botanist Theophrastos (ca. 370-ca. 270

BCE) mentions a leprosy substance over olive trees as: “λειχήν” (5.9.10). In the Renaissance, the word “lichen” appears in 16th-century Latin botanical texts, for instance in the *Historia stirpium* published in 1542 by the German botanist Leonhart Fuchs (1501-1566). In his chapter on lichens, he mentions the following under *Nomina*:

λειχήν Graecis, Lichen Latinis, officinis et herbarijs Hepatica, Germanis Stein oder Brunnenleberkraut dicitur¹⁸.

Textual data

Below I reproduce the text related to Ushnah in the works of Ibn Sina and Ibn al-Baytar. For a good understanding, I include some biographical and contextual information about both authors and their work.

Ibn Sina

Abu Ali al-Ḥusayn ibn Abd Allah ibn al-Ḥasan ibn Ali ibn Sina (980-1037) - or by his shorter, Latin medieval name *Avicenna* -, was also known as the “Prince of Physicians”, as he was one of the greatest physicians and philosophers in the Eastern Medieval Islamic Community: the Medieval Mashriq. Avicenna authored a five-book medical encyclopaedia: *Al Qanun fi't Tibb (Canon of Medicine)* which was the standard medical textbook used, and commented on, in the Islamicate and medieval Europe until the eighteenth century as a major source among physicians¹⁹. The *Canon of Medicine*, consists of five books with the following content: 1) *Kulliyat (Principles)* is a general discussion of the scientific foundations of medicine and anatomy; 2) *Mufradat (Simple drugs)* is an account of the therapeutic properties of the substances used in medicine (*materia medica*); 3) *Mualajat (Pathology)* is devoted to specific or localized ailments; 4) *Hummiyat (Fevers)* deals with more general diseases, such as fever, that affect the whole body; 5) *Murakkabat (Compound drugs)*

is about pharmacology. Ibn Sina created a system of medicine based on three pillars: Aristoteles' Philosophy, Galenos' Medicine, and Dioscorides' Pharmaco-botany. Nevertheless, he consulted the works of many other physicians who he cited by name including (but far from being limited to) Hippocrates, Abu Bakr al Razi (Rhazes in Medieval Latin), and Ali ibn Abbas al Majusi (Haly Abbas in Medieval Latin). *Al Qanun fi't Tibb* was transmitted in manuscript form in the Islamicate world until it was printed for the first time in Rome, in 1593.

Text & Translation of Ibn Sina's chapter on Ushnah

The Süleymaniye Manuscript Library (SML) in Istanbul holds several well-preserved codices of *Al Qanun fi't Tibb*. I consulted the codex 265 of the Turhan Valide Sultan Collection (TVS) to establish the Arabic text below. Ushnah (اشنة) is the 11th drug in the second book of the manuscript at ff. 122^r-122^v (Fig. 2). The Arabic text and its English translation are given in Table 1.

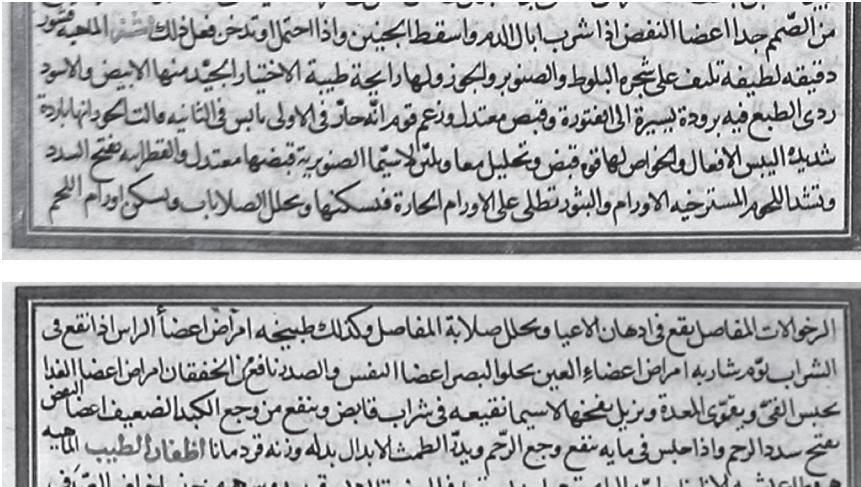


Fig. 2. Ushnah, TVS 265 © SML

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Table 1. Ushnah (اشنة) from Ibn Sina

<p><i>Quiddity:</i> Smooth, thin crusts. It wraps on an oak (<i>Quercus sp.</i>), pine (<i>Pinus sp.</i>), and walnut²⁰ (white poplar, <i>Populus alba</i> L.) trees and has a sweet, pleasant odour; people said it comes from countries of India.</p>	<p>الماهية: قشور دقيقة لطيفة. تلتف على شجرة البلوط والصنوبر والجوز ولها رائحة طيبة وقال قوم أنها يؤتى من بلاد الهند.</p>
<p><i>Choice:</i> The good ones are white, and the black (ones) are bad. Dioscorides said; the best of them is that on cedar (<i>Cedrus libani</i> A. Rich.) which is pine (<i>Pinus sp.</i>), and then the better is the one present on walnut (white poplar, <i>Populus alba</i> L.) The best is the one with the most pleasant odour, and white to blue.</p>	<p>الاختيار: الجيد منها الأبيض والأسود رديء، قال دياسقوريدوس إن الأجود منها ما كان على الشروين وهو الصنوبر وكانت بعد ذلك فالأجود ما يوجد على الجوز. وأجودها أطيبها رائحة وما كان بياضاً إلى الزرقة.</p>
<p><i>Nature:</i> It is slightly cold to tepid, and it constipates moderately; some people claimed that it is hot in the first degree and dry in the second. People of Kuze-stan said it is very cold and dry.</p>	<p>الطبع: فيه برودة يسيرة إلى الفطور، وقبض معتدل وزعم قوم أنه حار في الأولى، يابس في الثانية، قالت الخوز إنها باردة شديدة اليبس.</p>
<p><i>Actions and Properties:</i> It has the power of constipating and dissolving together; especially the one growing on pine (<i>Pinus sp.</i>) is laxative for moderate constipation. The one on cedar (<i>Cedrus libani</i> A. Rich.) deobstruent, and it tightens flaccid flesh.</p>	<p>الأفعال والخواص: لها قوة قبض وتحليل معا وتلين لاسيما الصنوبرية قبضه معتدل والقطرانية بفتح السدد وتشد اللحم المسترخية.</p>
<p><i>Tumours and Blisters:</i> Applied over hot tumours, it calms them, dissolves solidities, and calms down tumours of flaccid flesh.</p>	<p>الأورام والبثور: يطلى على الأورام الحارة فيسكنها ويحلل الصلابات ويسكن أورام اللحم الرخو.</p>
<p><i>Organs of Articulations:</i> When put in anointments against fatigue, it releases the rigidity of articulations; it does the same when cooked.</p>	<p>آلات المفاصل: يقع في ادهان الإعياء ويحلل صلابة المفاصل وكذلك طبيخه.</p>
<p><i>Organs of Head:</i> When it is put in beverages, it puts asleep the person who ingests it.</p>	<p>أعضاء الرأس: إذا نقع في الشراب نوم شاربه.</p>
<p><i>Organs of Eye:</i> It clarifies the sight.</p>	<p>أعضاء العين: يجلوا البصر.</p>
<p><i>Organs of Breath and Chest:</i> It is beneficial against palpitations.</p>	<p>أعضاء النفس والصدر: نافع في الخفقان.</p>
<p><i>Organs of Nourishment:</i> It prevents vomiting, strengthens the stomach, and eliminates flatulence, especially when it is infused in constrictive beverages. It is beneficial against weak liver pain.</p>	<p>أعضاء الغذاء: يحبس القيء ويقوي المعدة ويزيل نفخها لاسيما نقيعه في شراب قابض وينفع من وجع الكبد الضعيف.</p>

<p><i>Excretory Organs:</i> It opens obstructions in the uterus when (females) sit in its water, benefits on uterine pain, and it runs the menstrual flow out.</p>	<p>أعضاء النفص: يفتح سدد الرحم وإذا جلس في مائه نفع من وجع الرحم ويدير الطمث.</p>
<p><i>Substitute</i> Its substitute is caraway (<i>Carum carvi</i> L.) in the same weight.</p>	<p>الإبدال: بدله وزنه قردمانا.</p>

Ibn al-Baytar

Ziyauddin Abu Muhammed Abd Allah ibn Ahmad ibn al-Baytar al Malaqi (1197–1248) the great pharmacist, botanist, and physician of the Almohad Caliphate of al-Andalus, was born in or near Malaga towards the end of the twelfth century, and died in Damascus in 1248 as mentioned by Vernet²¹. He was known as *Ambitar* in the Latin medieval world. His works have not been intensively followed and commented on in the West even though he was a member of the Western Medieval Islamic Community: the Medieval Maghrib. Sarton mentions²² Ibn al-Baytar as “the greatest botanist and pharmacist of Islam and of the Middle Ages, regarding his very methodical and critical compilation, together with his personal observations.” According to Cabo Gonzalez²³, Ibn al-Baytar’s journey from the West to the East through northern parts of Africa and Asia Minor provided him with the possibility of an extraordinary formation in the theoretical and practical study of botany. This itinerary served Ibn al-Baytar to take botanical and lexicographic references of simple drugs as well. Ibn al-Baytar’s major work is entitled *Jami al Mufradat al Adwiyyat wa al Aghdiyyat* which is a *Collection on Simple Drugs and Nutrients*. The work does not deal only with simple drugs, but also with food. In the 2349 chapters contained in the work, he provides detailed information on about 1400 drugs, almost 300 of which were mentioned for first time in the Arabic medico-pharmaceutical literature. References to previous physicians in Ibn al-Baytar’s work are remarkably precise. If he does not know the title of a book or the name of the author, he explicitly mentions: “Majhul / لوهجم”, that is, “Anonymous”. Ibn al-Baytar proceeded according to Aristotle’s scien-

tific method as it appears from the following statement in the foreword of *Jami al Mufradat al Adwiyyat wa al Aghdiyyat*:

In this book, I have included the knowledge of ancient and contemporary physicians, checked and verified by my own observations and experiences. I have not included what is not acceptable in reality.

Text & Translation of Ibn al-Baytar's chapter on Ushnah

Among the various codices of Ibn al-Baytar's work, I have consulted the one preserved at Istanbul Suleymaniye Manuscript Library, Ayasofya Collection, 3608. Ushnah (اشنة) is the 84th drug.



Fig. 3. Ushnah, Ayasofya 3608 © SML

The relevant part of folio 14^v from the manuscript is reproduced in Fig. 3. The Arabic text and its translation into English are given in Table 2.

Table 2. Ushnah (اشنة) from Ibn al-Baytar

It is known as “Shaibat al Ajuz” (= The Old Woman’s Grey Hair).	هو المعروف بشيبة العجوز
Dioscorides in the first (book of <i>De materia medica</i>): The best is the one which grows on cedar (<i>Cedrus libani</i> A. Rich.), in the mountains; next comes the one found on white walnut ²⁴ (white poplar, <i>Populus alba</i> L.) The best of these is the one that smells best and is white. As for the one with a blackish colour, it is inferior.	ديسكوريدوس في الأولى: الجيد منها ما كان على الشربين وكانت جبلية وبعدها ما يوجد على الجوز وأجود من هذه ما كانت أطيب رائحة وكانت بيضاء، وما كان منها لونه إلى السواد ما هو فإنه أردا
Galenos in the seventh (book of his work on <i>Simple medicines</i>): Its power is moderately astringent; therefore, it is not intensively cold, but it is rather close to tepid. In spite of this, it has a dissolving and softening power, especially the one found on pine (<i>Pinus sp.</i>) trees.	جالينوس في السابعة: قوته قوة قابضة باعتدال، ولذلك ليس هو ببارد بريدة قوية بل هو قريب من الفتورة، وفيه مع هذا قوة محللة ملينة وخاصة فيما يوجد منها على شجر الصنوبر
Dioscorides: And its power is astringent, suitable for uterine pain if boiled and (females) sat in its decoction. It sometimes enters the preparation of various oil mixtures because of its astringency. It is (also) beneficial when added to the preparation of fumigations and oils that resolves fatigue from muscles.	ديسكوريدوس: وقوتها قابضة تصلح لأوجاع الرحم إذا طبخت وجلس في مائها وقد تقع في أخلاط سائر الأدهان من أجل القبض الذي فيها وهي نافعة إذا وقعت في أخلاط الدخن والأدهان التي تحلل الأعباء
Ibn Samajoon ²⁵ : The power of lichens varies according to the power of the trees on which they are generated and developed.	ابن سمجون: قوة الأشنة تختلف بحسب قوة الشجر التي تتكون فيه وتتخلق منه
Masih of Damascus ²⁶ : It is beneficial if it is mashed in water and applied on weak places such as the armpits, the ureters, the basis of the ears and for the pain of the shoulders.	مسيح الدمشقي: إذا سحق مع الماء ووضعت على المواضع الضعيفة مثل الأربيتين والإبطيين والحالبين ووجع الكتفين وأصول الأذنين ينفعهما

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<p>Razi²⁷: It prevents vomiting, and strengthens the stomach.</p>	<p>الرازي: تحبس القيء وتقوي المعدة</p>
<p>Ibn Imraan²⁸: It makes the stomach good, dries moisture, and is beneficial against hotness and redness of eyes. (When) it is boiled and its decoction is drunk; it strengthens the heart. When it is mashed with water; applied on hot spots, it cools them. It is an ingredient of perfumes made of musk and amber, aromatic pastilles, medicines of musk, and collyria.</p>	<p>إسحاق بن عمران: تطيب المعدة وتجفف البيلة وتنفع من حرارة العين وحمرتها و تطبخ بالماء ويشرب طبيخها فيشد القلب وتسحق بالماء وتوضع على المواضع الحارة فتبردها و تدخل في الغوالي^{٢٩} واللخالخ وأدوية المسك والأكحال.</p>
<p>Abd Allah ibn Saleh³⁰: It is in the nature of Ushnah to receive the fragrance of all the neighbouring things; this is why it is used as the base of fragrant powders. When used as their base, it does not impregnate the clothes.</p>	<p>عبد الله بن صالح: الأشنه في طبيعتها قبول الرائحة من كل ما جاورها، فلذلك تجعل جسد الذرائر و إذا جعلت جسداً فيها لم تطبع في الثوب</p>
<p>Ahmed ibn Ibrahim³¹: If you macerate it in astringent beverages and drink such beverages, it strengthens the stomach and removes the flatulence in the abdomen, and it makes children sleep deeply.</p>	<p>أحمد بن إبراهيم: إذا أنقعت في شراب قابض وشرب ذلك الشراب قوي المعدة وأذهب نفخ البطن وأنام الصبيان نوماً مستغرقاً</p>
<p>Ibn Sina: By its fragrance, it is congenial to the essence of the soul, strengthens it, contracts it, and makes it grow; thanks to its subtleness, it penetrates it. Because of this, it is beneficial against palpitations, it strengthens the heart and opens uterine obstructions. When anointed on hot inflammations, it calms them down; it dissolves the solidity of articulations; it is beneficial against the pain of weak liver. When infused in water, it runs the menstrual flow out, and it is beneficial against uterine pain.</p>	<p>ابن سينا: بعطرية هو ملايم لجوهر الروح ويقويه ويقبضه وينميهِ وللطافته تنفذ إليه فهو لهذا نافع من الخفقان ومقو للقلب ويفتح سدود الرحم ويطلق على الأورام الحارة فيسكنها ويحلل صلابة المفاصل وينفع من وجع الكبد الضعيف وإذا جلس في طبيخها أدرت الطمث ونفع من أوجاع الرحم</p>
<p>Majhul (Anonymous): It breaks (metabolic) stones; if it is crushed with vinegar and applied as a hot compress, it benefits the spleen and teeth.</p>	<p>مجهول: تقطت الحصاة^{٣٢} و إذا سحقته بخل وكمد بها الطحال تفعبته تنفع من الصنان.</p>

<p>Sharif³³: It regenerates the loosened flesh of wounds resulting of surgeries. If it is ground and used like collyria, it sharpens the sight. If it is boiled with a beverage and if this decoction is drunk, it is beneficial against bites of venomous insects. Sitting in its decoction, relieves the pain (caused by) exhaustion.</p>	<p>الشريف: تنبت اللحم المسترخي في الجراحات وإذا سحقت واكتحل بها أهدت البصر، وإذا طبخت في شراب وشرب طبيخها نفع من نهش الهوام والجلوس في طبيخها يذهب المرض الإعيائي</p>
<p>Razi: When it is unavailable, the substitute for ushnah is caraway (<i>Carum carvi</i> L.) in the same quantity.</p>	<p>الرازي: وبدل الأشنة إذا عدم وزنه قرديمانا</p>

Following the information given by Littré³⁴, in a previous study, I investigated the ethnological uses of lichens in *Liber Almansoris*³⁵ of Abu Bakr Muhammad ibn Zakariyya al Razi (*Rhazes*, 854 - 925 CE) and concluded that, the generic name *Usnea* in contemporary lichenology comes from Ushnah (اشنة) in Medieval Arabic.

From the analysis of Ibn Sina's and Ibn al-Baytar's text on lichens, we see that, Ibn Sina gives more abstract data and a summary of the necessary information to describe a simple medicine, particularly if we compare his text with Ibn al-Baytar's encyclopaedic notes. Ibn Sina mentions mostly Dioscorides, Galenos and Rhazes and it might be hypothesized that all the other information may be regarded as his own knowledge or experience. Ibn al-Baytar, as for him, collects every data, lists the information with the mention of the authors he has consulted, besides of data resulting from his own experience. A short contextual comparison of both texts from Ibn Sina and Ibn al-Baytar under Ushnah (اشنة) is given in Table 3 below.

Table 3. Textual Comparison of Ibn Sina and Ibn al-Baytar

Ibn Sina (11 th century)	Ibn al-Baytar (13 th century)
In this title, he cites only Dioscorides and Galenos by name.	In his citations, he claims to follow the <i>Hadith Tradition</i> (Notice the Majhul).

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Takes the subject in a medical view in divisions: Quiddity, Choice, Nature, Actions and Properties, etc..	Transfers of pharmaceutical information, loyal to the author: Dioscorides, Galenos, Ibn Samaan, Masih of Damascus, etc...
Mentions walnut instead of poplar due to an error in copying of Dioscorides codices in Arabic.	Mentions walnut instead poplar due to an error in copying of Dioscorides codices in Arabic.
Ushnah has a sweet pleasant odour...	is used as the base of fragrant powders...
A reference to India	-----
Ushnah, put in beverage, anesthetizes the drink.	-----
Ushnah clarifies the sight.	Ushnah benefits against the hotness and redness of the eye.
Ushnah prevents vomiting, strengthens the stomach and removes its flatus.	Ushnah prevents vomiting and strengthens the stomach.
-----	Ushnah dries the moisture...
-----	Ushnah makes the stomach good, and dries the moisture ³⁶ .
Ushnah clarifies the sight.	Ushnah is an ingredient of musk perfumes, aromatic powders, medicines of musk and collyria.

A comparison with contemporary lichenology

Lichens are tiny squamules, folios or fibres; they have different colours (white, black, bluish grey) unlike mosses and liverworts, which are only green. In addition, lichens are fragrant as well. Since lichens produce a wide range of secondary metabolites also called *Lichen Substances*³⁷, they have been used in medicine, pharmacy, and industry from antiquity to present day.

Due to the similar appearance of their thalli, some species of *Alectoria*, *Evernia*, *Pseudevernia* and *Usnea* genera, have been named as “*Muscus arboreus*” in medieval medicinal texts and they are easily confused by non-specialists still today. Besides, *Evernia sp.* and *Pseudevernia sp.* are known as “*Oak Moss*” still. Fig. 4 is a photo of *Usnea barbata* while Figure 5 is that of *Alectoria sar-*

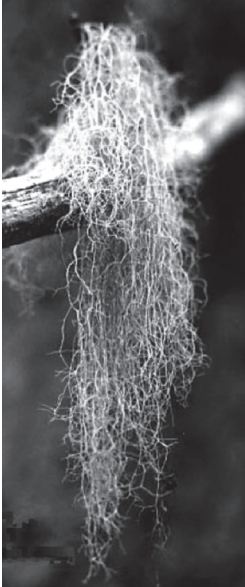


Fig. 4. *Usnea barbata*
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Fig. 5. *Alectoria sarmentosa*
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Fig. 6 *Muscus arboreus*
© Özlem Korkmaz

mentosa, two epiphytic pendulous lichens that are quite similar to each other. Fig. 6 is an artist reception³⁸ of *Muscus arboreus* from Matthioli's *Commentaries on Dioscorides*³⁹, dating to 1568.

It is not clear whether Ibn Sina and Ibn al-Baytar, when they mention Ushnah, referred to *Alectoria sp.*, *Evernia sp.*, *Pseudevernia sp.*, or *Usnea sp.*, however they obviously pointed out some species of epiphytic lichens. The species belonging to these mentioned genera contain *Usnic acid*⁴⁰, - among many other secondary metabolites - with some certain pharmaceutical properties⁴¹, which gives us a possibility to understand the uses of lichens in medieval medicine.

In a monographic study, Usnic acid (Fig. 7) is reported to perform analgesic, antibacterial, antipyretic, anti-inflammatory, antiproliferative, antiviral, antimicrobial and antiprotozoal activities with citation to medicinal use of lichens containing Usnic acid. Several *Usnea*

sp. are as well reported being used in Asia, Africa and Europe for pain relief, fever control and *Usnea barbata* (L.) Weber ex F.H.Wigg. being allegedly used by Hippocrates to treat urinary complaints⁴². Besides these, when tested on rats it is found

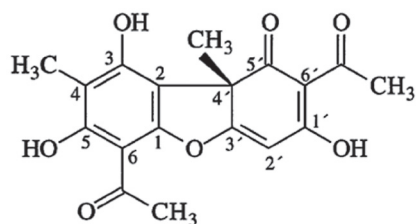


Fig. 7 Usnic Acid (C₁₈H₁₆O₇)

that Usnic acid has a dose-dependent anti-inflammatory activity comparable to ibuprofen at the same dose-level⁴³.

Usnea species and Usnic acid have a potential of commercial use as well. In Argentina, “*Barba della Piedra*” (*Usnea densirostra*) has been sold to treat many ailments, in which Usnic acid is employed as an active agent as well as a preservative. The extracts of lichens rich in Usnic acid have been utilized in pharmaceuticals, perfumery, and in cosmetic applications. In Germany, lichen extracts used in cosmetics and pharmaceuticals are marketed under trade names *Omnigran a*, *Granobil*, and *Usnagren A* and *T*. In Italy, Usnic acid has been used in vaginal creams, foot creams, powders, and hair shampoo⁴⁴. Research reports that *Evernia prunastri* (L.) Ach.) -also known as Oak Moss- extracts containing atranol and chloroatranol besides more than 173 substances perform a fragrance nature besides dose-dependent allergen activity⁴⁵. Other reviews on the biological properties of Usnic acid and cultured samples of *Usnea complanata* (Müll. Arg.) Motyka. report that Usnic acid has cardiovascular effect. The addition of increasing and cumulative concentrations of Usnic acid doses produces a negative inotropic effects⁴⁶. The solvent extract *U. complanata* showed both cardiovascular-protective activity and antioxidant properties⁴⁷. Usnic acid has potential either as a systemic therapy or as a topical agent for the treatment of tumours. The anti-tumour activity was confirmed on an ascetic tumour (Sarcoma-180) implanted in Swiss mice and estimated by means of the tumour inhibition⁴⁸.

The gastro-protective effect of Usnic acid isolated from *Usnea longissima* was investigated in the indomethacin-induced gastric ulcers in rats. The gastric lesions were significantly reduced by all doses of Usnic acid as compared with the indomethacin (25 mg/kg body weight) treated group⁴⁹. Research reports hydro-ethanolic extract of *Cladonia furcata* (Huds.) Schrad. has suppressive effect on gastric acid secretion by opposition to the action of histamine and blocking of H⁺-K⁺-ATPase, suggesting a justification for the traditional usage to treat gastroesophageal reflux disease⁵⁰.

Conclusions

This study focuses on the transfer of knowledge from East to West and vice-versa through manuscripts. It offers an evaluation of the works by two great figures of Medieval Medicine in Arabic - Ibn Sina and Ibn al Baytar - through modern lichenology. It is clear that, from Ibn Sina's time (11th century) in the East to Ibn al-Baytar's time (13th century) in the West, literature developed as did also the quantity of available data. It must be noted that, although Ibn al-Baytar moved to East, his main work followed a Western (Maghrib) tradition compared to Ibn Sina's, Eastern (Mashriq) in nature as the difference in the styles of the two physicians indicates, as does also the simple drugs they mention.

In recent years, there has been a renewed interest in lichens as a potential source for bioactive compounds with therapeutic properties⁵¹ since secondary metabolites of lichens show different biological and physiological activities that might be of great relevance in pharmacology and clinic. Different research programmes on lichens in contemporary science and various uses in today market help us understanding how and why lichens were used in ancient texts. This paper may be a basis for further studies in the history of medicine and science. On one hand, I tried to understand if historical work may provide the basis for a comparison and evaluation of the data offered

by the ancient texts, while contemporary research may be instrumental to verify the validity or exactness of ancient information. On the other hand, I wish to figure out if ancient texts are still a potential and interesting source for modern researches or not. Considering the text of ancient physicians, a contemporary scientist may find inspiration for further modern pharmaco-chemical research, which may increase knowledge and yield new plant based products.

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20. The word الحوز (walnut) in the Arabic text should be emended into الحوز (white poplar, *Populus alba* L.) based on the reference to Dioscorides: ἡ λευκίνων. This results from a confusion between the letter jim (in the word for walnut) and ha (in the word for white poplar) in Arabic, which are similar and are differentiated by a dot in jim. Thus, جوز (*Juglans regia* L.) must be considered as حوز (*Populus alba* L.) in this text.
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24. This word must be الحوز. See note 20 above.
25. For the predecessor physicians mentioned by Ibn al-Baytar, these two references have comprehensive information: Leclerc L, *Histoire de la Medecine Arabe*, vol I., vol. II. Paris: 1876. Ullmann M, *Die Medizin im Islam.* Leiden: Brill; 1970. Ibn Samajoon, Abu Bakr Hamid, from Cordoba, Spain, probably lived between 10th -11th century. He is famous for his book *Kitab al-Jami li-aqwal al-qudama wa al-mutahadditin min al-atibba wa al-mutafalsifin fi al-adwiya al-mufrada / The Book on Collection of Statements of Old and New Physicians and Philosophers on the Simple Drugs.* In his book, the drugs are arranged in the abjad order of Arabic alphabet. However, Ibn Samajoon brings little from his own; rather confines himself to the careful processing of excerpts from Dioscorides, Galenos, Oribasios, Abu Hanifa, and some pharmacists (Ullmann M, note 25. p. 267-268).

26. Masih bin al Hakam, Abu'l Hasan Isa bin Hakam, from Damascus, Syria, lived in the second half of 8th century. His famous work is *Kitab al Kunnash / Book of the Simple Drugs* (Ullmann M, note 25. p. 112).
27. Razi, Abu Bakr Muhammad b. Zakariya, (Rhazes in Latin) from Rey, Iran, lived between 854 - 925 or 935. Physician at the court of Samanid Prince Abu Ali Mansur b. Ishaq to whom he devoted his book: *Kitab al Mansuri* (Ullmann M, note 25. p. 128).
28. Ibn Imraan, Ishaq ibn Imraan, from Baghdad, Iraq, lived between 9th – 10th centuries. Came from Bagdad to Qairawan has written numerous books. His late work is *Maqala fi al-Malankhuliya / Treatise on Melancholy* (Ullmann M, note 25. p. 125).
29. الغوالي is a perfume made of several substances including musk and amber.
30. Abd Allah ibn Saleh, Abu Muhammad Abd Allah ibn Saleh al Kattani al Hariiri, from Marrakesh, Morocco, lived in the second half of 12th century, was one of the great masters of Ibn al-Baytar along with al Nabati (Leclerc L, II, note 25. p. 248; Ullmann M, note 25. p. 279).
31. Ahmed ibn Ibrahim, Abu Jafar Ahmed ibn Ibrahim b. Abi Khalid al Jazzar, He was a student of Ishaq ibn Sulaiman and lived in Qairawan, Tunisia. He died around 1004. Of his works, “*Kitab Zad al Musafir wa qut al Hadir / The Traveler’s Provisions for those who travel and the food for those who settle*” is the one best known in the Eastern and Western Islamic Communities (Ullmann M, note 25. p. 147).
32. الحصاة is the stone in a specific organ like kidney or gallbladder. In this translation, (metabolic) stones has been preferred for expression.
33. Sharif, Abu Abd Allah Muhammad bin Muhammad bin Abd Allah bin Idris from Ceuta, Spain, lived probably between 1100 - 1165. Also known as Sharif al Idrisi of Sicily. Well known as a geographer of King Roger’s court, but he is much less as a naturalist doctor (Leclerc L, II, note 25. p. 65).
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35. See: Yavuz M, Çobanoğlu G, note 16.
36. This phrase reminds thallus of lichens -not a tissue-, which may dry the moisture through its hyphal texture.
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38. Özlem Korkmaz is the botanical illustrator of *Muscus arboreus* figure.

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40. Synonym: 2, 6- diacetyl- 1, 2, 3, 9b- tetrahydro- 7, 9-dihydroxy- 8, 9b- dimethyl-dibenzofuran- 1, 3- dione
41. Ingólfssdóttir K, Chung GAC, Skúlason VG, Gissurarson SR, Vilhelmsdóttir M, Antimicrobial activity of lichen metabolites in vitro. *European Journal of Pharmaceutical Sciences* 1998;6:141-144. Romagnı Jg, Meazzab G, Nanayakkarac Npd, Dayana Fe, The phytotoxic lichen metabolite, Usnic acid, is a potent inhibitor of plant p-hydroxyphenylpyruvate dioxygenase. *FEBS (Federation of European Biochemical Societies) Letters* 2000;480: 301-305.
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Correspondence should be addressed to:

Asst. Prof. Dr. Mustafa YAVUZ, History of Science Department, Istanbul Medeniyet University, South Campus, Kadiky, İstanbul, Turkey.
mustafay007@gmail.com