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

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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

Key words: Lichens - Medieval medicine - Ibn Sina - Ibn al-Baytar
dominates, lichens are traditionally classified as a lifeform of fungi\(^1\). 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 Deuteromycota\(^2\).

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 volume\(^3\). 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
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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* species\(^4\). 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 thallus\(^6\). Lichens contain ascorbic acid, biotin, \(\alpha\)-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 compounds\(^7\).

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 solvents\(^8\). Secondary metabolites are not essential for the survival and growth of lichens\(^9\), and the functions of these compounds in the lichen symbiosis are still poorly understood\(^10\). However, they may help to protect the thalli against herbivores, pathogens, competitors and external abiotic factors, such as high UV irradiation\(^11\). Lichens also have intensive interactions with the environment in which they
grow. Lichens can grow on bark, wood, soil, and rocks among many other substrates\textsuperscript{12}.

**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 times\textsuperscript{13}. There is an article\textsuperscript{14}, 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 Šarafaddin 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 Hašaiš of Hunayn b. Ishaq, al Qanun fi’Tibb of Ibn Sina and Jami al Mufradat al Adwiyyat wa al Aghdiyyat of Ibn al-Baytar\textsuperscript{15}, ethnological uses of some lichens in Liber Almansoris of Abu Bakr Muhammad b. Zakariyya al Razi (Rhazes)\textsuperscript{16}, and the Arabic translations of Dioscorides’ *Materia Medica* from a lichenological point of view\textsuperscript{17}.

**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:*

\[\lambdaειχήν\] Graecis, Lichen Latinis, officinis et herbarijs Hepatica, Germanis Stein oder Brunnenleberkraut dicitur\(^{18}\).

**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 physicians\(^{19}\). 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 (Fever)* 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’l 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’l 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. 122r-122v (Fig. 2). The Arabic text and its English translation are given in Table 1.
Table 1. Ushnah (اشنة) from Ibn Sina

<table>
<thead>
<tr>
<th><strong>Quiddity:</strong> Smooth, thin crusts. It wraps on an oak (Quercus sp.), pine (Pinus sp.), and walnut (white poplar, Populus alba L.) trees and has a sweet, pleasant odour; people said it comes from countries of India.</th>
<th>الماهية: قشور دقيقة لطيفة تلف على شجرة البلوط والصنوبر والجوز وله رائحة طيبة وقال قوم أنها تأتي من بلاد الهند.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Choice:</strong> The good ones are white, and the black (ones) are bad. Dioscorides said; the best of them is that on cedar (Cedrus libani A. Rich.) which is pine (Pinus sp.), and then the better is the one present on walnut (white poplar, Populus alba L.) The best is the one with the most pleasant odour, and white to blue.</td>
<td>الاختيار: الحسن منها البيضاء والأسود رديء، قال دياسقوريدوس إن الأحوج منها ما كان على الشروين وهو الصنوبر وكانت بعد ذلك فالأخيوج ما يوجد على الجور وأجودها أطيبها رائحة وما كان بيضا إلى الزرقة.</td>
</tr>
<tr>
<td><strong>Nature:</strong> 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 Kuzestan said it is very cold and dry.</td>
<td>الطبع: فيه برودة يسيرة إلى الفتور، وقبض معتدل وزعم قوم أنه حار في الأولي، يابس في الثانية، قالت الخوز إنها باردة شديدة اليبس.</td>
</tr>
<tr>
<td><strong>Actions and Properties:</strong> It has the power of constipating and dissolving together; especially the one growing on pine (Pinus sp.) is laxative for moderate constipation. The one on cedar (Cedrus libani A. Rich.) deobstruent, and it tightens flaccid flesh.</td>
<td>الأفعال والخواص: لها قوة قبض وتحلل معا وتلين لأسما الصنوبرية قبضه معتدل والقططرية بفتح السدد وتشد اللحم المسترخية.</td>
</tr>
<tr>
<td><strong>Tumours and Blisters:</strong> Applied over hot tumours, it calms them, dissolves solidities, and calms down tumours of flaccid flesh.</td>
<td>الأورام والبثور: يطلى على الأورام الحارة فيسكنها ويحلل الصلابات ويسكن أورام اللحم الرخ.</td>
</tr>
<tr>
<td><strong>Organs of Articulations:</strong> When put in anointments against fatigue, it releases the rigidity of articulations; it does the same when cooked.</td>
<td>أعضاء المفاصل: يقع في ادهان الإعياء ويحلل صلابة المفاصل وكذلك طبخه.</td>
</tr>
<tr>
<td><strong>Organs of Head:</strong> When it is put in beverages, it puts asleep the person who ingests it.</td>
<td>أعضاء الرأس: إذا نقع في الشراب نوم شاربه.</td>
</tr>
<tr>
<td><strong>Organs of Eye:</strong> It clarifies the sight.</td>
<td>أعضاء العين: يجعل البصر.</td>
</tr>
<tr>
<td><strong>Organs of Breath and Chest:</strong> It is beneficial against palpitations.</td>
<td>أعضاء النفس والصدر: نافع في الخفقات.</td>
</tr>
<tr>
<td><strong>Organs of Nourishment:</strong> It prevents vomiting, strengthens the stomach, and eliminates flatulence, especially when it is infused in constrictive beverages. It is beneficial against weak liver pain.</td>
<td>أعضاء الغذاء: يحبس القيء ويقوي المعدة ويزيل نفخها لاسيما نفعه في شراب قابض وينفع من وجه الكبد الضعيف.</td>
</tr>
</tbody>
</table>
Mustafa Yavuz

**Excretory Organs:** It opens obstructions in the uterus when (females) sit in its water, benefits on uterine pain, and it runs the menstrual flow out.

<table>
<thead>
<tr>
<th>أعضاء النفض: يفتح سدد الرحم وإذا جلس في مائه نفع من وجع الرحم ويدر الطمث.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Substitute</strong> Its substitute is caraway (Carum carvi L.) in the same weight.</td>
</tr>
<tr>
<td>الإبدال: بدله وزنه قردمانًا.</td>
</tr>
</tbody>
</table>

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 Vernet. 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 mentions 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 Gonzalez, 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 / لوهم”, that is, “Anonymous”. Ibn al-Baytar proceeded according to Aristotle’s scien-
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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](image-url)
The relevant part of folio 14° 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

<table>
<thead>
<tr>
<th>English</th>
<th>Arabic</th>
</tr>
</thead>
<tbody>
<tr>
<td>It is known as “Shaibat al Ajuz” (= The Old Woman’s Grey Hair).</td>
<td>هو المعروف بشيبة العجوز.</td>
</tr>
<tr>
<td>Dioscorides in the first (book of De materia medica): The best is the one which grows on cedar (Cedrus libani A. Rich.), in the mountains; next comes the one found on white walnut (white poplar, Populus alba 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.</td>
<td>ديسکوریدوس في الأولى: الجيد منها ما كان على الششربي، وكانت جبلية، وبعدها ما يوجد على الجوز وأجود من هذه ما كانت أطيب رائحة وكانت بيضاء، وما كان منها لونها إلى السواد ما هو فإنه أردا.</td>
</tr>
<tr>
<td>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.</td>
<td>ديسکوریدوس: وقوتها قابضة، تصلح لأوجاع الرحم إذا طبخت وجلس في مائها وقد تقع في أخلط سائر الأدوية من أجل القبض الذي فيها وهي نافعة إذا وقعت في أخلط الدخان والأدوية التي تحلل الأعياء.</td>
</tr>
<tr>
<td>Galenos in the seventh (book of his work on Simple medicines): 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 (Pinus sp.) trees.</td>
<td>جالينوس في السابعة: قوته قابضة باعتدال، ولذلك ليس هو ببارد برودة قوية بل هو قريب من الفتورة، وفيه مع هذا قوة محللة ملينة وخاصة فيما يوجد منها على شجر الصنوبر.</td>
</tr>
<tr>
<td>Ibn Samajoon: The power of lichens varies according to the power of the trees on which they are generated and developed.</td>
<td>ابن سمجون: قوة الأشنة تختلف بحسب قوة الشجر التي تتكون فيه وتتخلق منه.</td>
</tr>
<tr>
<td>Masih of Damascus: 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.</td>
<td>مسيح الدمشقي: إذا سحقت مع الماء ووضعت على المواضع الضعيفة مثل الأربيتين والإبطين والحالبين ووقع الكفرين وأصول الأذنين بفعهما.</td>
</tr>
</tbody>
</table>
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<table>
<thead>
<tr>
<th>Source</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Razi</td>
<td>It prevents vomiting, and strengthens the stomach.</td>
</tr>
<tr>
<td>Ibn Imraan</td>
<td>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.</td>
</tr>
<tr>
<td>Ibn Sina</td>
<td>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.</td>
</tr>
<tr>
<td>Ahmed ibn Ibrahim</td>
<td>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.</td>
</tr>
<tr>
<td>Majhul</td>
<td>It breaks (metabolic) stones; if it is crushed with vinegar and applied as a hot compress, it benefits the spleen and teeth.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Source</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>إسحاق بن عمران</td>
<td>تحبس القيء وتقوي المعدة وتنعف من حرارة العين وحمرتها وتطبخ بالماء ويشرب طبيخها فيشذ القلب وتتسحق بالرمل وتوضع على المواضع الحارة فتبردها وتتبخر في الغالي واللخالخ وأدوية السكر والأعمال.</td>
</tr>
<tr>
<td>عبد الله بن صالح</td>
<td>الأشنة في طبعها قبول الرائحة من كل ما جاورها، فلتجل جسد الذرائر وإذا جعلت جسداً فيها لم يتطبع في الثوب</td>
</tr>
<tr>
<td>أحمد بن إبراهيم</td>
<td>إذا أقعت في شراب قابض وشرب ذلك الشراب قوي المعدة وأذبه فغث البطن وأثام الصبيان نوماً مستغرقاً.</td>
</tr>
<tr>
<td>ابن سينا</td>
<td>بعطرية هو ملايم لجوهر الروح ويقيه ويقيمه ويقيمه للطافته تتفذ إليه فهو لهذا نافع من الخففان ومقر للقلب ويحفظ سدد الرحم ويستر على الأورام الحارة فيسكنها ويحل صلابة المصايل وينفع من جوع الكبد الضعيف وإذا جلس في طبيخها أدرت الطمث ونفع من أوجاع الرحم.</td>
</tr>
<tr>
<td>مجهول</td>
<td>نفتنت الحصاة إذا سحقت بخل ومكده بها الطحال تفعنت تفعنت من الصنان.</td>
</tr>
</tbody>
</table>
Sharif: 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.

Razi: When it is unavailable, the substitute for ushnah is caraway (Carum carvi L.) in the same quantity.

Following the information given by Littré, in a previous study, I investigated the ethnological uses of lichens in Liber Almansoris 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 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

<table>
<thead>
<tr>
<th>Ibn Sina (11th century)</th>
<th>Ibn al-Baytar (13th century)</th>
</tr>
</thead>
<tbody>
<tr>
<td>In this title, he cites only Dioscorides and Galenos by name.</td>
<td>In his citations, he claims to follow the Hadith Tradition (Notice the Majhul).</td>
</tr>
</tbody>
</table>
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<table>
<thead>
<tr>
<th>Takes the subject in a medical view in divisions: Quiddity, Choice, Nature, Actions and Properties, etc.</th>
<th>Transfers of pharmaceutical information, loyal to the author: Dioscorides, Galenos, Ibn Samajoony, Masih of Damascus, etc…</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mentions walnut instead of poplar due to an error in copying of Dioscorides codices in Arabic.</td>
<td>Mentions walnut instead poplar due to an error in copying of Dioscorides codices in Arabic.</td>
</tr>
<tr>
<td>Ushnah has a sweet pleasant odour… is used as the base of fragrant powders…</td>
<td>Ushnah benefits against the hotness and redness of the eye.</td>
</tr>
<tr>
<td>A reference to India</td>
<td>-----</td>
</tr>
<tr>
<td>Ushnah, put in beverage, anesthetizes the drink.</td>
<td>-----</td>
</tr>
<tr>
<td>Ushnah clarifies the sight.</td>
<td>Ushnah prevents vomiting, strengthens the stomach and removes its flatus.</td>
</tr>
<tr>
<td>-----</td>
<td>Ushnah prevents vomiting and strengthens the stomach.</td>
</tr>
<tr>
<td>-----</td>
<td>Ushnah makes the stomach good, and dries the moisture.</td>
</tr>
<tr>
<td>-----</td>
<td>Ushnah is an ingredient of musk perfumes, aromatic powders, medicines of musk and collyria.</td>
</tr>
</tbody>
</table>

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-
mentosa, two epiphytic pendulous lichens that are quite similar to each other. Fig. 6 is an artist reception of *Muscus arboreus* from Matthioli’s *Commentaries on Dioscorides*, 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* - among many other secondary metabolites - with some certain pharmaceutical properties, 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 complaints. Besides these, when tested on rats it is found that Usnic acid has a dose-dependent anti-inflammatory activity comparable to ibuprofen at the same dose-level.

*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 shampoo. 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 activity.

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 effects. The solvent extract *U. complanata* showed both cardiovascular-protective activity and antioxidant properties.

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 inhibition.
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 group\(^4^9\). 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 disease\(^5^0\).

**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 (11\(^{th}\) century) in the East to Ibn al-Baytar’s time (13\(^{th}\) 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 properties\(^5^1\) 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.
A comparative study of epiphytic lichens

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.

BIBLIOGRAPHY AND NOTES

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Andersen F, Andersen HK, Bernois A, Brault C, Bruze M, Eudes H, Gadras C, Signoret ACJ, Mose KF, Müller BP, Toulemonde B, Andersen KE, Reduced content of chloroatranol and atranol in oak moss absolute significantly reduces the elicitation potential of this fragrance material. Contact Dermatitis 2014;72:75-83.
Çobanoğlu G, Yavuz M, Tıp Tarihinde Likenlerle Tedavi. Yeni Tıp Tarihi
Frankos VH, NTP Nomination for Usnic acid and Usnea barbata Herb. FDA-CFSAN-ONPLDS Food and drug Administration, Division of Dietary Supplement Programs: USA; 2005.
Littré É, Dictionnaire étymologique des mots d’origine orientale. Paris: Librairie Hachette; 1876.


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20. The word جوز (walnut) in the Arabic text should be emended into حور (white poplar, Populus alba L.) based on the reference to Dioscorides: ἢ 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 حور (Populus alba L.) in this text.


24. This word must be حور. See note 20 above.


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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 Hariri, 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).


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).

34. Littré E, Dictionnaire étymologique des mots d’origine orientale. Paris: Librairie Hachette; 1876.

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.


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


44. Frankos VH, NTP Nomination for Usnic acid and Usnea barbata Herb. FDA-CFSAN-ONPLDS Food and drug Administration, Division of Dietary Supplement Programs. USA. 2005.

45. Andersen F, Andersen HK, Bernois A, Brault C, Bruze M, Eudes H, Gadras C, Signoret ACJ, Mose BF, Müller BP, Toulemonde B, Andersen KE, Reduced content of chloroatranol and atranol in oak moss absolute significantly reduces the elicitation potential of this fragrance material. Contact Dermatitis 2014;72:75-83.


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