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Lichens in al-Biruni's *Kitab al-Saydanah fi al-Tibb*

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Abstract

Lichens are understood to be symbiotic organisms consisting of mycobiont and photobiont partners. This mutual partnership results in the production of unique secondary metabolites, which are used in contemporary pharmacy and medicine. The purpose of this study is to explore the uses of lichens in a particular period of medieval pharmacology: it retraced the relevant Arabic terms for, and descriptions of, lichens in the *Kitab al-Saydanah fi al-Tibb*, the “Book of Pharmacy in Medicine” written by Abu Rayhan Muhammad ibn Ahmad al-Biruni (973-1048). It will be shown that al-Biruni used *اشنة* (*ushnah*) for naming epiphytic lichens and *حزاز الصخر* (*hazaz al-sakhr*) for saxicolous ones. The information about lichens transmitted in his text is in accordance with that of his contemporary Ibn Sina, the famous physician and philosopher. In that period, the study, transmission and updating of the legacy of Antiquity promoted and influenced the use of lichens in Arabic and Islamic pharmacology and medicine.

Keywords

Islamic medicine – lichens – medieval pharmacy – medieval botany – al-Biruni – materia medica

Introduction

The purpose of this study is to investigate the use to which epiphytic and saxicolous lichens were put in the pharmacological work of al-Biruni, *Kitab al-Saydanah fi al-Tibb* (“Book of Pharmacy in Medicine”). I will first define lichens according to contemporary lichenology and then evaluate al-Biruni’s Arabic manuscript and provide a translation of the relevant passages with the aim of shedding light on the use of lichens in medieval Arabic pharmacology, also in

its ethnographic context. While avoiding presentism and anachronisms, I will nonetheless end by drawing some parallels between al-Biruni's understanding of lichens and contemporary botany.

The structure of this study will be as follows. Section 1 cites a number of contemporary studies on the biology of lichens, with particular attention to their current pharmacological usage. In Section 2, I offer a brief outline of al-Biruni's life and works, with special attention to his understanding of nature and the interesting parallels he establishes between geometrical principles and botanical phenomena. Section 3 will introduce the *Kitab al-Saydanah fi al-Tibb* ("Book of Pharmacy in Medicine"), the last book al-Biruni authored, and offers some information on its manuscript versions, the translations into modern languages and the facsimile edition. Section 4, will turn to two drugs discussed in *Kitab al-Saydanah fi al-Tibb*, under the titles *Ushnah* and *Hazaz al-Sakhr*, respectively. I offer an edition of the Arabic text and an English translation, indicating – in my footnotes – the presumed contemporary scientific names of the plants he mentions. Section 5 places *Ushnah* and *Hazaz al-Sakhr* in the history of materia medica, so as to establish whether the simple drugs al-Biruni mentions belong to any lichen species, on the one hand, and to characterize the authenticity of al-Biruni's approach, on the other. Sections 4 and 5 provide the basis for a concluding discussion and evaluation of what is original or transmitted about what we find in al-Biruni about the use of lichens in tenth- and eleventh-century pharmaco-medicine in the Islamic civilization.

1 Lichens in Contemporary Science

Contemporary biology books tell us that lichens are symbiotic organisms comprised of at least two partners: there is the fungal partner, which is called mycobiont; and the algal partner, the photobiont.¹ Although lichen thalli are dominated by the fungal symbiont, which controls the photosynthetic partner(s) with regard to both biomass and morphology, unknown numbers of additional organisms can participate in this symbiont system.² Lichens therefore exist as a unified life-form of symbiosis, that is, a mutual partnership that takes place not only at the morphological but also at a physiological level. As a result of their physiology, lichens can grow on several substrates in different

1 Thomas H. Nash III, *Lichen Biology* (New York, 2008), 1-8.

2 Martin Grube and Matts Wedin, "Lichenized Fungi and the Evolution of Symbiotic Organization," *Microbiology Spectrum*, 4 (2016), 749-765. doi:10.1128/microbiolspec.FUNK-0011-2016.

environments, such as arboreal bark, leaves, rocks, soil, twigs, wood and even on metals.³ Lichens display a diversity of morphology and different colours, and they are sometimes confused with mosses or liverworts by non-experts. Lichens produce unique secondary metabolites which helps us understand their use in pharmacy, medicine, chemistry, nutrition, and husbandry.

When we seek for literature on the economic importance of lichens in previous ages, we find surveys from the mid-twentieth century, notably by George Albert Llano, that cover the period from Antiquity to the present day.⁴ They make it clear that the number and properties of secondary metabolites discovered in the twentieth century had a significant role in a reassessment of the importance of lichens. In addition to the great many papers that address the taxonomy and biology of lichens, there are some that focus on the ethno-medicinal and ethno-botanical aspects of their usage.⁵ With regard to our present topic, there exist also a few studies that investigate medieval Arabic and Turkish manuscripts for the pharmaco-medical use of lichens.⁶

In order to recognize more clearly the parallels between the use of lichens as propagated by al-Biruni a full millennium ago, and that of our own age, it may be worth saying a word about the use of lichens in contemporary academic medicine and in folk medicine. Among the many kinds of lichens that are used in medicine or pharmacy, the lichen genus *Usnea* is the most famous, as it is used for treatment of various diseases such as diarrhoea, ulcers, urinary infections, tuberculosis, pneumonia, stomach aches, and fungal diseases. It has also been used to grow hair, to cure sterility, for pulmonary diseases, as a flavouring agent, as antiseptic, anti-tubercular, anti-viral agent or decongestant and for the local treatment of ulcers and tuberculosis.⁷ In Turkish folk medicine, a study has established that some *Usnea sp.* are widely used in the

3 Paolo Modenesi, "Skull Lichens: A Curious Chapter in the History of phytotherapy," *Fitoterapia*, 80 (2009), 145-148.

4 George Albert Llano, "Lichens: Their Biological and Economic Significance," *The Botanical Review*, 10 (1944), 1-64; idem, "Economic Uses of Lichens," *Economic Botany*, 2 (1948), 15-45.

5 For ethno-medicinal approaches, see, for example, María Reyes Gonzalez-Tejero, Miguel José Martínez-Lirola, Manuel Casares-Porcel, and Joaquín Molero-Mesa, "Three Lichens Used in Popular Medicine in Eastern Andalucía (Spain)," *Economic Botany*, 49 (1995), 96-98, doi:10.1007/BF02862281. For an ethno-botanical approach, see, for example, Diana G. Ivanova and Dobri Ivanov, "Ethnobotanical Use of Lichens: Lichens for Food Review," *Scripta Scientifica Medica*, 41 (2009), 11-16.

6 See Gülşah Çobanoğlu and Mustafa Yavuz, "Tıp Tarihinde Likenlerle Tedavi," *Yeni Tıp Tarihi Araştırmaları*, 9 (2003), 37-90.

7 G. Prateeksha, Balwant Singh Paliya, Rajesh Bajpai, V. Jadoun, Jatinder Kumar, Sandet Kumar, Dulip Kumar Upreti, Braj Raj Singh, Sanjeeva Nayaka, Yogesh Joshi, and Brahma N. Singh, "The Genus *Usnea*: A Potent Phytomedicine with Multifarious Ethnobotany, Phytochemistry and Pharmacology," *RSC Advances*, 6 (2016), 21672-21696.

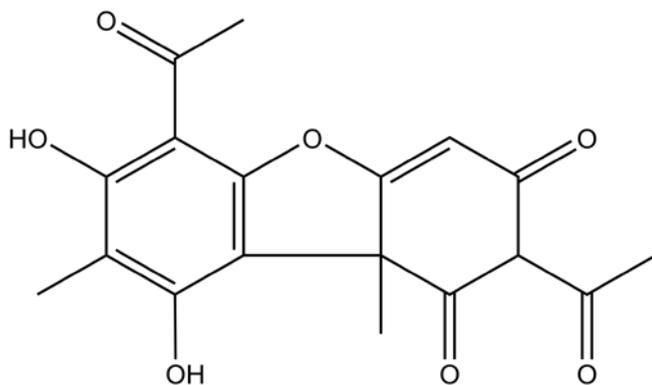


FIGURE 1
Usnic Acid

treatment of cancer, tuberculosis and ulcers in northern regions of Anatolia, besides *Dolichousnea longissima* (Ach.) Articus, which has had folk-medicine uses in the treatment of gastric ulcers.⁸ This latter species has also been used in order to strain impurities from hot pitch, before the hot pitch was subsequently used as a medicine. *Usnea sp.* are also reported to be used in Asia, Africa and Europe in order to relieve pains and control fever.⁹

The reason why *Usnea sp.* are taken to possess so many pharmacological virtues is because of the prominent secondary lichen metabolite, usnic acid, which they contain (see Fig. 1).

This usnic acid is reported to perform anti-bacterial, anti-fungal, anti-viral, antioxidant, anti-inflammatory, analgesic, antipyretic, anti-cancer, antigenotoxic, anti-mutagenic, anti-platelet (antithrombotic), and anti-ulcerogenic effects in various diseases.¹¹ The gastro-protective effect of usnic acid, isolated

8 Kenan Yazıcı and Ali Aslan, "Lichens from the Regions of Gümüşhane, Erzincan and Bayburt (Turkey)," *Cryptogamie Mycologie*, 24 (2003), 287-300.

9 C.S. Vijayakumar, Saraswathi Viswanathan, Muntha Kesava Reddy, S. Parvathavarthini, Arindam B. Kundu, and Ethirajan Sukumar, "Anti-inflammatory Activity of (+)-Usnic Acid," *Fitoterapia*, 71 (2000), 564-566.

10 The chemical formula of usnic acid is $C_{18}H_{16}O_7$. The figure has been drawn by using Perkin Elmer Chem Draw[®] v.16.0.1.4 software.

11 Branislav Ranković, Marijana Kosanić, Tatjana Stanojković, Perica Vasiljević, Nedeljko Manojlović, "Biological Activities of *Toninia candida* and *Usnea barbata* together with their Norstictic Acid and Usnic Acid Constituents," *International Journal of Molecular Sciences*, 13 (2012), 14707-14722; G.M. Pavithra, K.S. Vinayaka, K.N. Rakesh, Syed Junaid, N. Dileep, T.R. Prashith Kekuda, Saba Siddiqua, and Abhishiktha S. Naik, "Antimicrobial and Antioxidant Activities of a Macrolichen *Usnea pictoides* G. Awasthi (Parmeliaceae)," *Journal of Applied Pharmaceutical Science*, 3 (2013), 154-160; Monica Hăncianu, Oana Cioancă, Ana Clara Aprotosoae and Anca Miro, *Plante medicinale de la A la Z* (Iași, 2016), 1260-1265; Preeti Shukla, D.K. Upreti, and L.M. Tewari, "Secondary Metabolite Variability in Lichen Genus *Usnea* in India: A Potential Source for Bioprospection," *Journal of*

from *Dolichousnea longissima* (Ach.) Articus, was investigated in indomethacin-induced gastric ulcers in rats, and the gastric lesions were significantly reduced by all doses of usnic acid, as compared with a group that was treated with indomethacin.¹²

When we leave the current scientific understanding of plants and their pharmacologically relevant properties and turn to earlier times, the question of identification becomes relevant. The desideratum is to identify *materia medica* mentioned in historical texts with certainty and accuracy. Since we lack the specimens of previous ages, and are not certain of plants – including lichens or mosses – that are mentioned in ancient or medieval books, we must rely on two tools that I shall call ‘etymological apparatus’ and ‘textual apparatus’ in the last part of this paper. These tools make it possible to identify lichens up to the level of the genus. However, we can never identify with certainty the lichens invoked by Dioscorides, Rhazes (al-Razi), Aliboron (al-Biruni) or Avicenna (Ibn Sina) at the species level, as their taxonomic identification would require much more sophisticated techniques.

As mentioned above, contemporary lichen taxonomists use the genus name of *Usnea*. Etymologically, this term can be traced back to medieval Islamic pharmaco-medicine, as we explained in some detail in one of our previous studies.¹³ The *Dictionnaire étymologique des mots français d'origine orientale* of 1876 states that “*Usnea* is Arabic-Persian, اوشنة ouchna, moss, lichen. It has been mentioned in Razi’s *Almansouri* at folio 47r, in the manuscript cited earlier.”¹⁴ The *Dictionnaire* thus traces the word to the *Kitab al-Mansoori* by Abu Bakr Muhammad Zakaria al-Razi.¹⁵ “The manuscript cited earlier” by Devic is an Arabic manuscript kept at the Bibliothèque Nationale de France, in which we find the passage to which Devic is referring: “al-Ushnah, it is easy for its hotness

Environmental Science and Technology, 2 (2015), 44-55; Prateeksha et al., “The Genus *Usnea*”; Violeta Popovici, L. Bucur, A. Popescu, A. Caraiiane, and V. Badea, “Determination of the Content in Usnic Acid and Polyphenols from the Extracts of *Usnea barbata* L. and the Evaluation of Their Antioxidant Activity,” *Farmacia*, 66 (2018), 337-341.

12 Fehmi Odabasoglu, Ahmet Cakir, Halis Suleyman, Ali Aslan, Yasin Bayir, Mesut Halici, and Cavit Kazaz, “Gastroprotective and Antioxidant Effects of Usnic Acid on Indomethacin-Induced Gastric Ulcer in Rats,” *Journal of Ethnopharmacology*, 5, 103 (2006), 59-65.

13 Mustafa Yavuz and Gülşah Çobanoğlu, “Ethnological Uses and Etymology of the Word *Usnea* in Ebubekir Razi’s *Liber Almansoris*,” *The British Lichen Society Bulletin*, 106 (2010), 3-12.

14 Louis Marcel Devic, *Dictionnaire Étymologique des Mots Français d'Origine Orientale: Arabe, Persan, Turc, Hébreu, Malais* (Paris, 1876), s.v.: “*Usnée* est l’arabe-persan اوشنة ouchna, mousse, lichen. Il en est parlé dans l’*Almansouri* de Razi, fol. 47 recto du manuscrit déjà cité.”

15 Al-Razi’s name was transliterated in the Latin Middle Ages as Rhazes, and his *Kitab al-Mansoori* was known as *Liber Almansoris*.

to hold the vomit and it strengthens the stomach.”¹⁶ Al-Razi's statement and Devic's citation of it constitute an etymological tool that may be useful for the identification of this specific materia medica. And yet, we also need a textual tool in order to understand more clearly the context and content of the knowledge that may have been transmitted through this word. But before addressing both texts and contexts, we must point out that the word *ushnah* – اشنة – may be used to denote both epiphytic lichens or mosses, and is therefore more accurately rendered by the Linnaean description *Muscus arboreus*, which is no longer in scientific usage.

2 Al-Biruni, His Life and Understanding of Nature

Al-Biruni was born in Khwarazm (in today's Uzbekistan) in 973 and died in Ghazna (in today's Afghanistan) ca. 1050. His full name was Abu al-Rayhan Muhammad ibn Ahmad al-Biruni, but he was commonly known as al-Biruni, and speakers of Romance languages were introduced to him as Aliboron.¹⁷ We know nothing about his ancestry or childhood, because of a lack of sources and because in his extant works, he never mentions any of it. We do know, however, that he was taught by the eminent Khwarazmian astronomer and mathematician Abu Nasr Mansoor who – by introducing al-Biruni to Euclidean geometry and Ptolemaic astronomy – probably elicited his interest in astronomy, mathematics and geometry.¹⁸ We also know that al-Biruni corresponded with the eminent philosopher and physician Ibn Sina (Avicenna).

Under the patronage of local rulers, al-Biruni established the latitudes of the various places to which he had travelled and recorded conspicuous astronomical phenomena, including lunar and solar eclipses. During his forced stay with Sultan Mahmud of Ghazna, he completed his famous book *Tahqiq ma li al-Hind* (“Verification on India”), an early encyclopaedical work on the culture and ethnology of the Indian subcontinent. Al-Biruni wrote around 146 works, of which 14 are major books, 22 are extant and only 13 have been published to date.¹⁹

16 Ms. Bibliothèque Nationale de France, Supplément Arabe 1005, fol. 47r: “الاشنة حرارتها: يسيرة لحبس القي و يقوى المعدة”.

17 Devic, *Dictionnaire*, s.v.

18 Amelia C. Sparavigna, “The Science of Al-Biruni”, *International Journal of Sciences*, 2 (2016), 52-60.

19 Edward Stewart Kennedy, “Al-Bīrūnī,” in Charles Coulston Gillispie, ed., *Dictionary of Scientific Biography* (New York, 1970), 147-158

In a book entitled *al-Athar al-Baqiya min Qurun al-Haliya* (“The Memoirs of Past Generations”), al-Biruni discusses a variety of calendars used by nations or communities known to him; this work has been translated into English as *Vestiges of the Past*.²⁰ Completed around the year 1000, this is al-Biruni’s first major work, and it was compiled in Gorgan, at the court of Qabus.²¹ This book contains an interesting anecdote, which may serve us as an introduction to al-Biruni’s understanding of nature. He presumes that this universe, geometrically structured as it is, can be understood by following the rules of mathematics. And since this is so, he supposes that certain numerical relations are specific to every kind of entity. He specifically mentions triangular patterns existing in the leaves and seeds of most plants, besides pentagonal patterns in petals and sepals of flowered plants.²² Plants, for him, are thus characterized by a specific geometry. Incidentally, he also mentions hexagonal patterns in snowflakes and in honeycombs, possibly reporting personal observation of snowflakes (اجزاء الثلوج) in his book.²³ The reference to hexagonal snowflakes

20 Eduard C. Sachau, *The Chronology of Ancient Nations: An English Version of the Arabic Text of the Athâr-ul-Bâkiya of Albîrûnî, or Vestiges of the Past* (London, 1879).

21 Seyyed Hossein Nasr, *An Introduction to Islamic Cosmological Doctrines* (New York, 1993), 108.

22 The “triangular patterns” mentioned by al-Biruni are reminiscent of the “primal triangles which produce fire, water, air and earth of the purest quality,” according to Plato’s *Timaeus* 73C.

23 *al-Athar al-Baqiya* is available at the Bibliotheque Nationale de France, Manuscript Arabe 1489. The text in question is extant in chapter 14, under the title “On the Festivals and Memorable Days of the Syriac Calendar Celebrated by the Melkite Christians,” fol. 164v line 7. The Arabic text reads as follows:

... والثالوث في كثير من أوراق النبات وحبوبها موجود، وكذلك الترابيع في حركات الكواكب وأيام البحرانات، والتخاميس في أقناع الزهر وأوراق أكثر أورادها وعروقها، والتسديس في الدوائر مطبوع، وفي كور النحل وأجزاء الثلوج موجود، وكذلك جميع الأعداد يوجد في المطبوعات من آثار النفس والطبيعة وخاصة في الزهر والأوراد، فإن أوراق كل وردة منها وأقناعها وعروقها تحتص بعدد في كل جنس على حدة...

A rough translation might go as follows (words in brackets being added by me): “... and the trinity (or triple formations occur) in many leaves and kernels of plants, as well as quadruplications in the motions of the planets and in the fever days (probably dog days). Quintuplications in the bottom of the flowers and in the leaves of most of their blossoms, and in their veins; sextuplications are natural forms of circles, and occur also in beehives and snowflakes. So, all numbers are found in physical appearances of the works of soul and nature, especially in flowers and blossoms. As for the leaves of every blossom (rose), their funnels and veins, (show in their formation) certain numbers peculiar to every genus of them ...”.

would deserve some extra investigation, because the discovery of that shape is often attributed to Johannes Kepler.²⁴

A few lines later, al-Biruni returns to the parallel between geometry and flowers, pointing out that every petal has an isosceles shape. When flower buds open, these isosceles triangles form a circular pattern (a fact that can be observed in many angiosperm species).²⁵ On the basis of this reflection, he can explain why it is almost impossible to find a flower with seven petals: seven is not an aliquot divisor of a full circle of 360° , as the division yields no integer, but something unwieldy like 54.428571 . This is not, however, how al-Biruni would have put it. Rather, in the Middle Ages, geometrical patterns were drawn with ruler and pair-compass, and arranging seven petals around a circle with compass and ruler was a feat. The earliest extant Arabic constructions of a regular heptagon date from the second half of the tenth and the eleventh centuries, and al-Biruni was probably involved in that enterprise.²⁶ Remarkably, then, al-Biruni applied the geometrical principles of his astronomical and mathematical activities to botany, almost six centuries before Joachim Jungius (1587-1657) chose to define the types of plant parts through geometrical

24 Johannes Kepler, *Strena, sive De nive hexangula* (Prague, 1611); translated in Kepler, *The Six-Cornered Snowflake. A New Year's Gift*, ed. and transl. Jacques Bromberg, Owen Gingerich, Guillermo Bleichmar, et al. (Philadelphia, PA, 2010).

25 The text about the botanical geometry starts at 164v line 17:

لي في خصيات الزهر شيء هو موضع التعجب و هو ان عدد اوراقها التي تحوز اطرافها دائرة عند انفتاحها جار في اغلب الامر على قضايا الهندسة و موافق في اكثر الاحوال للاوتار التي وجدت بالاصول الهندسية دون القطوع المخروطية فلا تكاد تجد زهرة من الازهار يكاد يكون عدد اوراقها سبعة او تسعة لامتناع عملها بالاصول الهندسية في الدائرة متساوية الاضلاع بل يكون ثلاثة و اربعة (164r) و خمسة و ستة و ثمانية عشر و هذا امر اكثري الوجود و ممكن ان يوجد في الاحياء جنس للسبعة او التسعة او يوجد في خلال الانواع المذكورة عدة كذلك...

"Among the features of the flowers there is an astonishing fact, that is, that the number of their leaves, whose endings form a circle when they open, follows in most cases the laws of geometry. In most cases they agree with the chords that have been found by the laws of geometry, not with conic sections. You hardly ever find a flower of 7 or 9 petals, since that would be impossible to construct according to the laws of geometry in a circle as isosceles. The number of petals is always 3, 4, (164r) 5, 6 or 18 (maybe he meant 8 and 10 but forgot to include a و in between). This is a matter of frequent occurrence. One day possibly one may find some species of flowers with 7 or 9 leaves, or one may find among the species known hitherto such a number of leaves ...".

26 Jan Pieter Hogendijk, "Greek and Arabic Constructions of the Regular Heptagon," *Archive for History of Exact Sciences*, 30 (1984), 197-330.

notions and methods, proceeding *more geometrico* in his botanical investigations.²⁷

In the end, al-Biruni must not be described as either a philosopher or a physician, but as a polymath who simultaneously engaged with astronomy, geometry, mathematics, ethnology and languages. His interest in pharmacology and medicine probably only arose towards the end of his life. At any rate, his book on simple drugs and materia medica, was the last book he authored.

3 *Kitab al-Saydanah*

In fact, al-Biruni died soon after completing his *Kitab al-Sydanah*, at the age of 77 (solar) or 79 (lunar), and had no opportunity to revise it. It became known as *Kitab al-Saydanah fi al-Tibb*, that is “Book of Pharmacy in Medicine.” It starts off with an introduction in five parts called *fasl* (فصل). In the first *fasl*, al-Biruni discusses possible etymological origins of the word *saydanane* from which the words *saydalah* and *saydanah* are derived. He also explains why he uses the word *saydanah* in the title of his book: in Sanskrit, *jandanani* is the word used for drugs. In Arabic, this word transforms into *saydanani*, with the result that in Arabic, *saydana* has come to mean both “pharmacy” or “pharmacology.” By using this originally Sanskrit word in the title of his comprehensive book, al-Biruni signals his interest in the Indian lore on materia medica.²⁸ In the second *fasl*, he compares drugs with foods and poisons, placing drugs between these two. He then offers some technical terminology for the different categories of drugs. The third *fasl* addresses the issue of substitution between kinds of materia medica. He supports this idea, especially when it comes to medicinal plants that have wild and cultivated forms. The fourth *fasl* is related to Arabic as a proper language for the philosophy and medicine of his time. In the last *fasl*, al-Biruni mentions his sources; we encounter well-known names such as Dioscorides, Galen, Paul of Aegina and Oribasius, whose books were available in Arabic. He also criticises two related books by al-Razi, the *Kitab al-Saydana* (“Book of Pharmacy”) and the *Kitab al-Abdal* (“Book of Substitutes”). He thanks his dear friend and colleague Abu Hamid ibn Muhammad *Nahshai*. In this *fasl*,

27 Brigitte Hoppe, *Empirie und Geometrie als Grundlagen der Botanik von Joachim Jungius* (1587-1657), in Ekkehard Höxtermann, ed., *Berichte zur Geschichte der Hydro- und Meeresbiologie und weitere Beiträge zur 8. Jahrestagung der DGGB in Rostock 1999* (Berlin, 2000), 119-130.

28 Considering the fact that he authored an encyclopaedic book (*Tahqiq ma li al-Hin*) on Indian culture, besides his discussion of the etymology and meanings of *saydanah*, one can conclude that al-Biruni also had an interest in Indian lore on materia medica.

al-Biruni finally mentions the polyglottic dictionaries that were available to him.

After these five initial *fusul*, the main body of the work offers 890 items of material medica in alphabetical order (*abjad*).²⁹ Their names are always given in Arabic, Greek, Latin, Syriac, Persian, and Sanskrit, but sometimes also in Hebrew, Khwarazmian, Tokharian and Turkish. Al-Biruni's linguistic abilities were such that he was at least able to use dictionaries in Greek, Syriac and Hebrew. In addition, he was able to translate several Indian works from Sanskrit into Arabic and vice versa.

In the historiography of medicine and of pharmacy, the *Kitab al-Saydanah fi al-Tibb* has been less studied than Avicenna's *al-Qanun fi al-Tibb* ("Canon of Medicine"). Its "Introduction" has been translated into Turkish from the sole manuscript kept in Turkey.³⁰ This copy, written out in 678 AH/1279 CE by Gazanfar al-Tabrizi and known as the Bursa codex, consists of 134 folios.³¹ Zeki Velidi Togan, who discovered this codex, mentions that the *Kitab al-Saydanah fi al-Tibb* was completed with the help of al-Biruni's student, Nahshai (Bahshai in Persian) around 1050.³² A two-volume edition and English translation was produced by Hakim Mohammed Said, with the assistance of Rana Ehsan Elahie, Kamal M. Habib and L.A. D'Silva (vol. 1) together with a commentary by Sami Khalaf Hamarneh (vol. 2).³³ The English translation was made on the basis of the Baghdad manuscript.³⁴ Since the Bursa codex is incomplete, the Turkish translation and facsimile of the Bursa codex, published under the auspices of Turkish Ministry of Culture, uses the Said edition for the translation of the missing parts.³⁵

29 *Fusul* is the plural form of *fasl*.

30 Mehmet Ş. Yaltkaya, *Kitâbü's-Saydala fi't-Tib Mukaddimesi* (Istanbul, 1937).

31 The full name of the copyist is *Fahr al-Din Abu Ishaq Ibrahim ibn Muhammad Gazanfar al-Tabrizi* (d. 1280), abbreviated as Gazanfar al-Tabrizi (غضنفر التبريزي). He was a well-known copyist of many medicinal works and also the physician of Mawlana Jalal al-Din Muhammad Rumi. See Cevat İzgi, "Gazanfer et-Tebrîzi," *Türkiye Diyanet Vakfı İslâm Ansiklopedisi* (Ankara, 1996), 13: 433-434.

32 Ahmet Zeki Velidi Togan, *Birûnî's Picture of the World* (Memoirs of the Archaeological Survey of India) (Delhi, 1941). Togan compared the Persian translation by Abu Bakr ibn Ali al-Kasani, kept at the British Museum, MS Or. 5849, to the Arabic manuscript kept in Bursa.

33 Hakim Mohammed Said, *Al-Biruni's Book on Pharmacy and Materia Medica* (Karachi, 1973).

34 Baghdad Iraqi Archaeology Department No: 191, which contains 209 folios.

35 Esin Kâhya, *Kitâbü's Saydana Fi't Tib Ebu'r-Reyhan el-Beyruni* (Ankara, 2011).

4 Arabic Text and English Translation

I here examine the Arabic manuscript of *Kitab al-Saydanah fi al-Tibb*, selecting, for the terms used to describe epiphytic and saxicolous lichens, *ushnah* (اشنة) and *hazaz al-sakhr* (حزاز الصخر), respectively. I have edited the Arabic texts that appear under these names, relying on the manuscript extant in Inebey Manuscript Library in Bursa, but comparing the wording with the Baghdad codex.³⁶ For the one paragraph missing from the Bursa codex, I had to rely on the latter manuscript. The term *ushnah* (اشنة) appears in folios 20v, 21r of the Bursa codex, and the term *hazaz al-sahr* (حزاز الصخر) in folio 50r. To my edition plus translation, I have added footnote comments on the botanical names of the materia medica mentioned by al-Biruni.

4.1 *Ushnah*:

اشنة. هو باليونانية: بروون و بالفارسية: دواله و دوالك و دوالي و بالهندية: جهريله و چريه و *brwun* in Greek³⁷, *duwalah*, *duwalak*, and *dawali* in Persian, *chharilah* and *charirah* in Indian.

و قال الفزاري: هو بالهندية: سيلبوا و بالسندية: سيابروا و هو بالسجزية: ژالکه و *Fazari*³⁸ said: "It's *sylibuwa* in Indian and *siabrwu* in Sindhi, and it is *dzalkah* in Sijzi.

و بهذا ذكره ابو نصر ابن ابي زيد صهار بخت في اقرباذينه و فسرہ بانہ الكرباس پايہ تشبيها له باصابع سام ابرص و هكذا عرّف في كّب الطب وربما قيل پاله و *Abu Nasr ibn Abi Zayd Saharbuht*³⁹ mentioned this name in his pharmacopoeia and interpreted its name as *karbas payah*, comparing it to poisonous leprosy on fingers and so it was known in medical books and sometimes it is called *palah*.

36 The Arabic manuscript is kept at Bursa Inebey Manuscript Library, Kurşunlu Collection No: 149. I have worked on a pdf copy of the manuscript and have double-checked my translation against Said's English and Kâhya's Turkish translations.

37 This is the Arabic transliteration of βρόνον, "moss," in Greek.

38 Ahmad ibn Abi Ya'qub al-Fazari was the author of *Kitab Habib al-'Arus wa Raihan al-Nufus*. He probably lived in the tenth century; see Max Meyerhof, *Das Vorwort zur Drogenkunde des Beruni* (Berlin, 1932); Fuat Sezgin, *Geschichte des arabischen Schrifttums*, vol. 3: *Medizin, Pharmazie, Zoologie, Tierheilkunde* (Leiden, 1970), 313.

39 On Abu Nasr ibn Abi Yazid Saharbuht, see Meyerhof, *Das Vorwort*, 157-226. Sezgin, *Geschichte*, 274.

Abu al-Abbas al-Khushshaki⁴⁰ in the *Book of Fragrance* stated that it is an herb on the coast from Bara to Ailah and Rayat al-Tur and also from Jaddah to Yemen and to the coast of Basra. Its leaf is similar to that of wormwood⁴¹ with a dark colour. Waves of the sea rise above it by the power of the wind, and it is suspended on the sea. It is covered by foam and then equally dried by the wind. It is not used unless it is rubbed between the palms and shaken off, so that the foam may be removed, and its whiteness may glisten.

Sometimes it is mixed with leaves of paper that have been cut up in this form, and it seems that this is why the people of Zabulistan call it *dawalah*, as if they take it from this counterfeit.

Galen said it is a resolvent and aperient, especially the one occurring on pine.⁴² Paul (of Aegina) associated it with cedar.⁴³ This is it. In *Kitab al-Mayamir* pine oil has been called *qatran* (tar).

Dioscorides said that the best variety is that which grows on cedar which is pine, followed by the

قال أبو العباس الخشكي في كتاب العطر: انه نبات على ساحل البحر من برة الى ايلة وراية الطور كما يدور من جده الى اليمن الى ساحل البصرة. ويشبه ورقة ورق الشيح البستاني كاسف اللون. تعلقه أمواج البحر عند قوة الريح فيعلق به غشاء البحر ويحيط به كالجلدة ثم يحففه سواء في الرياح ولا يستعمل الا بعد الفرق بين الراحتين و نفضه ليسقط عنه الغشاء و يصفو بياضه

وقد يغش بطروس الصحف المقطعة على هيئة و يشبه ان يكون هذا سبب تسمية الزابلية **دواله** كأنهم اخذوه من هذا المزور.

قال جالينوس: وهو محلل ملين و خاصة ما وجد منه على شجر الصنوبر و عبر عنه **بولس** بشجر القطران و هو هو فقد ذكر في كتاب الميامر دهن الصنوبر المعروف بالقطران.

قال **ديسقوريدس**: ان الاجود منها ما كان على الشروين و هو الصنوبر و بعده ما كان

40 Abu al-Abbas al-Khushshaki, author of *Kitab al-Iti*; probably lived in the tenth century; see Meyerhof, *Das Vorwort*, 157-226; Sezgin, *Geschichte*, 312-313.

41 *Artemisia herba-alba* Asso.

42 *Pinus* sp.

43 *Cedrus libani* A. Rich.

variety that grows on walnut.⁴⁵ The more fragrant it is, the better it will be, especially if it has a bluish-white tinge. People of Khuzestan said that both varieties are very cold and dry and they have the power of constipating and resolving together, and they are ative. Especially the one growing on pine is laxative for moderate constipation. The one on cedar is de-obstruent, and it tightens flaccid flesh. Applied over hot tumours, it calms them, dissolves solidities, and calms down tumours of flaccid flesh.

Razi⁴⁶ and others mentioned that it wraps itself around walnut, oak,⁴⁷ and pine in the manner of ivy. It is whitish with an attractive fragrance, and the one inclined towards blackness is bad. The best variety is the one growing on pine.

Some others mentioned love-in-a-mist⁴⁸ instead of pine. It seems they misread; and it seems that the qualities (mentioned) by the physicians are different from the qualities given by al-Hushshaki and the apothecaries, as if it is another genus.

على الجوز واجودها اطيها رائحة و ما كان ابيض على الزرقة و قالة الخوز: انهما باردة شديدة اليبس و بها قوة قبض و تحليل معا و تلين و لاسيما الصنوبرية منها و قبضها معتدل و القطرانية تفتح السدد و تشد اللحوم المسترخية و تطفى على الأورام الحارة فتسكنها و تحلل الصلابات و تسكن اورام اللحم الرخو.⁴⁴

وقال الرازي وغيره: انه يلتف على شجر الجوز والبلوط والصنوبر التفاف الكشوث وهو ابيض طيب الرائحة و ما مال منه الى السواد فردي و اجوده ما التف على الصنوبر .

و ذكر بعضهم: الشوز مكان الصنوبر و كأنه تصحيف وهذه الصفات من الأطباء مخالفة لصفات الحشكي و العطارين و كأنه جنس اخر .

44 This paragraph in the Arabic text is found only in the Baghdad codex.

45 *Juglans regia* L.

46 Abu Bakr Muhammad ibn Zakariya al-Razi.

47 *Quercus* sp.

48 *Nigella sativa* L.

The pharmacists know two varieties: *the Baghdadian*, which is white and fragrant, and from which the compound perfume 'abir is prepared. It does not grow in Baghdad itself but it has been brought to the city because of its popularity among apothecaries; and *the Indian* variety, which is inferior to the former both in colour and fragrance. It can only be crushed when wetted by water.

Ibn Masawaih⁴⁹ and Razi said that caraway⁵⁰ is its substitute.

4.2 *Hazaz al-sahr*:

Paul (of Aegina) mentioned it as *hazaz al-jabal*.⁵¹ It is that thing which grows on stones, similar to algae. Saharbuht said it has been named *hazaz* (tetter) since it cures tetter.

والمعروف منه عند الصيادلة نوعان البغدادية وهو الابيض الارج الفائق الذي يتخذ منه العبير وليس بغداد بمعدن له وانها يكثر فيها لرواج العطرين أهلها ودونه الهندي رائحة و لونا وليس يندق الا بعد البل بالماء.

وقال ابن ماسويه و الرازي في بدله: انه القردمانا.

حزاز الصخر

و بولس ذكره حزاز الجبل وهو شبيه يكون على الصخر يشبه بالطحلب وقال صهاربخت سمى خزازا لانه يشفي من العلة المسماه بهذا الاسم.

5 Discussion

As mentioned, Meyerhof in the early twentieth century examined al-Biruni's *Kitab al-Saydanah fi al-Tibb* and its sources, and he translated the foreword.⁵² He concluded that it had without any doubt been written by al-Biruni alone, as it bore the stamp of his original personality, his interest in many fields of learning, and his extensive knowledge. The short sections cited in our own study seem to confirm this assessment, for they document the typical combination of al-Biruni's scientific, philological and historical approaches.

49 Abu Zakariyya Yuhanna (Yahya) Ibn Masawaih lived in the ninth century; see Paula De Vos "The "Prince of Medicine" Yuhanna ibn Masawayh and the Foundations of the Western Pharmaceutical Tradition," *Isis*, 104 (2013), 667-712.

50 *Carum carvi* L.

51 "Tetter of mountain": this is probably an error. The correct form should be "tetter of rocks."

52 Meyerhof, *Das Vorwort*, 157-226.

Indeed, the *Kitab al-Saydanah fi al-Tibb* stands as one of the most original texts in Arabic on the subject of materia medica for its authenticity, approach and objectivity. In its structure, it is quite similar to a medico-pharmacological lexicon. Unlike Avicenna, however, al-Biruni focuses on the cultural aspects of *materia medica*. Moreover, as he provides numerous synonyms for his items of *materia medica*, his book is also a valuable source for lexicographical or terminological studies.

Let's look once more at what al-Biruni writes on lichens, comparing it to the medieval pharmaco-medicinal lore in Mashriq and with the works of Ibn Sina (Avicenna), and examining it also from our contemporary understanding of the properties of lichens. We have seen that al-Biruni uses *ushnah* (اشنة) for epiphytic and *hazaz al-sakhr* (حزاز الصخر) for saxicolous lichens, agreeing in this with Ibn Sina. And yet, his terminology differs from Ibn Sina's due to his affinity with medieval Indian medicine. Al-Biruni also offers a richer range of synonyms for *ushnah* in local dialects, which he takes from a variety of authors. He also differs methodologically in the arrangement of material medica. Ibn Sina's *al-Qanun fi al-Tibb* examines simple and complex drugs, while al-Biruni describes only simple drugs. Furthermore, Ibn Sina, in the materia medica part of his work, offers some secondary titles for every drug, such as essence (الماهية), selection (الاختيار), nature (الطبع), actions and characteristics (الافعال و), decoration (الزينة), tumours and swellings (الأورام و البثور), sores and wounds (الجراح و القروح), parts of the head (اعضا الراس), parts of the eye (اعضا العين), respiratory organs and thorax (اعضا النفس و الصدر), organs of digestion (اعضا الغذاء), organs of evacuation (اعضا النفض), fevers (الحميات), toxins (السموم), and substitutes (الابدال). These secondary titles vary according to the features of a given medical material. Al-Biruni, by contrast, uses no secondary titles, but first provides the names or synonyms in other languages as a matter of nomenclature, and then, referring to various authors and physicians, mentions the main features of any given materia medica as a matter of identification. Finally, he describes the uses and pharmacological properties of a given item of materia medica as a matter of description.

With respect to al-Biruni's terminology, we may mention here that his quotation from Dioscorides contains a mistake. Where he writes "على الجوز" / on walnut," a contemporary English translation of Dioscorides, defines this tree as a "white poplar," that is, *Populus alba* L.⁵³ A 1529 edition of Dioscorides' *De*

53 *Dioscorides, De materia medica, ed. and transl. Lily Y. Beck (Hildesheim, 2005), C. 1.21, p. 21.*

materia medica gives us λεύκη in Greek and *Populus alba* in Latin.⁵⁴ The correct term must be “white poplar,” the error being presumably due to a transcription error of الجوز (walnut) instead of الحور (poplar).

Al-Biruni offers بروون *broon* (or *brwun*) as a synonym of اشنة *ushnah*, which is simply the Arabic transliteration of βρῦον in Greek. He also gives us the following Persian synonyms: دوالك (*duwalak*), دواله (*duwalah*) and دوالي (*dawali*) – terms whose relationship with اشنة *ushnah* we have discussed elsewhere.⁵⁵

The trade and usage of lichens in traditional Ayurvedic and Unani medicines have drawn the attention of earlier scholars.⁵⁶ In that health-related trade, lichens were sold under the names of *charila*, *shailya*, and *chadila* according to Unani pharmacopoeia, terms that equally refer to *ushna*, or *Usnea longissima* Ach.⁵⁷ These names in fact correspond to the Hindi names that al-Biruni cites: چهريله (*chharilah*) and چريره (*charirah*). As for the synonyms al-Biruni offers from other Indian languages (Sindhi and Sijzi), they will need examination. We must assume that he was able to consult medical or etymological books on *materia medica* from the Indian subcontinent, for, during his aforementioned forced stay with Sultan Mahmud of Ghazna, he completed his famous book *Tahqiq ma li al-Hind* (“Verification on India”), an early encyclopaedical work on the culture and ethnology of the subcontinent.

Al-Biruni furthermore cites Abu Nasr ibn Abi Zayd Saharbuht to the effect that *ushnah* resembles “poisonous leprosy on fingers.” This comment may be due to the word’s etymology: the Greek word λειχήν (*leikhen*) means tetter or scab, but which was first used to denote lichens, according to the dictionaries.⁵⁸

As for the reference to Abu al-Abbas al-Khushshaki, he seems to mention another odoriferous material – possibly a species of plants or algae. Al-Biruni may not have been aware of the difference between plants, algae and lichens,

54 Discorides, *Peri hyles iatrikes. De materia medica*, ed. Marcellus Virgilius Adrianus, (Cologne, 1529), C.1.20, p. 43. Meyerhof, *Das Vorwort*, 157-226.

55 دوالك: a little strap, a leather strap used in a game; a species of a fragrant creeper. دواله: A kind of sweet smelling creeper. دوالي: A kind of fragrant creeper; see Francis Joseph Steingas, *Persian-English Dictionary* (Tehran, 1998), s.v. On this terminology, see Mustafa Yavuz and Gülşah Çobanoğlu, “Tıp Tarihinde Likenlerle İlgili Terimler,” *Avrasya Terim Dergisi*, 3 (2015), 1-9. Çobanoğlu and Yavuz, “Tıp Tarihinde Likenlerle Tedavi,” 37-90.

56 Nayankumar C. Shah, “Lichens of Economic Importance from the Hills of Uttar Pradesh, India,” *Journal of Herbs, Spices & Medicinal Plants*, 5.3 (1998), 69-76. doi:10.1300/J044v05n03_09; Nayankumar C. Shah, “Lichens of Commercial Importance in India,” *The Scitech Journal*, 1.2 (2014), 32-36.

57 *Dolichousnea longissima* (Ach.) Articus in the current taxonomy.

58 Henry George Liddell & Robert Scott, *A Greek-English Lexicon* (New York, 1883), s.v.

since in Islamic medicine – following ancient traditions – *materia medica* was often classified according to their effect in or on the body.

The expression “it is mixed with leaves of paper that have been cut up in this form” is certainly interesting since thalli of epiphytic pendulous lichens may have been imitated in the Middle Ages by cut papers. Probably some medicines were mixed with counterfeit material for economic reasons.

Like most of the medieval physicians who authored books in Arabic, al-Biruni frequently refers to Galen and Dioscorides for relevant topics. He invokes Galen for the notion that lichens, notably those growing on pine trees, are resolvent and aperient. He specifically refers to Galen’s *Book of Simple Drugs* VI.⁵⁹ Two Arabic copies of this book happen to be extant at the Real Biblioteca del Monasterio de San Lorenzo de El Escorial. The relevant passage reads:

Ushnah: this is a plant that grows on oak, pine and walnut. Its power is moderately astringent; therefore, it is not intensively cold, but it is rather close to tepid. It has a dissolving and softening power, especially the one found on oak / pine trees.

الاشنة: هو نبات يوجد نابتا على البلوط والصنوبر والجوز. وقوته قوة قابضة باعتدال، وذلك انه ليس بارد برودة قوية بل هو قريب من الفتورة، وفيه مع هذا قوة محللة ملينة وخاصة فيما يوجد منها على شجر البلوط / الصنوبر

The two Arabic manuscript from Spain differ only in one word, which names the host of the lichen. Manuscript 794, fol. 14r, mentions شجر البلوط “oak tree” where manuscript 793, fol. 103v, has شجر الصنوبر “pine tree”. Al-Biruni seems to agree with the second manuscript, because الصنوبر is more likely to correspond to Galenic κέδρος, “cedar tree.”

It is noteworthy that *ushnah* اشنة is taken to possess simultaneously constipating and laxative properties. Indeed, Galen agrees with Dioscorides and repeats this attribution of simultaneously constipating and laxative properties. On the basis of Dioscorides, it is said to calm tumours, which are hot. It is interesting here to compare this to Ibn Sina’s mention of *ushnah* اشنة, in the second part of his *al-Qanun fi al-Tibb*.⁶⁰ A recent comparison between what Ibn Sina

59 Galen’s book on *materia medica* was known in Arabic as *كتاب الادوية المفردة لجالينوس* and in Latin as *De simplicium medicamentorum temperamentis et facultatibus libri xi*.

60 The term *ushnah* اشنة is used in Giovan Battista Raimondi’s Arabic edition of Ibn Sina, *al-Qanun fi al-Tibb* (Rome, 1593), 128.

and al-Baytar had to say on lichens, provides us with an excerpt by Ibn Sina from Dioscorides.⁶¹

Dioscorides said; the best of them is that begets (grows) on cedar, which is pine, and then the better is the one present on walnut (white poplar). The best is the one with the most pleasant odour, and white to blue.

قال دياسقوريدوس إن الأجود منها ما كان على الشروين وهو الصنوبر وكانت بعد ذلك فالأجود ما يوجد على الجوز. وأجودها أطيبها رائحة وما كان يابضاً إلى الزرقة

The same text is rendered as follows in a contemporary English translation of Dioscorides:

βρύον, Tree moss, but some call it *splachnon*; it is found on trees of the cedar, white poplar, and oak families. The best grows on cedars and that on poplars is second best. It is good, if it is highly aromatic and light in colour, but if it is somewhat black, it is inferior. It has an astringent property, which operates on uterine pathologies in decoctions for sitz baths. Because of the astringent element it contains, it is mixed both with unguents made from ben and with ointments, and it is well suited for making fragrant stuffs and analgesics.⁶²

It is evident that the two contemporaries, al-Biruni and Ibn Sina, agreed in their use of Dioscorides for their respective discussions of *ushnah*. In fact, they probably used the same, or at least a similar source, that is, the Arabic translation of Dioscorides.

In the second part of his work, Ibn Sina also mentions حزاز الصخر *hazaz al-sakhr*.⁶³

Tetter of rock (saxicolous lichens): Essence, Galenos said that it is the thing that begets (grows) on the stones, it is similar to the moss. It desiccates in two aspects, since its strength is

حزاز الصخر: الماهية قال جالينوس هذا شيء يكون على الحجر يشبه الطحلب، وهو يجفف من الوجهين جميعاً لأن قوته تجلوا وتبرد، فالجلاء والتجفيف أكتسبه من الصخر، و

61 Mustafa Yavuz, "A Comparative Study of Epiphytic Lichens Mentioned by Ibn Sina and Ibn al-Baytar," *Medicina nei Secoli. Arte e Scienza*, 30 (2018), 617-640.

62 Dioscorides, *De materia medica*, 21.

63 The expression حزاز الصخر / *hazaz al-sakhr* is used in Raimondi's 1593 Arabic edition of Ibn Sina, *al-Qanun fi al-Tibb*, 182.

clearing and cooling. The clearing and dryness (properties) are acquired from the rock, the cooling from the water. Characteristics, dehydrator, cooler. Dioscorides said that it stops bleeding, but I do not say that.

التبريد من الماء. الخواص مجفف مبرد وقال
ديسقوريدوس يقطع الدم ولا أقول به

From the Arabic text and its translation, it is obvious that with the title of *Hazz al-Sakhr*, al-Biruni refers to Paul of Aegina, and Saharbuht, while Ibn Sina instead refers to Galen and Dioscorides. This is why they are transmitting different information under the same title. It is also noteworthy that referring to Saharbuht, al-Biruni points to the hazaz-tetter connection which recalls the antique use of lichens for the cure of some skin diseases.

Conclusion

We have seen that the genus name *Usnea* comes from the Arabic *ushnah* (اشنة). As we have seen, the nomenclature and terminology provide us with an *etymological apparatus*, by means of which we can – at least in cases where names have remained similar – identify certain plants or plant-like phenomena that were used as *materia medica* in the ancient and medieval times. However, in order to justify our identifications, we also need to understand the contexts and contents of the texts that have been transmitted to us. Such interpretations and contextualisations may be called our *textual apparatus*, and it includes a comparison of data from the past with the present. While avoiding anachronisms, one may combine the two tools to track the transmission of knowledge from Greco-Roman Antiquity to the Islamic and Latin Middle Ages and then to the modern period, providing us with a sense of the unbroken endurance and development of scientific knowledge. Such a continuity is particularly clear in the case of *ushnah* / *Usnea*.

We have seen that Al-Biruni, the author of *Kitab al-Saydanah fi al-Tibb*, was neither a pharmacist nor a therapist, but rather a polymath with a particular expertise in astronomy and mathematics, and with an approach to the natural world that relied on an examination of the terminology and nomenclature used in different languages. Because of his historical and philological approach to *materia medica*, he transmits more detailed information than Ibn Sina does in his *al-Qanun fi al-Tibb*, citing sources that Ibn Sina failed to invoke.

Simple drugs such as those described in an encyclopaedic work like *Kitab al-Saydanah fi al-Tibb* are a potential source for today's pharmaceutical studies. An ethno-botanical review pointed out in 2009 that pharmacologists and

botanists are prone to overlook lichens due to their slow growth-rate, but that they might possess important properties that have hitherto been ignored.⁶⁴ Recent years have in fact seen an increasing interest in lichens as potential sources for bioactive compounds possessing therapeutic properties.⁶⁵ Now, it cannot alas be established whether al-Biruni or anyone else mentioning *ushnah*, referred to *Alectoria sp.*, *Evernia sp.*, *Pseudevernia sp.*, or *Usnea sp.*, because, due to the similar appearance of their thalli, several taxa in these genera were clustered as *Muscus arboreus* in medieval Latin texts. In fact, they are easily confused by non-specialists even today. Referring back to pre-modern taxonomies, *Evernia sp.* and *Pseudevernia sp.* are still commonly known as “oak moss.” In the same vein, Al-Biruni considered lichens to be plants, but classified a species of epiphytic lichens under the title *ushnah*. Among the species belonging to the above-mentioned genera, we find usnic acid (among many other secondary metabolites), which does possess established pharmaceutical properties, some of which may have been recognized and exploited in the Middle Ages.⁶⁶

Our textual apparatus has in fact yielded some physiological or morphological data. With respect to *hazaz al-sakhr*, al-Biruni provides insufficient information for any identification, but it is definitely a saxicolous lichen. The situation is much richer with *ushnah*. Citing a variety of authors, al-Biruni says of it that it cures poisonous leprosy (which is lichen planus, not leprosy) on fingers, is a resolvent and aperient, can be used for fragrance and as an ingredient of perfume, has a laxative effect and is used for calming hot tumours. If we consider the studies quoted earlier on the biological properties of usnic acid, we might suggest that this acid is in fact the main component of al-Biruni's *ushnah*. Moreover, citing Dioscorides, al-Biruni mentions the oak tree as its habitat or substrate. Interestingly, sixteenth-century illustrated commentaries on Dioscorides' *Materia medica* clearly picture *Usnea sp.* on oak branches

64 Ivanova and Ivanov, “Ethnobotanical Use,” 11-16.

65 Marijana Kosanić, Branislav R. Ranković, Svetlana Ristić and Nedeljko Manojlović, “Bioactive Constituents from Lichens,” *Zbornik radova*, 21 (2016), 639-644; Branislav R. Ranković, and Marijana Kosanić, “Lichens as a Potential Source of Bioactive Secondary Metabolites,” in Branislav R. Ranković, ed., *Lichen Secondary Metabolites* (London, 2015), 1-26.

66 Kristín Ingólfssdóttir, Gavin A.C. Chung, Vilhjálmur G. Skúlason, Stefán R. Gissurarson and Margrét Vilhelmsdóttir, “Antimicrobial Activity of Lichen Metabolites in Vitro,” *European Journal of Pharmaceutical Sciences*, 6 (1998), 141-144; Joanne G. Romagni, Giovanni Meazza, N.P. Dhammika Nanayakkara and Franck E. Dayan, “The Phytotoxic Lichen Metabolite, Usnic Acid, is a Potent Inhibitor of Plant *p*-Hydroxyphenylpyruvate Dioxygenase,” *FEBS Letters*, 480 (2000), 301-305; Kristín Ingólfssdóttir, “Molecules of Interest: Usnic Acid,” *Phytochemistry*, 61 (2002), 729-736.

under the header '*Muscus arboreus*'. Indeed, for many centuries, *Muscus arboreus* was illustrated in the pendulous form of an epiphytic *Usnea sp.*

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