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NEW RECORDS OF CRUSTOSE LICHENS FROM IRAN, INCLUDING A NEW GENUS RECORD

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Abstract
The crustose lichen species *Diploicia canescens* (Dicks.) A. Massal., *Polyozosia sambuci* (Pers.) S.Y. Kondr., Lőkös & Farkas and *Pertusaria leioplaca* (Ach.) DC. are reported for the first time from Iran, Golestan Province. Furthermore, the genus *Diploicia* is newly recorded for the lichen flora of Iran. The samples were collected from the Hyrcanian Forests of Golestan Province and deposited in the herbarium of the Research Institute of Forest and Rangelands, Tehran, Iran (TARI). These species have been identified based on detailed morphological, anatomical, and chemical characters. Each species can be distinguished by its characteristic thallus morphology, apothecia, or fertile warts. Their diagnostic characteristics, ecology, and geographic distribution are discussed. These findings indicate the high diversity of crustose lichens in northern Iran and clearly highlight the importance of recording new genera and species to complement the lichen flora and to support lichen-related biodiversity surveys and ecological studies.

Keywords: Crustose lichens; Golestan province; Hyrcanian Forest; Iran; taxonomy

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گزارش های جدید از گلسنگ های پوسته ای ایران، شامل ثبت یک جنس جدید برای ایران

ساره سادات کاظمی: پژوهشگر بخش تحقیقات گیاهشناسی، موسسه تحقیقات جنگلها و مراتع کشور، سازمان تحقیقات، آموزش و ترویج کشاورزی، تهران، ایران
هری سیپمن: استاد باغ و موزه گیاهشناسی برلین –داهلم، آلمان

چکیده: گونه‌های گلسنگ‌های پوسته‌ای *Diploicia canescens* (Dicks.) A. Massal., *Polyozosia sambuci* (Pers.) S.Y. Kondr., Lőkös & Farkas و *Pertusaria leioplaca* (Ach.) DC. برای نخستین‌بار از استان گلستان، ایران گزارش می‌شوند، علاوه بر این، جنس *Diploicia* نیز برای اولین بار به فلور گلسنگی کشور افزوده می‌شود. نمونه‌ها از جنگل‌های هیرکانی استان گلستان جمع‌آوری و در هرباریوم موسسه تحقیقات جنگلها و مراتع کشور(TARI) نگهداری شدند، این گونه‌ها با توجه به خصوصیات مورفولوژیکی– تشریحی و شیمیایی دقیق، شناسایی شده‌اند. هر یک از این گونه‌ها بر اساس ویژگی‌های مورفولوژی تال، آپوتسیوم‌ها یا زگیل‌های بارور قابل تشخیص هستند. ویژگی‌های تشخیصی، اکولوژی و پراکنش جغرافیایی این گونه‌ها نیز مورد بحث قرار گرفته است.

این یافته‌ها بیانگر تنوع بالای گلسنگ‌های پوسته‌ای در شمال ایران بوده و اهمیت ثبت جنس‌ها و گونه‌های جدید را برای تکمیل فلور گلسنگی ایران و پشتیبانی از بررسی‌های تنوع زیستی و مطالعات اکولوژیکی مرتبط با گلسنگ‌ها را به‌خوبی نشان می‌دهد.

INTRODUCTION

Lichens are generally divided into three groups based on their thallus structure: crustose, foliose, and fruticose. Approximately 50% of all lichens found and known are crustose lichens, also called micro lichens. Their growth and development are not as well-known and studied as those of foliose and fruticose lichens, which are generally more conspicuous and better studied (Armstrong & Bradwell 2010; Honegger 1993). Different from the other two groups, crustose lichens lack a lower cortex and are attached to trees, soil, or rocks by hyphae of a medullary layer. Therefore, it is difficult to separate the crustose lichen from its substrate without destroying it (Büdel & Scheidegger 2008). Also, a piece of hard substrate with crustose lichens may be overgrown by one species and yet be made up of many individuals that have merged. The thalli of simple-structured crustose lichens are called homoiomerous. They lack a cortex and often have a granular structure. Their hyphae spread over the substrate in a thin filamentous mat that envelops the algae. Thalli with a differentiated top layer, a cortex, are called heteromerous. Reflecting morphological peculiarities, crustose lichens are divided into nine subgroups: squamulose, endolithic, endophloeodic, powdery, peltate, pulvinated, lobate, effigurate, and suffruticose crusts (Sigurbjörnsdóttir 2016). Often, the thallus of crustose lichens is divided by fissures into small scales called areoles. The lower hyphae of the areoles may grow beyond the main part of the thallus and form a thin spreading layer around it. This mat of hyphae is usually dark in color and is called a prothallus. Because Iran is a mountainous country with vast deserts and plains, and often very low precipitation, and large parts of Iran are in the world's driest climate, the diversity of crustose lichens is much greater than that of foliose and fruticose lichens. This is reflected by the latest checklists of lichens in Iran and other publications published in the field of lichenology so far (Seaward & al., 2004, 2008; Haji Moniri & Sipman 2017; Sohrabi & al. 2019, 2020), where the number of crustose lichens reported from Iran is much greater than that of foliose and fruticose lichens. Similarly, based on available records, about 55 crustose lichen species have been reported from Golestan province so far (Seaward & al. 2004 & 2008; Sohrabi 2005a, 2005b, 2007; Sohrabi & Orange 2006; Haji Moniri 2009; Aptroot & al., 2012; Kazemi & Ghahremaninejad 2008; Kazemi & al. 2019; Kazemi & al. 2020; Kazemi & al. 2024).

MATERIALS AND METHODS

Golestan is one of the northern provinces of Iran, and it is located in the geographical area of 54° to 56° east longitude and 36.30° to 38.15° north latitude. In terms of topography, it is divided into three regions: mountainous, foothills, plains and lowlands. This province has a diverse climate due to its special geographical location between the Caspian Sea and the Elburz Mountains. The specimens of this study were collected in Golestan Province (Iran), and the voucher specimens are deposited in the lichen herbarium of the Research Institute of Forest and Rangelands, Tehran, Iran (TARI). For the identification, Cannon & al. (2021a, 2021b, 2022) were used. The external morphology of the thallus and reproductive structures were observed, measured, and photographed using a stereomicroscope (Luxeo 4D stereomicroscope and Luxeo 4D camera with Pixelpro software). Observation of anatomical structures, measurements, and photography were recorded under a light microscope (Zeiss compound microscope). Some specimens were sectioned by soaking the specimen with distilled water and then cutting the thallus with a razor blade. For the chemical tests, an aqueous solution of KOH 10%, sodium hypochlorite (C), paraphenylenediamine in ethanol (Pd), and Lugol's solution (I) were used, and Thin-layer chromatography (TLC) was performed only for *Pertusaria leioplaca* (Ach.) DC. using solvent systems A (toluene, dioxane, acetic acid), B (hexane, methyl tert-butyl ether, formic acid), and C (toluene, acetic acid) following Orange & al. (2010).

RESULTS

In this study, we present three taxa that are new to Iran, including *Diploicia* A. Massal., a genus recorded for the first time in the country's lichen flora. All the records are present in the Hyrcanian Forest in Golestan province. They are crustose lichens on bark in a deciduous forest. Diagnostic descriptions of the morphology and chemistry of species, distribution, ecology, and comparisons with similar species are provided.

Diploicia canescens (Dicks.) A. Massal.

New to Iran. This is the first record of the genus *Diploicia* for the lichen flora of Iran.

Examined specimen: Golestan: Aliabad-e katoul, Zaringol forest, near the exit of the Chino village, 36.853476 N; 54.976891 E; 650 m; S. Kazemi 8002 (TARI).

Thallus crustose, placodioid, white to very pale grey or glaucous gray, forming round rosettes 1-5 cm across with clearly defined, contiguous marginal lobes (Fig. 1), lobes extending outward from the center, 0.4-1.2 mm wide, occasionally irregular, discrete or confluent, lobe tips: eciliate, rotund, or ± truncate; soralia mostly laminal, effigurate first, followed by consolidating; soredia green-white, occasionally getting grey tips, Soralia at last bursting and giving rise to a crateriform soralium with bluish gray soredia.

Upper cortex pseudoparenchymatous, formed by vertically arranged hyphae, filled with many minute crystals forming chains in K. Medulla usually white, mustard-colored to slightly yellow, made of loosely interwoven, 4-5 µm thick hyphae, without lower cortex, attached by medullary hyphae, without rhizines. Apothecia rare, black, lecideine (without a thalline margin), orbicular, up to 1 mm in diameter, laminal on thallus. Proper exciple thin, black to brown; epithecium granular, black-brown; hymenium colorless; paraphyses forked or simple, the apical cells swollen, with a dark cap; hypothecium black or black-brown. Asci 8-spored, cylindrical-clavate, Bacidia-type. Ascospores brown to gray green, ellipsoid, one-septate, with a thick wall, 9-14 × 4-7 µm. Pycnidia immersed, brown-black; more common on young lobes of fertile specimens, wall colorless; conidia colorless, simple to rod-shaped, 4-8 µm × 0.8-1 µm (Cannon & al. 2021b; Smith & al. 2009).

Chemistry: Thallus K+ yellow**,** C-, KC-, P+ yellow; medulla: K-, C-, KC-, P-, UV+ dull orange (atranorin, chloroatranorin, diploicin, and a xanthone) (Smith & al. 2009).

Habitat: on the bark of *Quercus castaneifolia* C.A. Mey. in Zaringol forest (Golestan Province), on the trunk.

Geographical distribution: Europe, Asia, Mediterranean region, Africa, North and South America (Brodo & al.2001).

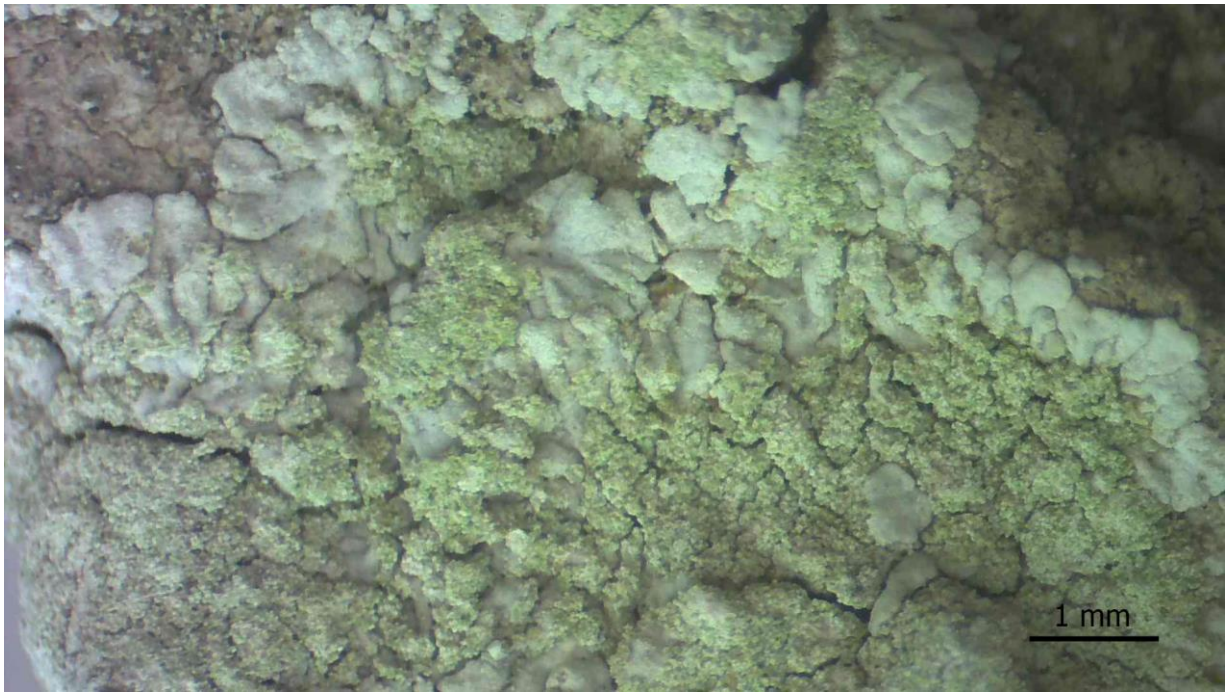

Fig.1. *Diploicia canescens* (TARI, Kazemi, 8002), thallus.

Notes: The genus *Diploicia* is new for Iran. This genus is much like *Physcia* sp. or *Hyperphyscia* sp., by its grey, lobed thallus, but lacks a lower cortex and rhizines; the thallus is thus not foliose, but placodiomorph. Apothecia were not observed in our specimen. They contain grey- one-septate ascospores (Cannon & al. 2021b).

Polyozosia sambuci (Pers.) S.Y. Kondr., Lőkös & Farkas (syn. ***Lecanora sambuci*** (Pers.) Nyl.)

The species *Polyozosia sambuci* (Pers.) S.Y. Kondr., Lőkös & Farkas is here recorded for the first time from Iran. The genus *Polyozosia* was separated recently from *Lecanora* s.s., and *Polyozosia* also has a synonym that is currently sometimes considered as a separate genus,

Myriolecia (Cannon & al.2022). *Polyozosia* includes several species reported before from Iran as *Lecanora* species (Seaward & al. 2008): *Polyozosia crenulata* (Ach.) S.Y. Kondr., Lőkös & Farkas (syn. *Lecanora crenulata* Hook., *Myriolecis crenulata* (Ach.) Śliwa, Zhao Xin & Lumbsch), *Polyozosia dispersa* (Pers.) S.Y. Kondr., Lőkös & Farkas (syn. *Lecanora dispersa* (Pers.) Röhl., *Myriolecis dispersa* (Pers.) Śliwa, Zhao Xin & Lumbsch), *Polyozosia hagenii* (Ach.) S.Y. Kondr., Lőkös & Farkas (syn. *Lecanora hagenii* (Ach.) Ach., *Myriolecis hagenii* (Ach.) Śliwa, Zhao Xin & Lumbsch), *Polyozosia semipallida* (H. Magn.) S.Y. Kondr., Lőkös & Farkas (syn. *Lecanora semipallida* H. Magn., *Myriolecis semipallida* (H. Magn.) Śliwa, *Lecanora xanthostoma* Cl. Roux ex Fröberg). Several more species reported from Iran belong to *Polyozosia*. They are presented in the literature as: *Lecanora agardhiana*, *L. albescens*, *L. invadens*, *L. juniperina*, *L. perpruinosa*, *L. semipallida*, and *L. zosterae*, as documented in various studies (Seaward & al.2004, 2008; Szatala 1957; Haji Moniri & al.2010, 2014; Haji Moniri & Sipman 2017; Valadbeigi & al. 2009; Valadbeigi & Sipman 2010). Their combinations into *Polyozosia* can be found on the Index Fungorum website on the page of all *Polyozosia* species(Index Fungorum Partnership Reference Index 2025; https://www.indexfungorum.org/).

Examined specimen: Golestan: Gorgan, Naharkhoran road, Talar Alpine, 36.790093° N; 54.476576°E, 502m, S. Kazemi 8723 (TARI).

Thallus crustose, of tiny clusters of granules, immersed, within the substratum, Infrequently, ± continuous, irregularly cracked, poorly delimited, white to grey, usually appears in little patches among other crustose lichens; prothallus not noticeable (Fig. 2A). Apothecia appearing alone or in clusters groups, sessile, emerging amongst the thallus granules, a little constricted at the base, 0.3–0.6 mm diam. ; thalline margin entire or a little crenulate at first but eventually becoming erratic and nearly excluded; disc epruinose, red to brown, flat to slightly convex; epithecium pale red brown, not clearly granular, granules superficial, coarse; hymenium hyaline, 45–60 µm high; paraphyses simple, thick, slightly expanded or capitate, brown pigmented at tips; asci clavate, 16 (–32) spored. Ascospore hyaline, simple, 7–12 × 4–7 µm (Fig. 2B). Pycnidia not seen (Cannon & al. 2022; Sliwa 2007).
Chemistry: Spot tests all negative.
Habitat: grows on the bark of *Zelkova carpinifolia* (Pall.) Dippel., in a deciduous forest with a variety of tree species on the hills surrounding the city.
Geographical distribution: Europe, North America, and Asia (Sliwa 2007; Inashvili & al.2022).

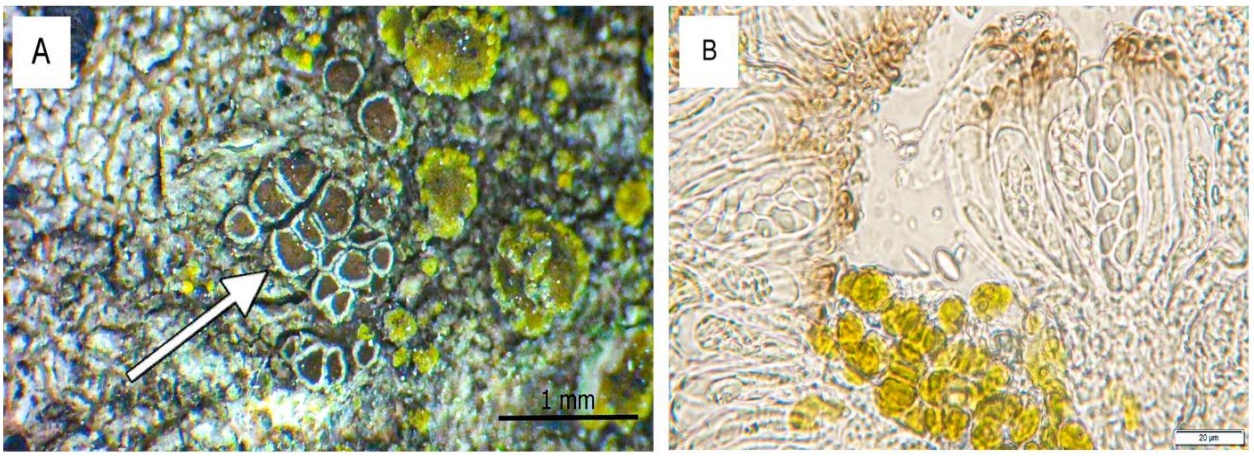

Fig. 2. *Polyozosia sambuci* (TARI, Kazemi 8723). A, thallus; B, ascus with ascospores.

Note: *Polyozosia sambuci* was found as a very small cluster of apothecia, together with *Caloplaca* sp. and *Lecidella elaeochroma* (Ach.) M. Choisy. It closely resembles *Polyozosia dispersa* (Pers.) S.Y. Kondr., Lőkös & Farkas and *Polyozosia persimilis* (Th. Fr.) S.Y. Kondr., Lőkös & Farkas with brownish apothecia with a grey margin, but *Polyozosia dispersa* is pruinose, and *Polyozosia persimilis* has only 8 ascospores per ascus. *Polyozosia sambuci* is the only species of its genus with 16 (–32) spored (Sliwa 2007).
Pertusaria leioplaca (Ach.) DC.
This is the first record of *Pertusaria leioplaca* (Ach.) DC. from Iran.
Examined specimen: Golestan: Gorgan, Garmabdasht forest, after Tappe saru, before waterfall, left side of the road, 36.70690 N; 054.58810 E, 943 m, S. Kazemi 7668 (TARI).

Thallus crustose, thin, superficial, deeply embedded in the bark, with a completely unzoned margin; pale greenish-grey to grey-white, with coarse crystal clusters, providing a snowy or rime ice appearance, smooth to somewhat rimose surface; fertile warts present (1-3 ostioles per wart), a little prominent, semiglobose to conical, with somewhat flattened apices and a broader base, 0.7-2 mm diam (Fig. 3A). Photobiont chlorococcoid. Apothecia 1(-3) per wart, immersed in the fertile warts, disc punctiform, ostiole-like. Asci broadly cylindrical, 4-spored (Fig. 3B), having a wide ocular chamber at the apex (Fig. 3C), *Pertusaria*-type. Ascospores hyaline, ellipsoid, 40-130 × 25-50 µm, spore wall with two distinct layers, smooth (Fig. 3D). Pycnidia rare, immersed; conidia 7-10 × 0.5-1 µm, bacilliform (Cannon & al. 2021a).

Chemistry: Thallus K- or + weakly yellow, C-, KC-, Pd+ yellow to orange, UV- or + pale orange-pink. TLC: 4,5-dichlorolichexanthone, stictic acid.

Habitat: On smooth bark in deciduous forest.

Geographical distribution: Europe, Macaronesia, N. & C. America, Asia, Africa (Smith & al. 2009).

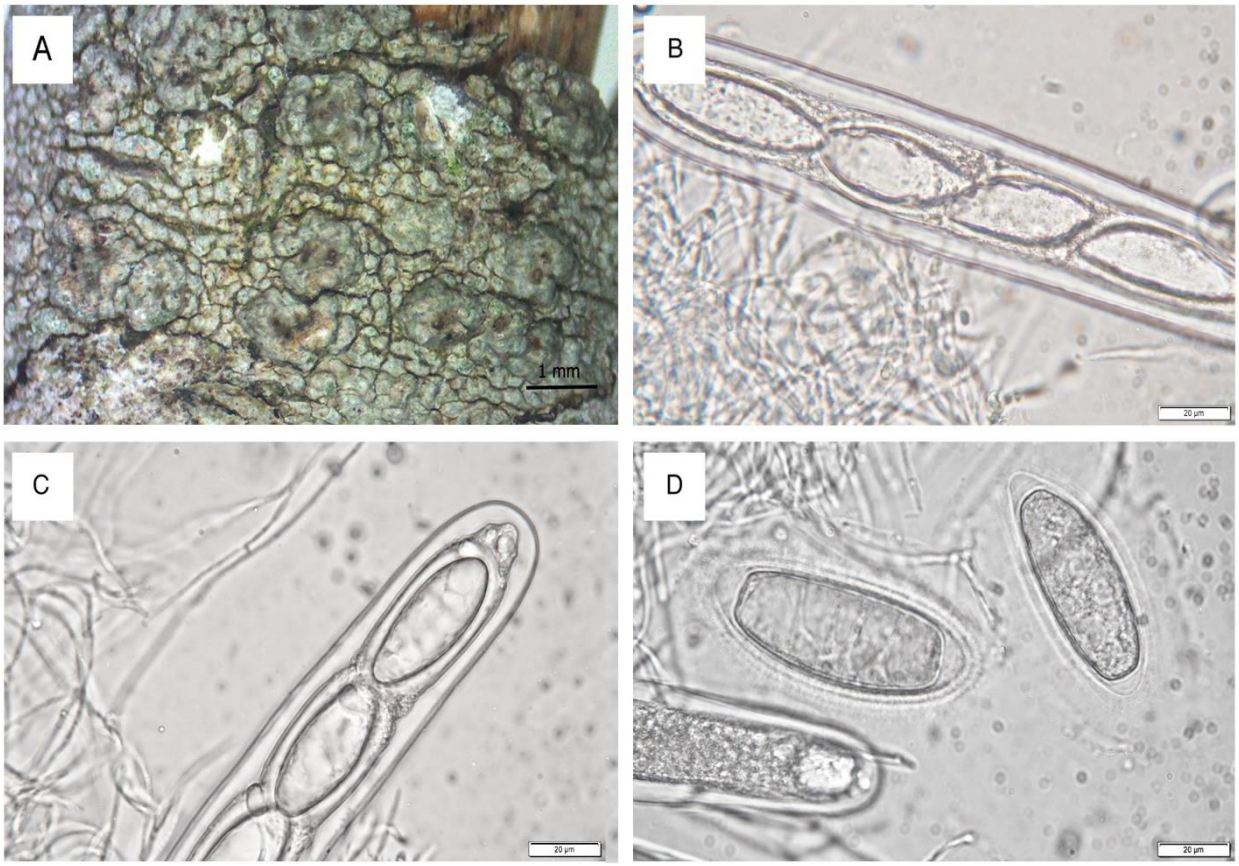

Fig.3. *Pertusaria leioplaca* (TARI, Kazemi, 7668). A, thallus; B, asci; C, ocular chamber in asci; D, ascospores

Notes: *Pertusaria leioplaca* has 4 spores per ascus. It resembles *P. pertusa*, which has 2-spored asci, and a more developed thallus but the same chemical composition, and the fertile warts of *P. pertusa* are strongly delimited and do not spread at the base.

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REFERENCES

Aptroot, A., Valadbeigi, T. & Sipman, H.J.M. 2012: A new species and new records of the lichen genus *Pyrenula* from Iran. -The Lichenologist 44(4): 445-448. https://doi.org/10.1017/S0024282912000023

Armstrong, R.A. & Bradwell, T. 2010: Growth of crustose lichens: a review. - Geogr. Ann., 92A (1): 3-17. https://doi.org/10.1111/j.1468-0459.2010.00374.x

Brodo, I.M., Sharnoff, S.D. & Sharnoff, S. 2001: Lichens of North America. -Published in

collaboration with the Canadian Museum of Nature, (198 – 558)

Büdel, B., & Scheidegger, C. 2008: Thallus morphology and anatomy. In: Nash III, T.H. (Ed.), Lichen Biology. -Cambridge University Press, New York, pp. 40–68. https://doi.org/10.1017/CBO9780511790478.005

Cannon, P., Chambers, S., Coppins, B., Sanderson, N. & Simkin, J. 2021a: Pertusariales: Pertusariaceae, including the genus *Pertusaria*. -Revisions of British and Irish Lichens 6: 1-13.

Cannon, P., Prieto, M., Coppins, B., Sanderson, N., Scheidegger, C. & Simkin, J. 2021b: Caliciales: Caliciaceae, including the genera Acolium, Amandinea, Buellia, Calicium, Diploicia, Diplotomma, Endohyalina, Monerolechia, Orcularia, Pseudothelomma, Rinodina and Tetramelas. -Revisions of British and Irish Lichens 15: 1-35.

Cannon, P., Malíček, J., Ivanovich, C., Printzen, C., Aptroot, A., Coppins, B., Sanderson, N., Simkin, J. & Yahr, R. 2022: Lecanorales: Lecanoraceae, including the genera Ameliella, Bryonora, Carbonea, Claurouxia, Clauzadeana, Glaucomaria, Japewia, Japewiella, Lecanora, Lecidella, Miriquidica, Myriolecis, Palicella, Protoparmeliopsis, Pyrrhospora and Traponora. Revisions of British and Irish Lichens 25: 1-83.

Haji Moniri, M. 2009: History of lichenology in Iran, with some additional lichens from Golestan province, (N. Iran). -Iran. J. Bot. 15 (2): 159-163.

Haji Moniri, M., Kamyabi, S. & Clayden, S.R. 2010: A preliminary study of *Rhizocarpon macrosporum* in Razavi Khorasan Province (NE Iran). -The Iranian Journal of Botany 16(1): 185–189.

Haji Moniri, M., Sipman, H. J. M. & Schultz, M. 2014: New records of lichenized and lichenicolous fungi from Northeastern Iran. — Herzogia 27: 367–376. https://doi.org/10.13158/heia.27.2.2014.367

Haji Moniri, M. & Sipman, H.J.M. 2017: New and noteworthy lichens from the semi-desert areas of North East Iran. -Iran. J. Bot. 23(2): 140-144. https://doi.org/10.22092/ijb.2017.11401

Honegger, R. 1993: Developmental biology of lichens. -New phytol. 125: 659-677. https://doi.org/10.1111/j.14698137.1993.tb03916.x

Inashvili, T., Kupradze, I. & Batsatsashvili, K. 2022: A revised catalog of lichens of Georgia (South Caucasus). -Acta Mycologica 57(3): 1-46. https://doi.org/10.5586/am.571

Index Fungorum Partnership 2025: Index Fungorum. – http://www.indexfungorum.org (Accessed 5 Nov. 2025)

Kazemi, S.S., & Ghahremaninejad, F. 2008: New records of the lichen species from Iran. -Iran. J. Bot. 14: 171-172.

Kazemi, S.S., Mehregan, I., Asri, Y., Saadatmand, S. & Sipman, H.J.M. 2019: Three new records of epiphytic lichen species from Iran. -Iran. J. Bot. 25(1): 56-60. https://doi.org/10.22092/ijb.2019.119246

Kazemi, S.S., Mehregan, I., Asri, Y., Saadatmand, S. & Sipman, H.J.M. 2020: Four new *Lepraria* species for Iran, with a key to all Iranian species. -Mycotaxon 135(2): 235-244. https://doi.org/10.5248/135.235

Kazemi, S.S., Sipman, H.J.M. & Safavi, S.R. 2024: New records of Arthoniales (Lichenized fungi) from Iran. -The Iranian Journal of Botany 30(1): 85-90. https://doi.org/10.22092/ijb.2024.365473

Orange, A., James, P.W. & White, F.J. 2010: Microchemical methods for the identification of lichens. British Lichen Society, London. pp: 7-75.

Seaward, M.R.D., Sipman, H.J.M., Schultz, M., Maassoumi, A.A., Haji Moniri Anbaran, M. & Sohrabi, M. 2004: A preliminary lichen checklist for Iran. -Willdenowia 34: 543-576. https://doi.org/10.3372/wi.34.34218

Seaward, M.R.D., Sipman, H.J.M. & Sohrabi, M. 2008: A revised checklist of lichenized, lichenicolous and allied fungi for Iran. -Sauteria 15: 459-520.

Sigurbjörnsdóttir, MA. 2016: The lichen-associated microbiome: taxonomy and functional roles of lichen-associated bacteria. Dissertation, The University of Iceland. http://hdl.handle.net/1946/23887

Śliwa, L. 2007: A revision of the *Lecanora dispersa* complex in North America. – Bryologist 110: 817–875.

Smith, C.W., Aptroot, A., Coppins, B.J., Fletcher, A., Gilbert, O.L., James, P.W. & Wolseley, P.A. 2009: The Lichens of Great Britain and Ireland. British Lichen Society, London. pp: 378-684.

Sohrabi, M. 2005a: Lichens from Golestan National Park (Iran). – Folia Cryptog. Estonica 41: 105-108.

Sohrabi, M. 2005b: Lichens of Golestan National Park. In: Akhani, H. (ed.): The Illustrated Flora of Golestan National Park (Iran), pp. 77-78. -Tehran University Press, Tehran.

Sohrabi, M. & Orange, A. 2006: New records of sorediate lichens from Iran. -Iran. J. Bot. 12 (1): 101-103.

Sohrabi, M. & Sipman, H.J.M. 2007: Lichens of Golestan National Park (NE Iran). –Mycologia Balcanica 4: 87–92.

Sohrabi, M., Ghiyasi, A., Bordbar, F., Safavi, S.R., Aliabadi, F., & Sipman, H. 2019: A checklist of

lichenized fungi of Kerman province, SE, Iran. -Mycologia Iranica 6(1): 21-32.

Sohrabi, M., & Sipman, H. 2020: An updated checklist of the lichenized and lichenicolous fungi of Arasbaran, UNESCO-Man and Biosphere Reserve, Northwest of Iran. -Mycologia Iranica 7(1): 45-62. https://doi.org/10.22043/mi.2020.122654

Szatala, O. 1957: Prodromus einer Flechtenflora des Irans. – Ann. Hist. Nat. Mus. Natl. Hung., Ser. nov. 8: 101–154.

Valadbeigi, T., Lumbsch, H. T., Sipman, H. J. M., Riahi, H. & Maassoumi, A.A. 2009: Additions to our knowledge of lichens and lichenicolous fungi in Iran. -Mycotaxon 110(1): 455–458. https://doi.org/10.5248/110.455

Valadbeigi, T. & Sipman, H.J.M. 2010: New records of lichens and lichenicolous fungi from Iran and their biogeographical significance. -Mycotaxon 113(1): 191–194. https://doi.org/10.5248/113.191