Hungarian University of Agriculture and Life Sciences

STUDIES ON LICHEN CONSERVATION THREATS BY INTERDISCIPLINARY NATURAL AND SOCIAL SCIENCE RESEARCH IN KENYA

Doctoral (PhD) dissertation

Coretor Nyiva Kanyungulu

Gödöllő

2026

The Doctoral School

Name of Doctoral School:	Doctoral School of Natural Sciences
Discipline:	Natural Sciences / Biological Sciences
Head of School:	Csákiné Prof. Dr. Erika Michéli Professor, MHAS MATE Institute of Environmental Sciences
Name of Doctoral Program:	Biological Sciences
Head of Doctoral Program:	Dr. Zoltán Nagy Professor, DSc Department of Plant Physiology and Plant Ecology MATE Institute of Biological Sciences
Supervisor:	Dr. Edit Farkas Scientific advisor, DSc HUN-REN Centre for Ecological Research Institute of Ecology and Botany

....	....
Dr. Zoltán Nagy	Dr. Edit Farkas
Approval of the Head of Doctoral Program	Approval of the Supervisor

Table of contents

List of abbreviations

CoG	Council of Governors
DTP	Doctoral Training Programmes
ECCF	European Council for the Conservation of Fungi
GBIF	Global Biodiversity Information Facility
GFRLI	The Global Fungal Red List Initiative
HPTLC	High-Performance Thin-Layer Chromatography
IAL	International Association for Lichenology
ICCL	International Committee for Lichen Conservation
IPGRI	International Plant Genetic Resources Institute
ISFC	International Society for Fungal Conservation
IUCN	International Union for Conservation of Nature
KAWG	Kamba Kyanika Adult Women Group
KFS	Kenya Forest Service
KNBS	Kenya National Bureau of Statistics
KWS	Kenya Wildlife Service
MCIDP	Makueni County integrated development plan
NMK	National Museums of Kenya
PRISMA	Preferred Reporting Items for Systematic reviews and Meta-Analyses
QGIS	Quantum Geographic Information System
Resp.	Responder
RLL	Recent Literature on Lichens
SSC	Species Survival Commission
UNECE	United Nations Economic Commission for Europe
UNFCCC	United Nations Framework Convention on Climate Change
USDA	United States Department of Agriculture

1. INTRODUCTION

Tropical forests are characterised by high levels of biodiversity ranging from animals to plants. The East African region has a unique biodiversity hosted by the Great Rift Valley that runs from Mozambique through Tanzania and Kenya and ends in Ethiopia. Kenya hosts a wide range of terrestrial tropical habitats, including mangrove and coastal forests, cloud forests and alpine vegetation found at high altitudes. Biodiversity is decreasing rapidly over time due to changing climatic conditions, habitat loss, and other environmental changes (MITTERMEIER et al. 2003, 2004, 2011; VAN BREUGEL et al. 2015). The remaining rainforests, extensive arid woodlands, and savannas still represent considerable diversity in plants and animals (MITTERMEIER et al. 2011). Thus, the country is one of the most intensely investigated East African areas also for its abundant lichen vegetation (FARKAS and MUHORO 2022, FARKAS et al. 2023, KAASALAINEN et al. 2021a, b, 2022, 2023a, b, SWINSCOW and KROG 1988) with an estimation of 1,400 species by Tassilo FEUERER in 2011 (KIRIKA et al. 2012a).

Lichens are a self-sustaining mutualistic relationship between a mycobiont (fungi) and one or more extracellularly existing photobiont (algae or cyanobacteria) that also involves an indefinite number of microorganisms (HAWKSWORTH and GRUBE 2020). They colonise a wide range of substrates, including bark, rocks, and soil, leaves of trees and fronds of fern trees in the tropics or various anthropogenic substrates. They are abundant across diverse ecosystems, from polar tundra to tropical forests, from sea level to high elevations in mountains well above the timberline or even tree line (KAASALAINEN et al. 2021a, AHTI et al. 1990). These organisms contribute to essential ecological processes such as microhabitat formation and primary succession (RAMBOLD 2015, SUTAR et al. 2021, ZEDDA 2015). Additionally, lichens contribute significantly to ecosystem functioning (ZEDDA and RAMBOLD 2015). For instance, provide famine food for wildlife—such as caribou and reindeer—and habitat for small invertebrates (COZZOLINO et al. 2022, SCHEIDEGGER and STOFER 2015).

Lichens are highly sensitive to environmental changes (INSAROV 2010, KULARATNE and De FREITAS 2013). They absorb water directly from the air, making them susceptible to air pollution and climate change. As a result, they are globally used as bioindicators – their presence or absence reflects air quality, forest health, and even climate change impacts. Declines in lichen populations often warn of problems such as increased pollution or habitat degradation, emphasizing their value in monitoring ecosystem health (AGNELLO et al. 2004, HAWKSWORTH et al. 2005).

They are crucial bioindicators of environmental pollution due to their physiological sensitivity (AGNELLO et al. 2004, ÇOBANOĞLU ÖZYIĞITOĞLU 2020). While vascular plants have tissues and organs for water uptake and other functions, the thalline structure of lichens allows the direct uptake of atmospheric air and water over the entire thallus surface, resulting in a direct interaction with air quality and various environmental factors (COZZOLINO et al. 2022).

Despite their resilience to desiccation and temperature extremes, lichens remain vulnerable to stressors. Their diversity in photobionts and the presence of secondary metabolites attribute to their survival and colonisation in harsh environments such as deserts, polar regions or temperate semi-arid sandy grassland vegetation, which are scarcely occupied by other organisms (XU et al. 2020, FARKAS et al. 2024). The poikilohydric nature (PÉREZ-ORTEGA et al. 2012) makes them sensitive to climate change and human pressure, which calls for conserving their diverse species (PAOLI et al. 2019).

Lichen diversity in Kenya has been challenged by land fragmentation and land use change, substantial research, temperature and precipitation patterns affecting environmental changes in Kenyan ecosystems, in contrast to a wide range of ecosystems serving as lichen habitats (KAASALAINEN et al. 2021a, 2023a). Vascular plants have typically received priority in Kenya's diversity and conservation strategies, whereas lichen-forming fungi (and fungi in general) are rarely mentioned in national biodiversity action plans or reserve management guidelines (ACTS 2016). Land fragmentation and forest encroachment have greatly led to the reduction of lichen populations (GIORDANI et al. 2020). Many macrolichens thrive in old-growth forests and undisturbed ecosystems. Kenya's high-elevation forests (e.g., in the Aberdares, Mount Kenya, Mau complex, Taita Hills) have suffered fragmentation and reduction (MITTERMEIER et al. 2011, Myers et al. 2000). Additionally, climate change is expected to alter temperature and precipitation patterns, affecting Kenya's ecosystems. Although detailed studies are lacking locally, these global climate-driven impacts are a concern for East African lichens (LAWRENCE et al. 2023, NAEKU 2020).

The most comprehensive treatment of the region's foliose and fruticose lichens is "*Macrolichens of East Africa*" by SWINSCOW and KROG (1988). This has given rise to advancement in lichenological research in Kenya (FRYDAY et al. 2022). New scientific techniques and approaches emerged that transformed the study of lichens. Molecular biology and DNA barcoding became available in the 2000s, allowing researchers to revisit and refine lichen classifications established by earlier mostly morphology-focused studies. Many Kenyan macrolichens identified in the 1980s have been re-examined with recent methods, leading to a concise species distinction (COCA et al. 2025, KIRIKA et al. 2015, 2016a, 2017, 2019, 2022). Collaborations between Kenyan scientists and international specialists have led to taxonomic and floristic studies and descriptions of several new species using advanced methods in the western world, which lacks in

Kenya (FARKAS et al. 2023, FARKAS and MUHORO 2022, KAASALAINEN et al. 2023b, KIRIKA et al. 2012a, b, SUIJA et al. 2018).

Documenting lichen biodiversity is a critical step toward conservation planning, ecological monitoring, and sustainable land-use management (SCHEIDEGGER and GOWARD 2002, SCHEIDEGGER and WERTH 2009). The first published 1994 IUCN Categories and Criteria (IUCN 1994), following considerable research and international consultation, were developed to improve objectivity and transparency in assessing the conservation status of species globally, and its understanding among users. The "*Guidelines for Using the IUCN Red List Categories and Criteria*" are regularly updated, the current version is of 16 March 2024 (IUCN 2024)**.** It states: **"**If a taxon is known, but there is no direct or indirect information about its current status or possible threats, then it is obviously Data Deficient (DD). A Data Deficient listing does not imply that a taxon is not threatened" (IUCN 2024). Consequently, DD is not a threat category but indicates that more information is required to categorise the species in future. YAHR et al. (2024) emphasize the key role of population size and distribution in Red List category assessment. They establish that assessors are struggling with availability of information about individual species. And this applies to several taxa of the world, and highly true for lichens in Kenya. In Kenya, where habitat loss and fragmentation continue to threaten natural ecosystems, understanding their composition and distribution may provide early warnings of ecological degradation and offer essential data for biodiversity assessments.

2. OBJECTIVES TO ACHIEVE

The following objectives were planned to achieve:

1. to analyse literature on lichen conservation for evaluating global research trends on threats to lichens, and for identifying drivers of threats to lichens and their shifts over time, various levels of threat,
2. to compile the updated lichen checklist of Kenya,
3. to establish a conservation risk category system for lichens in Kenya,
4. to identify lichens from East-African collections,
5. to explore traditional knowledge on lichens and its importance in the conservation of lichens in Kenya,
6. to find solutions and suggest proposals for conserving and/or recovering lichens under threat.

3. LITERATURE REVIEW

Tropical ecosystems, particularly their forests, are characterized by high levels of biodiversity ranging from animals to plants (MITTERMEIER et al. 2003, 2004, 2011). The East African region has a unique biodiversity hosted by the Great Rift Valley that runs from Mozambique through Tanzania and Kenya and ends in Ethiopia. VAN BREUGEL et al. (2015) adopted a recently developed high-resolution potential natural vegetation map for East Africa to support the identification of the conservation priorities and studied how these are represented in the protected area network of the area. This may contribute to a more direct representation of global priorities in regional or national implementations. Kenya hosts a wide range of terrestrial tropical habitats, including mangrove and coastal forests, cloud forests and alpine vegetation found at high altitudes. Kenya has experienced a roughly 1 °C increase in mean annual temperature since the 1970s, while a total of 76,346 km^2 area of the country was shifted from a cooler to a warmer zone, and the hottest zone increased 0.59 °C (LAWRENCE et al. 2023). Furthermore, a total of 136,129 km^2 was shifted from a wetter to a drier zone, and the average precipitation in the most arid zone decreased 2.57 mm, resulting that all arid regions expanded from 72% over all of Kenya's area in 1980 to 81% in 2020 (HABEL et al. 2023, LAWRENCE et al. 2023). Therefore, the biodiversity is decreasing enormously over time due to environmental changes (MITTERMEIER et al. 2003, 2004, 2011, VAN BREUGEL et al. 2015). This fact needs special attention, since the mountains especially in East Africa, such as the ancient Eastern Arc Mountains spanning from southern Tanzania to Kenya are encompassed by extensive arid woodlands and savannas still representing a considerable diversity in plants and animals (MITTERMEIER et al. 2011). Thus, the country is one of the most intensely investigated East African areas also for its abundant lichen vegetation (FARKAS and MUHORO 2022, FARKAS et al. 2023, KAASALAINEN et al. 2021a,b, 2022, 2023a, b, SWINSCOW and KROG 1988) with an estimation of 1,400 species by Feuerer in 2011 (see FEUERER 2011 in KIRIKA et al. 2012).

The other side of the problem (i.e., the decrease of biodiversity) is that the destruction of natural forest ecosystems reduces the quality of livelihoods of local people. This also means a transformation of the socio-cultural environment and system, thus, the loss is multiple. It has also become clearer and more and more necessary, therefore, to re-align the natural and cultural environment, to identify and create the "survival" and "revival" that are well known in cultural anthropology and sociology (associated with the names of Tylor and Durkheim, respectively) (ELLER 2020). Consequently, there is a need for intergenerational communication and better communication of scientific knowledge to policy makers and society. A consistent example from Southern Kenya is that researchers and governmental organizations are taking the initiative to prevent ecosystem degradation by involving the local community, with local traditional knowledge and intergenerational communication as the cornerstone (HABEL et al. 2023). The protection of biological and ecological diversity has been a policy and sustainability issue for some time, but cultural protection lags, even though they share many common factors that, when addressed together, point to a much better outcome. These include culturally relevant education and revitalisation programmes (PRETTY and PILGRIM 2008). In broad agreement with this, in order to gather appropriate knowledge, an interdisciplinary study is necessary; the natural science, ecological-botanical approach alone is not sufficient, but a social science, social and cognitive anthropology approach is also needed, i.e., an approach that involves meeting and communicating with people. This must be considered in relation to the current specific questions, in specific places, combining and consistently applying together the interface between lichen-biology/ecology and cultural anthropology. This yields, for example, information about how members of a given community relate to changes in their environment and what factual or abstract knowledge they have about particular elements of it (in this case, lichens). This is all the more justified because of the following factors.

There are a few ethnobotanical studies in Kenya (MUTHEE et al. 2011), where traditionally applied medicinal plants (for example with anthelmintic effect) are revealed. NANKAYA et al. (2020) based on data from 289 plant species found that gastrointestinal and respiratory system disorders were most often treated by them. In the field of ethnolichenology, researchers try to find indigenous knowledge on the traditional applications of lichens by humans (DEVKOTA et al. 2017, YANG et al. 2021, VINAYAKA and KEKUDA 2023). Indigenous and traditional knowledge refers to the specific information passed down through generations among indigenous and local communities exclusive to a particular culture or community. Higher plants (herbs) and lichens have several such traditional applications (alleviating respiratory or gastrointestinal disorders), especially in medicine (GAKUYA et al. 2020). Therefore, lichens can be utilised in pharmaceutical products as raw materials (PEREIRA et al. 2020). Collection and preservation of ethnomycological and ethnolichenological data are supported by the initiative "Ethnomycological knowledge in Africa" by the database application EthnoMycAfrica launched in 2021. It aimed to create a repository for published data from recent peer-reviewed publications and books (KINGE et al. 2023).

Currently, most children are no longer interested in learning the practices of their ancestors, as is often hypothesized that traditional knowledge may not help them later in life, and thus traditions (less useful or even useful ones) are being lost at a fast rate (BELLINO 2018, GÓMEZ-BAGGETHUN 2022). A significant part of this knowledge loss is due to cultural modernisation.

Globalization has put pressure on people to integrate and adapt to the ways of other cultures. This is also true for many smaller societies or indigenous people. The youth of the society, not seeing much value in their traditional ways due to schooling and digital tools introduction, have dropped many traditions and absorbed the new culture (FERNÁNDEZ-LLAMAZARES et al. 2021). This has led to a gap in the knowledge of the traditional culture and a loss of valuable cultural assets. Without it, the knowledge cannot be passed down to new generations of community members. Additionally, knowledge transmission is a key to maintaining the culture and identity of a given community, which is characterised by its way of life and its heritage (HUNTINGTON 2018). Joining the elders and youth in participatory research related to their knowledge is an important step in reversing this trend, as it validates the knowledge of the youth and encourages them to assume the role of knowledge reservoirs (BELLINO 2018). Although there is substantial research on lichen diversity and threats caused by environmental changes in East Africa including Kenya, there is a gap between limited traditional knowledge on lichens and its passage to newer generations, especially their use and conservation measures compared to other regions. Most studies primarily focus on lichen diversity, taxonomy, habitat (FARKAS and MUHORO 2022, FARKAS et al. 2023, KAASALAINEN et al. 2021a, 2022, 2023b, SUIJA et al. 2018, SWINSCOW and KROG 1988), and composition (KIRIKA et al. 2018), while some citizens are rich in knowledge mostly acquired through direct contact with their environment.

The natural vegetation in Kenya encompasses many ecosystems, from humid lowland coastal forests and equatorial rainforests to savannas and arid shrublands, rising into high montane forests and alpine zones. This ecological diversity provides various habitats for lichens (HABEL et al. 2023, KIRIKA 2012a, LAWRENCE et al. 2023). Kenya's montane forests – including those on Mt. Kenya, the Aberdare Range, and Mau Forest – are hotspots of lichen diversity (MYERS et al. 2000, MITTERMEIER et al. 2004, 2011, KIRIKA et al. 2018, 2012b, KAASALAINEN et al. 2021a, b, 2023a, KANTELINEN et al. 2021). These high-elevation forests are humid and often covered by mist or fog, fostering abundant epiphytic lichens on bark and branches. Surveys in these habitats consistently report on high species diversity and new records (KIRIKA et al. 2018). Montane forests host a large number of species of macrolichen genera, such as *Parmotrema*, *Ramalina*, *Usnea*, and diverse microlichens. In the coastal and lowland forests (e.g., Shimba Hills, Taita Hills in the east) and western lowlands (e.g., Kakamega Forest), warm tropical conditions support rich lichen floras. Coastal forests experience high humidity and salty air influence, enabling the growth of salt-tolerant lichens mostly on mangrove trunks and coastal rocks. Lowland rainforests like Kakamega, with year-round precipitation, are especially notable for foliicolous lichens (YESHITELA 2008, YESHITELA et al. 2009a, b). Many parts of Kenya are semi-arid and characterised by savanna shrublands, with *Acacia-Commiphora* bushland, or true desert in the far north (e.g., Chalbi desert). These open ecosystems are characterized by a long dry season and sparse tree cover, yet lichens are still present and ecologically important. On the bark of savanna trees (like *Acacia* or *Commiphora*), crustose lichens and small foliose lichens can be found, often also on the twigs (KIRIKA et al. 2022).

Worldwide, lichens are increasingly exposed to environmental pressures, such as air pollution, habitat loss, overharvesting, land use changes, and climate change (ÇOBANOĞLU ÖZYIĞITOĞLU et al. 2020, UPRETI et al. 2005, ALLEN and LENDEMER 2016). Heavy industrial emissions have led to the disappearance of many species from polluted regions, while nitrogen enrichment and ozone gases continue to endanger sensitive lichen taxa (GUTIÉRREZ-LARRUGA et al. 2020). The loss of forests, urban expansion, and other land-use changes further reduce the availability of suitable habitats and substrates. Harvesting for dyes, medicines, crafts, and commercial purposes has led to a decrease in population of some lichen families e.g Parmeliaceae and Physciaceae (UPRETI et al. 2005) and sometimes particular species (e.g., *Alectoria*, *Usnea* spp.) in specific regions (MOXHAM 1986). Additionally, the modern climate shifts are increasing at high rates which might exceed the ability of many lichens to adapt or disperse to new environments (ALLEN and LENDEMER 2016, APTROOT 2009).

Airborne pollutants represent one of the significant threats to lichens. Chemicals such as fluoride, lead, nitrogen compounds, and sulfur containing substances interfere with lichen metabolism and reproduction. Their impacts include reduced photosynthetic activity, inhibition of spore germination, and eventual population loss. These physiological disturbances often translate into shifts in community structure and local extinction of sensitive taxa (BENHAMADA et al. 2024, CARRERAS and PIGNATA 2007, GUTIÉRREZ-LARRUGA et al. 2020, NASH 2008). Appendix_Table 1 presents a summary of the air pollution impacts on lichens.

Beyond air pollution, lichens are heavily affected by human activities such as agriculture, infrastructure expansion, and unsustainable harvesting. Land-use changes lead to habitat fragmentation and a reduction of available substrates. Overcollection, often for trade, medicinal, or cultural purposes leads to reduction in lichen populations. These anthropogenic drivers together reduce species richness, abundance, and biodiversity, as shown in Appendix Table 2.

Climate change contributes to lichens current stresses by altering physiological responses, modifying species ranges, and threatening endemic lichen species (APTROOT 2009, APTROOT et al. 2021). Many epiphytic lichens in some areas of temperate regions are declining as compared to terricolous species (APTROOT and VAN HERK 2007). The survival and metabolic functions of lichens are further affected through physiological stress induced by elevated temperatures and increased UV exposure (APTROOT 2009, APTROOT et al. 2021, CHOWANIEC et al. 2023). These climate-driven risks are summarized in Appendix Table 3.

Although lichens are important components of ecosystems and highly sensitive to environmental change, they are still often overlooked in conservation frameworks. Only a small proportion of species have been formally assessed for extinction risk, leaving many potentially threatened taxa unrecognised (GHEZA et al. 2022, MCMULLIN 2019, MCMULLIN and ALLEN 2022).

The necessity of conserving lichens became increasingly apparent in the 1990s (SCHEIDEGGER 1998, IUCN SSC 2025). Though there are lichens protected by law in several countries (e.g., FALTYNOWICZ 1998, PIŠÚT 1999, SCHEIDEGGER and GOWARD 2002, SCHEIDEGGER and WERTH, SAMIR et al.2019), still the number of species is limited and they receive insufficient attention. Local redlisting of species is a useful tool for increasing awareness of the threat status of lichens. This activity is usually carried out earlier than protection by law is achieved by national governments. WIRTH (1977, 1984) in Germany, PIŠÚT (1985) in Slovakia, CIESLINSKY et al (1986) in Poland, TRASS and RANDLANE (1987) in Estonia, CLERC et al. (1992) in Switzerland were among the first to prepare Red lists and lichens in Europe. IUCN Categories and Criteria 1994 were first published in 1994 after deep research and international consultations. Objectivity and transparency were aimed at assessing the conservation status of species globally and their understanding among users. The categories and criteria are regularly updated, the current version was published on 16 March 2024, IUCN 2024. YAHR et al (2024) emphasise the importance of collaboration with the Global Fungal Red List Initiative (GFRLI) 2025, and the IUCN Red List Unit in the final reviews and updates of fungal (incl. lichen) contents in the IUCN Red List.

Bibliometric analyses provide valuable insights into the progress of scientific research (e.g., (ALEIXANDRE-BENAVENT et al 2017, 2018) and are increasingly applied in environmental and conservation studies. Bibliometric reviews have addressed global challenges such as deforestation, conservation, biodiversity, biodiversity loss, and climate change (STORK and ASTRIN 2014, WANG et al. 2018, RANA 2020, LIU et al. 2022, TAN et al. 2023, XIA et al. 2023, PICA et al. 2024).

Average citations per document reached 36, showing the importance of lichen conservation research within the environmental sciences. The mean of 5 co-authorship per article highlights collaborative work in the research of threats to lichen conservation, although there is a low international co-authorship of 23%, which presents a gap for more research and internationally collaborative work (Table 1)

Table 1. Overview of the scientific output of 319 articles.

Description	Results
MAIN INFORMATION ABOUT DATA	
Timespan	1981–2024
Sources (Journals, Books, etc)	169
Documents	319
Document Average Age	12
Average citations per doc	35.61
DOCUMENT CONTENTS	
Keywords Plus (ID)	1773
Author's Keywords (DE)	1945
AUTHORS	
Authors	1276
Authors of single-authored docs	27
AUTHORS COLLABORATION	
Single-authored docs	31
Co-Authors per Doc	4.89
International co-authorships %	22.57
DOCUMENT TYPES	
Article	294
article: proceedings paper	13
Review	12

Before 2005, annual scientific production on lichen conservation was generally low, fluctuating between 0 and barely 10 articles per year according to Figure 1. This period reflects a stage when research on threats to lichens concentrated in pollution monitoring and with limited integration into broader conservation or climate change discussions. After 2005, there was a marked and sustained increase in publication output, reflecting a shift in the field's scope. Annual production rose steadily, surpassing 10 articles, and experienced a sharp acceleration from 2017 onwards, peaking at over 26 publications in 2021.

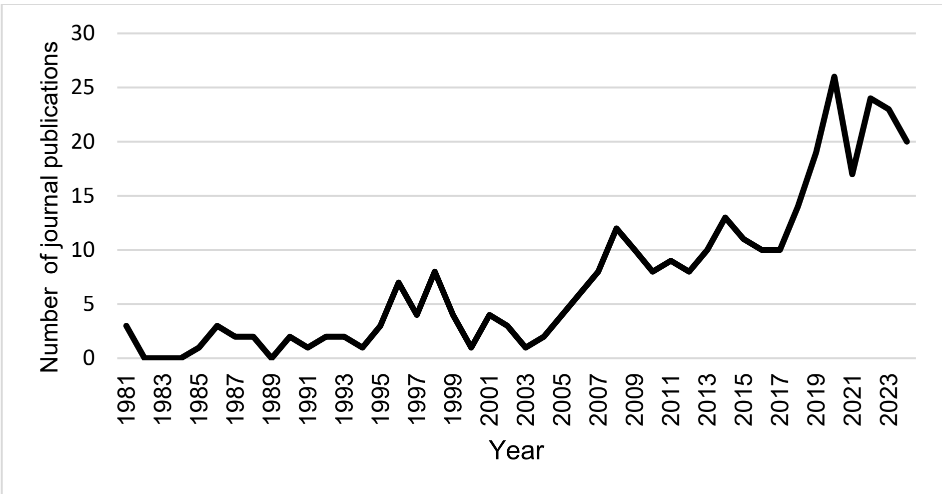

Figure 1. Annual scientific output on lichen threats expressed in the number of journal publications between 1981–2024.

Across the 319 publications reviewed, 1,276 authors were identified, emphasizing the broad collaborative base of research in this conservation field. However, only a small proportion of contributors have maintained sustained publishing activity. Specifically, 30 authors produced four or more papers (Figure 2), indicating uneven authorship pattern typical of conservation science, where a core group of specialists drives much of the published work.

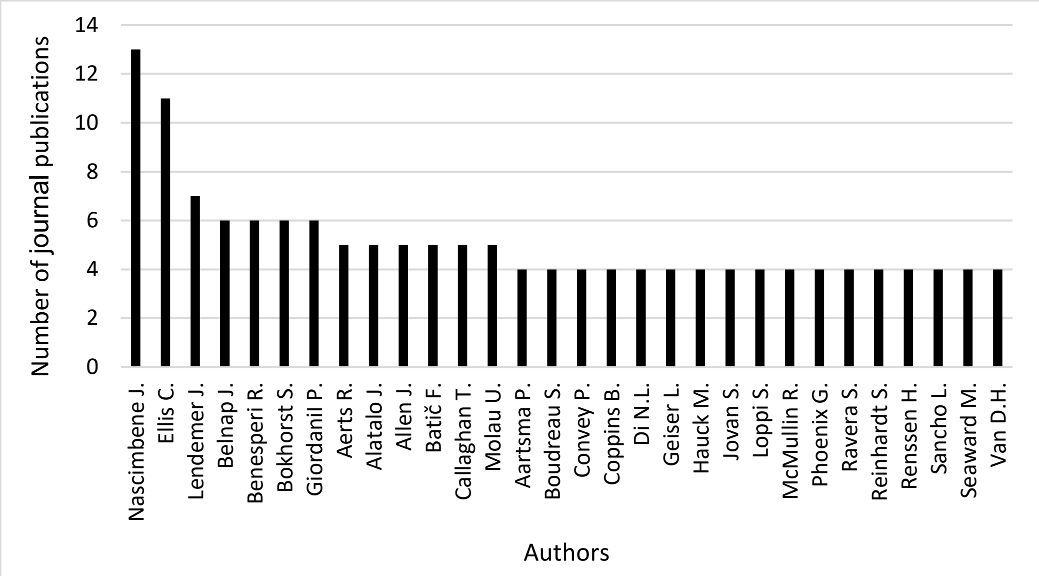

Figure 2. Most relevant authors with ≥4 publications between 1981–2024.

The most prolific contributors were Juri Nascimbene (13 publications) and Christopher Ellis (11 publications). James Lendemer followed them with 7 papers, and a set of active authors such as Jayne Belnap, Renato Benesperi, Stef Bokhorst and Paolo Giordani each with 6 papers. The remaining productive authors published 5 or 4 articles each. Collectively, this group of 30 authors contributed a substantial proportion of the overall output of the investigated dataset. At the same time, the diversity of names with fewer publications also indicates broad participation from the wider lichenological and ecological community. This combination reflects both sustained leadership from established scholars and contributions from a broader pool of researchers, which may support the interdisciplinary character of the field.

Figure 3 illustrates the most relevant (≥6) contributing institutions identified through the bibliometric analysis. The institutional analysis revealed that a limited number of organisations accounted for a substantial proportion of the total scientific output within the dataset. SLU – Swedish University of Agricultural Sciences (Sveriges Lantbruksuniversitet) contributing 18 publications, followed by Laval University contributing 16 publications,, emerged as the most prolific institutions, followed by USDA Forest Service with 14 publications, then the University of Alaska System and University of California System (12-12 publications).

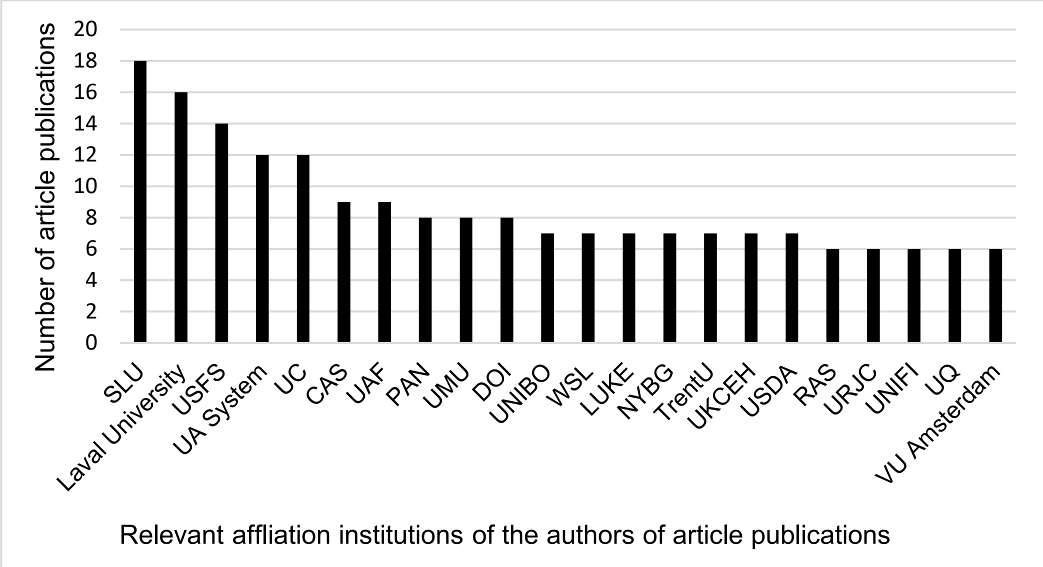

Figure 3. Most relevant affiliations with ≥6 publications between 1981–2024. Abbreviations of institutions are as follows: SLU – Swedish University of Agricultural Sciences (Sveriges Lantbruksuniversitet), Laval University, USFS – USDA Forest Service (United States Forest Service), UA System – University of Alaska System, UC – University of California (University of California System), CAS – Chinese Academy of Sciences, UAF – University of Alaska Fairbanks, PAN – Polish Academy of Sciences, UMU – Umeå University, DOI – United States Department of the Interior, UNIBO – Alma Mater Studiorum – Università di Bologna, WSL – Eidgenössische Forschungsanstalt für Wald, Schnee und Landschaft, LUKE – Natural Resources Institute Finland, NYBG – New York Botanical Garden, SLU –, TrentU – Trent University, UKCEH – UK Centre for Ecology & Hydrology, USDA – United States Department of Agriculture, RAS – Russian Academy of Sciences, URJC – Universidad Rey Juan Carlos, UNIFI – University of Florence, UQ – University of Quebec system, VU Amsterdam – Vrije Universiteit Amsterdam.

Other key contributors included the Chinese Academy of Sciences, University of Alaska Fairbanks, the Polish Academy of Sciences, Umeå University and the United States Department of the Interior each producing between 8–9 publications. Several governmental and research organizations, such as the Natural Resources Institute Finland (LUKE), and the UK Centre for Ecology and Hydrology (UKCEH), also demonstrated notable productivity, each with 7 publications. The predominance of European and North American institutions underscores the geographic concentration of research capacity and funding in these regions, reflecting their leading roles in advancing the scientific discourse within the field.

Figure 4 presents 20 journals out of 169 where most of the research work have been published. The concentration of threats to lichen conservation articles in broad environmental science journals highlights a strong focus on global environmental change and a highly interdisciplinary research approach. For example, Environmental Pollution (12 articles) and Global Change Biology (10 articles) top the list, showing that air quality and climate change are dominant themes in lichen conservation literature.

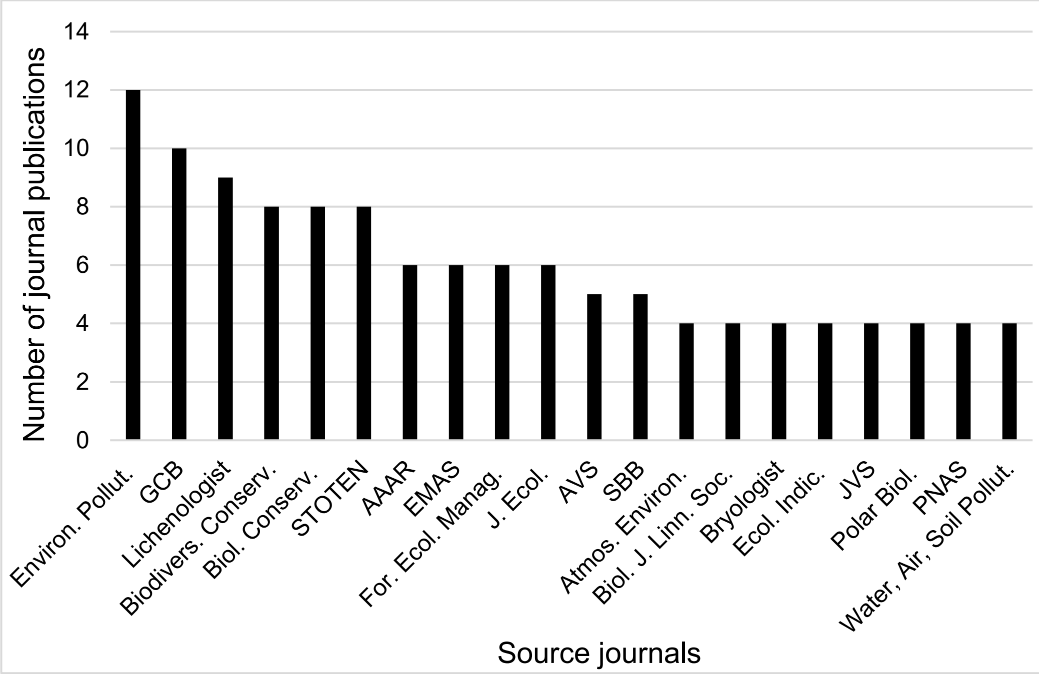

Figure 4. Top publication sources with ≥4 journal publications between 1981–2024. Abbreviations of the titles of the journals are as follows: Environ. Pollut. – Environmental Pollution, GCB – Global Change Biology, Lichenologist, Biodivers. Conserv. – Biodiversity and.Conservation, Biol. Conserv. – Biological Conservation, STOTEN – Science of the Total Environment, AAAR – Arctic, Antarctic and Alpine Research, EMAS – Environmental Monitoring and Assessment, For. Ecol. Manag. – Forest Ecology and Management, J. Ecol. - Journal of Ecology, AVS – Applied Vegetation Science, SBB – Soil Biology & Biochemistry, Atmos. Environ. – Atmospheric Environment, Biol. J. Linn. Soc. – Biological Journal of the Linnean Society, Bryologist, Ecol. Indic. – Ecological Indicators, JVS – Journal of Vegetation Science, Polar Biol. – Polar Biology, PNAS – Proceedings of the National Academy of Sciences of the United States of America, Water, Air, Soil Pollut. – Water, Air and Soil Pollution).

Additionally, The Lichenologist (9) is particularly notable, as it is a highly specialised journal dedicated to lichen research and conservation. Its position among the top three sources highlights the strong role of lichen-focused studies within the broader conservation literature. Other influential sources included Biodiversity and Conservation, Biological Conservation, and Science of the Total Environment (8 articles each), which together reflect the integration of biodiversity, ecological monitoring, and environmental change in conservation research. Journals such as Arctic, Antarctic and Alpine Research, Environmental Monitoring and Assessment, Forest Ecology and Management, also played a key role in linking conservation priorities with ecosystem dynamics and management strategies.

Figure 5 shows the scientific production per country on a global scale in the research topic of threats to lichen conservation. The United States emerges as the leading contributor together with Italy and the United Kingdom, followed by Canada and China, and several European countries, including Sweden, Norway, Finland, Germany. Australia is also with highly notable publication activity. Moderate to low output is observed across South America, parts of Asia, and Africa, with most of the African continent showing little to no representation in the dataset.

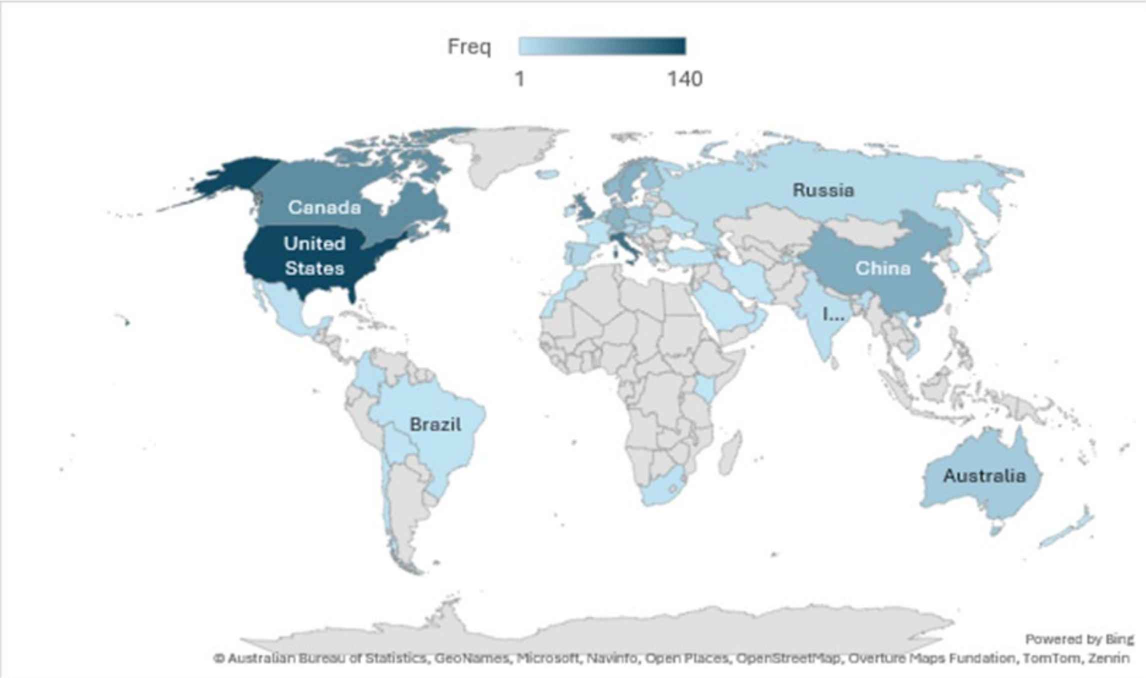

Figure 5. Countries' scientific production expressed by affiliation of authors (countries). Shades of blue from pale to dark indicate increasing production from 1 to 140 publications between 1981–2024.

The keyword co-occurrence network (Figure 6) was generated using VOSviewer with a minimum threshold of 13 occurrences. Out of 899 keywords identified in publications addressing threats to lichens from 1981 to 2024, 13 met the cut-off. It revealed three major thematic clusters. The largest and most central cluster (red, cluster 1) was organised around climate change, demonstrating the strongest connectivity with other keywords. Keywords associated with this cluster included temperature, tundra, growth, responses, and decline, reflecting the central role of climatic factors in shaping lichen physiology, population dynamics, and ecosystem impacts. A second cluster (blue, cluster 2) was centred on air pollution, closely linked to epiphytic lichens and diversity. This emphasises the ongoing significance of atmospheric pollution as a research focus, especially regarding its effects on species richness and the use of lichens as bioindicators of environmental health.

The third cluster (green, cluster 3) focused on lichens, ecosystems, vegetation, and climate. This group highlights the integration of lichen conservation into broader ecological and vegetation studies.

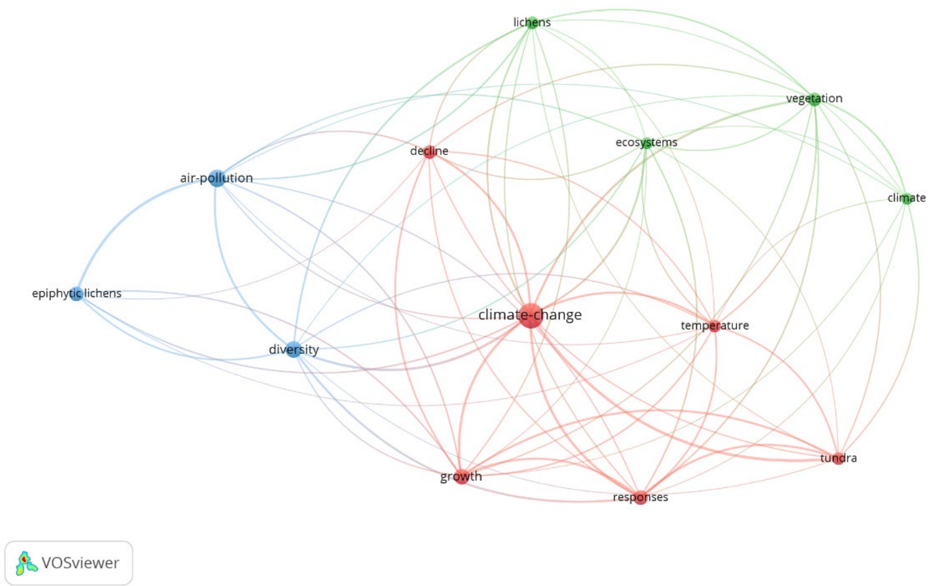

Figure 6. Keyword co-occurrence map generated in VOSviewer with a minimum threshold of 13 occurrences. Out of 899 keywords identified in publications between 1981 and 2024, 13 met the cut-off. Node size indicates frequency, link thickness shows co-occurrence strength, and colours indicate clusters (themes): red, cluster 1; blue, cluster 2; and green, cluster 3. For further explanation of themes, refer to the text.

Figure 7 presents the cumulative occurrence of selected keywords in the lichen conservation literature from 1981 to 2024. The results indicate that climate change has become the most prominent and fastest-growing theme, with a sharp increase in usage after 2015 (FU and WALTMAN, 2022). Air pollution shows a steady growth trajectory beginning in the early 1990s, reflecting its long-standing importance in lichen research, although its rate of increase has been surpassed by climate change in recent years.

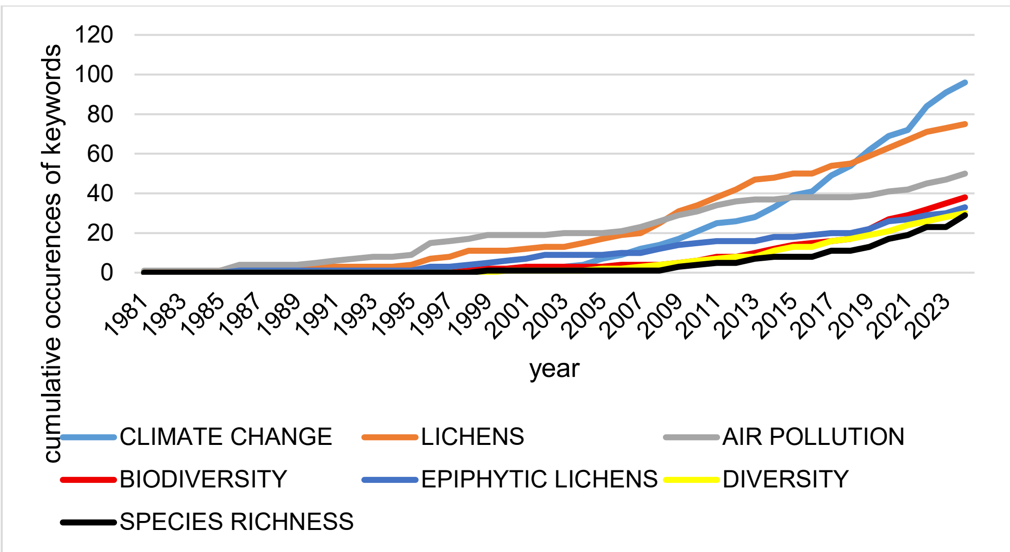

Figure 7. Cumulative occurrences of themes and objects expressed in keywords between 1981–2024.

4. MATERIALS AND METHODS

4.1. Bibliometric analysis methodology

Bibliometrics (VOSviewer and Biblioshiny) was applied for the analysis. It is a quantitative method that applies statistics to publication and citation data to map the evolutionary structure and the progress of a research field (BAKER et al. 2020). It not only ensures a systematic and transparent analysis but also enables a replicable evaluation procedure based on the statistical measurement of science, scientists, and scientific activity (ARIA and CUCCURULLO, 2017). Online bibliographic databases such as Web of Science (WoS) and Scopus are among the proposed sources of metadata concerning scientific works (COBO et al. 2011), as their corpus can be read by analysis software and were therefore chosen for the present study. The systematic flowchart of data search, screening and analysis was carried out according to PAGE et al. (2021). For retrieving the relevant literature, a comprehensive search was conducted across both Web of Science and Scopus databases using the string: ((("lichen*")) AND (("threat") OR ("decline")) AND (("climate change") OR ("air pollution") OR ("direct human impact"))) (Kanyungulu and Farkas 2026). The timespan was restricted to 1981–2024. The years 1981–2004 represent the initial years of research on lichen conservation threats. This phase aligned to the formation of councils that promoted such works, for example, the European Council for the Conservation of Fungi (ECCF) formed in 1985 which is responsible for conservation matters within the European Mycological Association (SENN-IRLET 2005). Currently, it has 80 representatives from across the continent (ECCF 2025). The International Committee for Conservation of Lichens (ICCL) was established during the second IAL Symposium in Båstad, Sweden in 1992. The Committee became also a Specialist Group under the umbrella of the Species Survival Commission (SSC) of the IUCN in 1994 (SCHEIDEGGER 1998, IUCN SSC 2025) . The period from 2005 to 2024 marked a notable increase in conservation biology research activity, coinciding with the growing recognition of climate change as a global driver of species decline (DOBSON 2005). Thus, the International Society for Fungal Conservation (ISFC) was formed in 2010 and currently it has 300 members representing over 60 countries. Its major aim was to emphasize the importance of fungi globally through awards, publications, meetings and other activities (ISFC 2025). The Global Fungal Red List Initiative (GFRLI) was started in 2014 with the aim of relaying information on the status of fungi: threats by pollution, habitat loss or overexploitation (GFRLI 2025).

To ensure consistency and reliability, the search followed the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) (PAGE et al. 2021). for synthesis and analysis of data. The literature search was limited to English-language research articles and review papers, excluding proceedings, editorials, and other non-scholarly document types. The selected publications were also reviewed personally one by one by examining their titles and abstract to identify those that were relevant to the subject matter. Those whose main agenda was not focused on threats on lichens were deemed irrelevant. The bibliographic records from both databases were exported in BibTeX (Scopus) format and plain text (Web of Science), then merged and standardised. Bibliometric analysis was carried out using the bibliometric package in RStudio and VOSviewer . According to ARIA and CUCCURULLO (2011), these two tools provide a comprehensive assessment of the research topic. The final dataset included studies directly addressing the major threats of lichens and how this topic of research has evolved. VOSviewer (version 1.6.20) was used to generate the keyword co-occurrence map from the study dataset. In total, 754 distinct author keywords were identified. To increase clarity, rarely used terms were ignored and the focus on the most relevant keywords, a minimum threshold of thirteen occurrences was applied. Thirteen keywords satisfied this criterion and were retained for analysis.

In VOSviewer, the size of each node and its label reflects the occurrence of that item in the dataset (i.e.; the number of documents in which the keyword appears). Larger nodes indicate terms that occur more frequently and are therefore more prominent in literature. Distance between nodes represents the relatedness of items: shorter distances indicate stronger relationships (higher co-occurrence or link strength), while longer distances indicate weaker relationships.

The bibliometric, biblioshiny R CORE TEAM (2023) package was used to generate data output, including an overview of annual scientific production, document sources, authors' scientific output, country-specific scientific production, and the cumulative occurrence of themes.

The focus of the study was on the threats to lichens between 1981 and 2024. Two periods were studied separately. The first period of 1981–2004, when research of the threats to lichens turned from lichens as bioindicators of air pollution (concentrating on air pollution (and its various types) as a major threat) towards lichens as objects of conservation studies. The second period of 2005–2024 is characterised by a marked increase in studies addressing climate change, direct human impacts, and the discovery of an increasing diversity of various other threat types.

We were concentrating on the geographical distribution of the investigated research fields (themes) via analysing authors’ affiliation (countries), and co-occurrence of keywords, and changing keyword trends with time based on public databases Web of Science (WoS) and Scopus. This was to highlight a robust and systematic understanding of how research on lichen conservation threats has evolved over the past 44 years, to identify critical fields that have been widened over time, and to suggest proposals for actions that can address the main topic of lichen threats. The bibliometric dataset comprises a timespan from 1981 to 2024, including 319 documents published in 169 distinct sources (Table 1).

4.2. The investigated area and basic sources for the annotated checklist

The map of Africa below illustrates the location of Kenya and a map of Kenya presents the biodiversity hotspots (further details in chapter 5.2.6. Macrolichen species diversity) within province and county boundaries (Figure 8). The system of 8 provinces was eliminated and changed to a system of 47 counties in 2013. However, it is presented for easier orientation in earlier records cited.

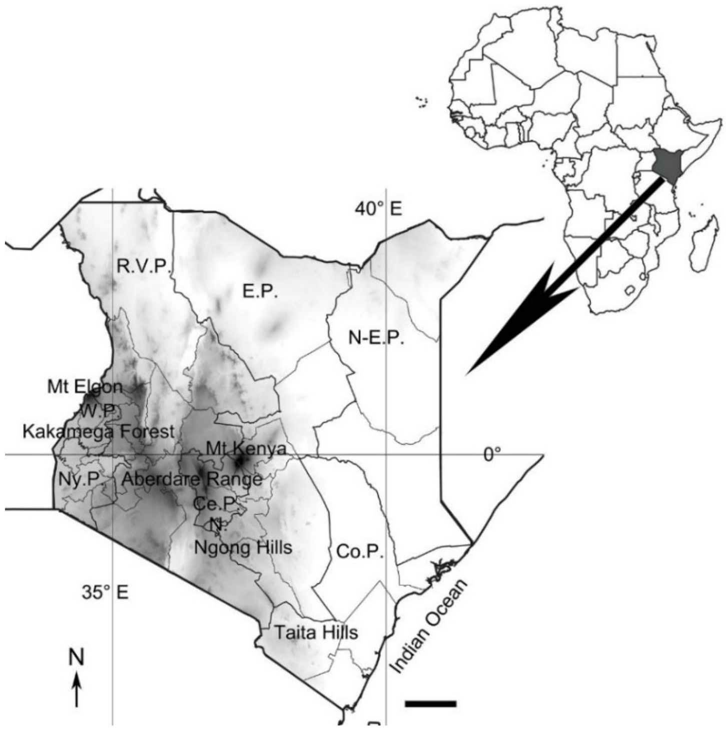

Figure 8. The geographical map of Kenya presenting the main areas, hotspots within province (until 2013) and county boundaries (QGIS 3.36 'Maidenhead' 2024). Provinces abbreviated: W.P. = Western, Ny.P. = Nyanza, R.V.P. = Rift Valley, Ce.P. = Central, N. = Nairobi, E.P. = Eastern, N-E.P. = North -Eastern, Co.P. = Coast. Scale bar: 100 km.

The distribution and habitat records summarised in the book "*Macrolichens of East Africa*" were the most crucial baseline for our research. We focused on updating its taxonomic nomenclature and new records of literature data published after 1988, since SWINSCOW and KROG (1988) had thoroughly examined the earlier literature sources for East African (including Kenyan) lichen records. The public online databases Google Scholar, Recent Literature on Lichens (RLL), Scopus, and Web of Science were used to search literature on Kenyan lichen records after SWINSCOW and KROG (1988). The following search words were used: "Lichens in Kenya" in databases of more general topic, and "Kenya" and the time period adjusted to 1988 – 2024 in RLL to achieve as many papers as possible according to basic guidelines from recommendations, and proposed steps to follow when conducting a systematic search (KHAN et al. 2003).

Approximately 90 literature sources were surveyed, revealing the current occurrence of c. 725 lichen species (incl. 172 crustose microlichen species).

The growth forms of lichens are most often characterised as fruticose (shrub-like), foliose (leaf-like) or crustose (crust-like) (HAWKSWORTH and HILL 1984), and lichens of fruticose and foliose lichen thalli generally referred as macrolichens, while crustose ones as microlichens. The publications were subjected to further analysis based on their contents. Articles highlighting crustose microlichens, including foliicolous lichens and lichenicolous fungi, papers focusing on lichens of other countries and merely mentioning their presence in Kenya (based on previous literature sources), and not containing records from Kenyan sites, were excluded from the research.

According to SWINSCOW and KROG (1988: 9) "the definition of macrolichens is "arbitrary". They "have taken it to include fruticose, foliose, and squamulose species and crustaceous species with podetium-like fruiting bodies (for example, those in the Caliciales). Species with a placodioid thallus have been excluded, though one or two exceptions have been made if most species in a genus have a squamulose thallus (for example, *Phyllopsora*)".

The Caliciales were largely categorised by us as microlichens and omitted from this treatment, since it is generally regarded as having crustose thalli with stalked (and mazediate apothecia). The crustose thalli can be granular or sometimes consist of minute squamules (of a few 0.1 mm diam.) The stalked apothecia are described as "podetium-like" by SWINSCOW and KROG (1988), however, the stalked Caliciales fruiting bodies are exclusively of fungal origin and very thin (can be considered as a part of the fruiting body), while real podetia contain both fungal hyphae and photobiont cells and carry fruitbodies on their top part, thus can be considered as a vertical continuation of the basal thalline parts.An exception was made for genera exhibiting dimorphic growth (e.g. *Cladonia*); while strictly crustose members were excluded. Those possessing squamulose or sub-foliose thalli were retained within the macrolichens (e.g., a few representatives of the genus *Phyllopsora*).

Finally, altogether, 42 journal articles were found and used for further analysis on macrolichen species of Kenya.

The macrolichen species from the 42 articles were listed in an Excel sheet with details on distribution data, substrate, and environmental tolerance factors were added. Annotation by distribution within Kenya was recorded where possible, East African countries were abbreviated similarly to SWINSCOW and KROG (1988): E (for Ethiopia), K (for Kenya), T (for Tanzania) and U (for Uganda), including also R (for Rwanda), and worldwide distribution data were also given if available. The year of collection was added if it was largely different from the year of article publication. The nomenclature was updated using mycological databases, which are Index Fungorum (https://www.indexfungorum.org/names/names.asp) and Mycobank (https://www.mycobank.org/), to ensure a common nomenclatural basis for comparable data gained from various literature sources over about 30 years, when a large number of taxonomic changes took place.

4.3. The investigated area and basic sources for the study of traditional knowledge

The study was conducted from July to September 2023 in four major counties in Kenya out of the 47 counties of the country. The study areas are named after the counties Kakamega, Narok, Nairobi, and Makueni (1–4 respectively) as shown in Figure 9. The map was constructed by a computer program for geographical information systems QGIS 3.36 'Maidenhead', released in 2024. More or less the entire county (in the case of Nairobi and Makueni) or a considerable part of the county (in the case of Kakamega and Narok) was visited and investigated. The northern and eastern part due to geography, relief, climate and vegetation is regarded less rich in lichens, furthermore these areas have a lower population density. Therefore the choice of the study areas was determined by these facts (see also further explanations below under characterization of climate).

According to Kenya National Bureau of Statistics (KNBS) 2019 (KNBS 2019*a*), the country's population was 47,564,296.

Kakamega County (1) is situated in the former Western Province of Kenya. The population of the county is 1,867,579 (KNBS 2019*b*) and its area is 3,033.8 km^2. The elevation of Kakamega County ranges from 1,240 m to 2,000 m above sea level and includes the only existing tropical rainforest (Kakamega forest) in Kenya (ANDOLE et al. 2020). This region is home to the Luhya people, Kenya's third largest ethnic group after the Kikuyu and Luo. The area is densely populated, which affects land utilisation and livelihoods. Agriculture is practised on small plots of land, which are becoming smaller for the next generationAt the same time, they have a strong connection with nature, and the tension between local and western knowledge and customs,as described by some authors, is particularly evident here (TOMORY 2019). The Luhya community will not give up the struggle for nature and traditional knowledge without a fight (KHASANDI-TELEWA 2016).

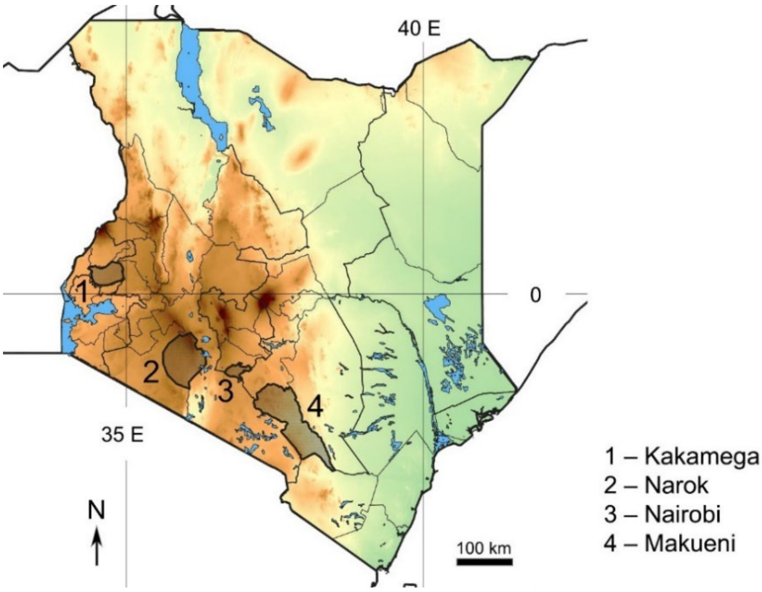

Figure 9. The geographical map of Kenya presenting the study areas within county boundaries (QGIS 3.36 'Maidenhead' 2024). Scale 100 km.

Narok County (2) is situated in the southern part of the Great Rift Valley. The county is positioned between the latitudes 0° 50' and 1° 50' S, and the longitudes 35° 28' and 36° 25' E (CoG 2022). The 2019 census estimates the population at 1,157,873, with the Maa community being the dominant ethnic group (KNBS 2019*b*). They are commonly referred to as Maasai and are well known for their cultural and conservation activities and advocacy in the area (NANKAYA et al. 2020, 2021). In 2023, Narok leaders called for the preservation of Kenyan cultures to preserve the country's heritage and pointed out that Maasai culture and sustainability are intertwined and play a role in the diversity of the country's tourism offerings. They see education as an intermediary bundle and argue for sustainable living and traditional knowledge (KIRUI 2024).

Nairobi County (3) involves the capital city of Kenya and acts as the Central Business District for the surrounding areas, situated between coordinates 1° 09′ S 36° 39′ E and 1° 27′ S 37° 06′ E (REN et al. 2020). It covers an area of 696 km^2. The Ngong Hills, situated west of the city, and the Karura forest in the north, are the predominant topographical features of the Nairobi region which has a population of 4,397,073 according to Kenyan census 2019 (KNBS 2019*a*). It is also the central area of the country's largest ethnic group, the Kikuyu people. The Kikuyus traditionally follow the environmental philosophy, which in the African way of thinking is one of the cornerstones of nature knowledge and respect for nature in accordance with environmental ethics. The gap between this and Western (European) attitudes also causes the cultural tension and discrepancy in knowledge interpretation that Tomory discusses in the perspective of enculturation-socialization and educational challenges and paradoxes. Agreeing with her, this is also why it is important to collect local knowledge in all aspects, especially with regard to natural knowledge, for which first-hand information is the most valuable (TOMORY 2018, 2024).

Makueni County (4) is in the former Eastern Province of Kenya. The county's population, as documented in the 2019 Census (KNBS 2019*b*), is at 987,653. The county is located between the geographical coordinates of latitude 1° 35' and 2° 59' S, and longitude 37° 10' and 38° 30' E. The county experiences a semi-arid climate, characterized by an average temperature range of 15°C to 26°C (MCIDP 2018). The majority of the population here belongs to the Kamba ethnic group. The Kamba culture has also encountered a widening gap between Western and African ways of thinking, a marked manifestation of which has been the shift from natural material pots to plastic containers. This was opposed in 2001 by the Kamba Kyanika Adult Women Group (KAWG), who approached the International Plant Genetic Resources Institute (IPGRI) (now Alliance of Bioversity International and CIAT) and the National Museums of Kenya (NMK) to seek a solution to the impending loss of landscape varieties and knowledge. KAWG members expressed a number of concerns, including the fact that the cultivation of Kitete (*Lagenaria siceraria*, a particular type of pumpkin) and the availability of many traditional varieties are in decline. They expressed concern that younger women did not have enough knowledge about the varieties available and that older women were not passing on knowledge to younger women because either there was little interest or the squash varieties were no longer present in the fields (KENNEDY et al. 2022).

The climate conditions of Kenya (Figure 10) are characterized by a tropical climate on the coast meaning it experiences higher rainfall (between 760–1,270 mm) and temperatures (average 27°C) throughout the year, a moderate climate inland, and a desert environment in the northern, northeastern, and eastern parts of the country (LAWRENCE et al. 2023)**.** The Köppen-Geiger climate classification follows BECK et al. (2018). The country undergoes two distinct periods of precipitation, one is lengthy (long rains occur from March/April to May/June) and the other is the short rainy season (from October to November/December). Climate change is altering the natural distribution of rainfall, causing the short rainy season to become longer (currently exceeding 3 months), which leads to increased flooding. Additionally, the dry period, which used to occur every ten years, recently occurs every year, resulting in more frequent and severe droughts, especially in arid and semi-arid areas (RONO et al. 2023).

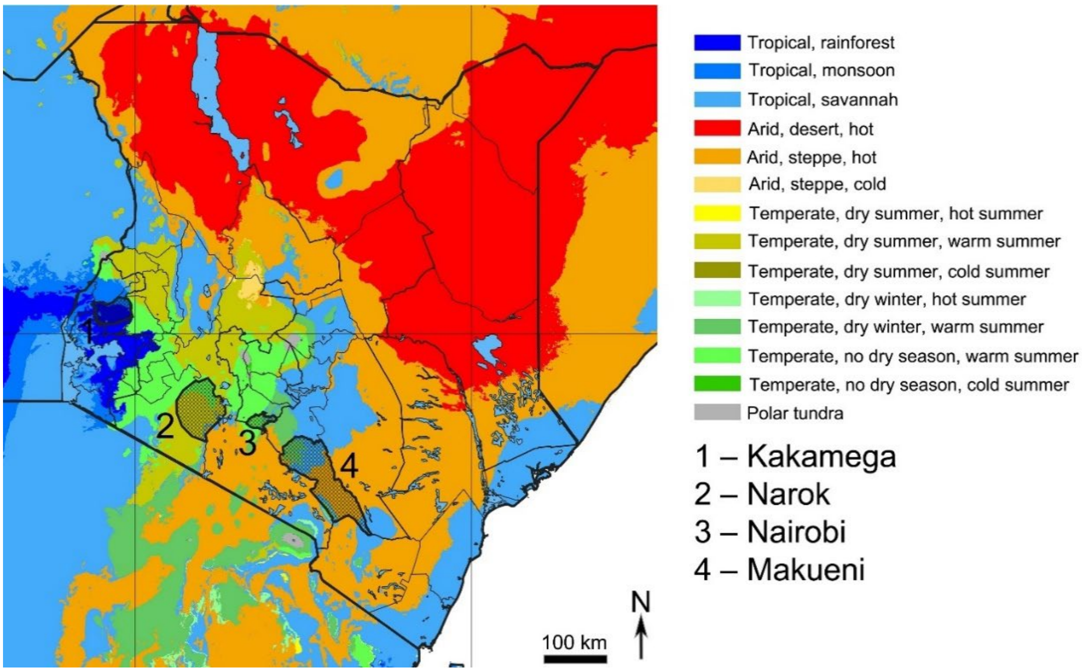

Figure 10. Köppen-Geiger climate classification map of Kenya (1980–2016) (BECK et al. 2018) presenting the localization of study areas within county boundaries. Scale 100 km.

Kakamega County, known for its biodiverse rainforest habitat, offers an ideal setting for investigating the variety and ecological functions of lichens. These conditions supply an ideal environment for a diverse range of plant species, also resulting in unique ecological conditions that promote the spread of a great number of lichen species. Makueni and Narok counties, known for their long-standing commitment to preserving culture, offer a unique chance to explore the traditional ecological knowledge related to lichens. It is believed that these regions have a large amount of accumulated local knowledge including information about the applications, importance, and methods of preserving lichens (CoG 2022, MCIDP 2018, NANKAYA et al. 2020). The study area of Nairobi County is remarkable due to its conflicting yet equally important characteristics, including a high population density and a wide range of literacy levels (REN et al. 2020). The hypothesis that an increased and varied population could result in a higher quantity of data on lichen knowledge prompts a thorough investigation of the impact of urbanisation on awareness, attitudes, and conservation actions related to lichens.

4.4. Data collection for the study of traditional knowledge; semi-structured interview

Data collection was carried out by combining the research approaches of lichen biology/ecology and cultural anthropology, using two basic sources: available literature and information from the field. Today's recent scientific disciplinary approach moves away from a sharp distinction among them and accepts the benefits of combining them. The use of qualitative methodology and participatory data collection in anthropology has been achieved. This specific method involves fieldwork, on-site observation, which can easily be supplemented by spontaneous and semi-structured interviews, conversations, even questionnaire-based data collection, due to the fact that one of the authors is Kenyan, so the interaction with the respondents is authentic as much as possible (BABBIE 2016).

A semi-structured interview using a predetermined set of open-ended questions (see Appendix 4) allows exploration of particular topics in detail freely, where the respondents have more extended knowledge. This is a "conversation with a purpose" according to BURGESS (1984). In line with this approach, a cornerstone of the research is the relativist approach of cultural anthropology, according to which each culture can only be understood in its own system and no one culture can be placed above the other (BOGLÁR 2001, KOTTAK 2021).

An important research and analytical component is cautious comparison, which in ethnographic terms means that only in the light of reliable data collected with an attentive and accepting attitude allows an opinion to be formed about a given group or area, but which is based on the assumption that all cultures are equivalent and can only be examined and evaluated in their own right, within their own system. On the other hand, the emphasis is on exploration and not necessarily on testing hypotheses. An important research characteristic is that the reliability of the research is not based on quantitative, statistical grounds, and therefore, the number of respondents is smaller. However, the information gathered is deeper. This is one of the pillars of research reliability, as it has a local focus. In contrast to the large number of interviews, however, the fact that communication with local people can reveal background factors, contexts and knowledge elements that would remain hidden or obscured by external manifestations in other methods contributes to reliability (BABBIE 2016, BOGLÁR 2001, KOTTAK 2021).

Ethnoecology is also a less well-known and applied field, but considering its basic principle, that traditional ecological knowledge views the landscape and man in unity and cooperation, this approach is very effective for exploring the topic in as many ways as possible. Its approach is based on the cultural anthropology principle that the local people have the appropriate knowledge about their own environment, its functioning and the changes affecting it and with it themselves so that local knowledge is absolutely necessary for the success of the appropriate programs, protection and support. In this case, it means the ecological perspective of traditional knowledge, which is connected with the elements of life support and healing.

The field data-collecting methodology utilized semi-structured interviews that included both closed and open-ended questions. To achieve the quality of the study, the selected questions were discussed in collaboration with the Traditional Ecological Knowledge Research Group in the HUN-REN Centre of Ecological Research (Vácrátót) for pre-screening and approval before delivering them to the participants.

The study was done in the dry season between July and September 2023 when most of the regions were accessible and participants were not busy on their farms. It was geared toward understanding the relationship between age, literacy levels, traditional knowledge, and urbanisation, and how this affects basic biological and ecological knowledge on lichens and their application, furthermore conservation issues especially lichens in Kenya.

The target people were citizens above 18 years who were grouped into 4 major groups: 15 participants 18–25, 23 participants 26–35, 15 participants 36–45, and 7 participants above 46. The literacy levels were also considered. The rural people and aged people were hypothesised to be rich in traditional knowledge while the literate and experts in ecology found in the forest conservation centers (Kakamega, Karura, Ngong forest) were assumed to have detailed knowledge of the status of lichens.

Knowledge levels were interpreted as none, little, medium, high as follows: *none*, if not existing; *little*, if the respondent shows limited familiarity on lichens, they might only have heard of them, but cannot provide any meaningful details or explanations about it; *medium*, if the respondent demonstrates a basic to moderate understanding of the biological nature of lichens, they can describe some key characteristics on morphology, or mention general functions or occurrences, their understanding may come from personal observation or basic knowledge, rather than formal education or expertise; *high*, if the respondent shows a thorough understanding of several aspects of lichenology, including specific details, terminology, and possibly conservational and/or ecological insights, e.g.. they are able to explain the role of lichens in the ecosystem, provide examples of species, describe the conditions they need to thrive, or refer to conservation efforts or studies, their knowledge often comes from specialized education, work experience, or extensive personal study.

4.5. Lichen specimens investigated

Lichen specimens (small fragments of thalli) were collected for educational purposes for identification during the field study carried out in Kenya by the dissertant in 2023. All collections were done exclusively in Makueni county on 17 August 2023. An additional collection for human use (tea) from 2000 was also studied. Earlier East African collections (Tanzania, T. Pócs et al.

1989, 1990) were identified. These were partly collected in the framework of the Usambara Rain Forest Research Project (in the 1980s) with the cooperation of the Hungarian and the Royal Swedish Academies of Sciences, as well as the Sokoine Agricultural University, Dar es Salaam/Morogoro, Tanzania; and also during various other study trips during the professorship of Tamás Pócs in the Morogoro Campus (1985–1990). For exact localities see Appendix 3.
Specimens (82) collected are deposited in Lichen Herbarium VBI (Vácrátót, Hungary) (abbreviation follows Index Herbariorum, Thiers continuously updated).

4.6. Morphological investigations

The morphology and anatomy of the lichen thalli were studied using a NIKON Eclipse/NiU (DIC, epifluorescence) compound microscope (Nikon Corporation, Tokyo, Japan), as well as a Nikon SMZ18 stereo microscope (Nikon Corporation, Tokyo, Japan). Micrographs were prepared using Nikon DS-Fi3 camera (with NIS-Elements BR software, Nikon Corporation, Tokyo, Japan) with the above-mentioned microscope.

4.7. Chemical analysis of lichen secondary metabolites

High-performance thin layer chromatography (HPTLC) analysis of lichen secondary metabolites, for the identification of lichen specimens, was carried out according to standard methods described by ARUP et al. (1993) and MOLNÁR and FARKAS (2011). CAMAG horizontal chamber of 10 cm × 10 cm, CAMAG TLC Plate Heater III, 10 cm × 10 cm HPTLC plates (Merck, Kieselgel 60 F254) were used. The solvent systems A (toluene – dioxene – acetic acid, 45 : 15 : 2 v / v / v), B (cyclo-hexane – methyl-tert-butyl ether – formic acid, 6.5 : 5 : 1 v / v / v) and most often solvent system C (toluene – acetic acid, 20:3 v/v) were applied. Plates were investigated under UV 254 nm and UV 366 nm after development, then fatty acids and water-repellent substances were studied, while sprayed with water, finally it was followed by spraying with 10% sulphuric acid and spots were observed at daylight.

5. RESULTS AND THEIR DISCUSSION

5.1. Bibliometric analysis

5.1.1. Research focus on threats to lichens over time

According to the results of the bibliometric analysis (1981–2004), research on lichen threats was sparse but heavily centered on air quality and environmental pollution (KANYUNGULU and FARKAS 2026). “Air pollution” stands out as one of the main themes during these decades. The

1970s and 1980s witnessed a significant concern over acidic rain, industrial emissions, and their ecological effects (HAWKSWORTH 1971). Lichens, being extremely sensitive to sulfur dioxide and other pollutants, were widely used as an indicator of air pollution (CONTI and CECCHETTI 2001, PRADO et al. 2025). The concerns of pollution led to standardised protocols for lichen monitoring in forest health and air pollution programs. A notable outcome was the integration of lichens into environmental policy – for example, lichens were included in European forest condition monitoring under the UNECE Air Convention from 1985 (FRATI and BRUNIALTI 2023, UNECE 2025a,b). In the 1990s–2000s, other pollution challenges emerged (e.g., the increase of nitrogen deposition), which kept the lichen–pollution theme relevant even as its research received somewhat less attention. Studies saw reported shifts in lichen communities due to nitrogen oxides and ammonia from agriculture and traffic, with increasing abundance of nitrophilous lichen species (e.g.; *Xanthoria parietina*) (GUTIÉRREZ-LARRUGA et al. 2020).

Around 2005, the annual number of lichen-threat publications began to increase noticeably. Globally, the early 2000s resulted in new high-level commitments to combat climate change and biodiversity loss. For instance, the Kyoto Protocol (negotiated in 1997) entered into force in 2005, and the Convention on Biological Diversity had outlined ambitious targets for 2010 to reduce biodiversity loss (CALDWELL et al.2024, UNFCCC 2025a). These initiatives emphasised climate impacts and species conservation as significant issues, expanding the scope and funding of research.

After 2017, the bibliometric patterns show an increase in the climate change cluster (Figure 6), also reflected by an increase in article production in the same year (Figure 1) marking a new dominant theme in lichen threat research. Several factors explain this rapid rise. The increase in publications after 2017 might be because of growing emphasis on global environmental change, biodiversity conservation, and ecosystem monitoring in international policy frameworks, as well as the increased availability of high-resolution environmental data and collaborative research networks. Although there has been a slight decline since this peak, recent output remains high (20–23 publications per year). The mid-to-late 2010s brought the landmark Paris Agreement (2015) (UNFCCC 2025b) on climate change and the start of climate advocacy, as well as key assessments of biodiversity loss. In addition, in the late 2010s, there was the integration of lichens into international conservation frameworks. Fungal specialists (including lichenologists) became organized under the IUCN Species Survival Commission to conduct Red List assessments for lichenized fungi, a process that was started after 2015. Thus only 7 lichen species were assessed in the IUCN Red List in 2015 (IUCN SSC 2025, DTP 2025). By 2022, the IUCN Red List included 94 lichen species (MUELLER et al. 2022).

Advances in scientific methodology and data accessibility further explain the post-2017 increase of publications. By the late 2010s, citizen-science platforms and biodiversity databases had included millions of fungal (including lichen) observations worldwide (HAELEWATERS et al. 2024). At the same time, high-throughput DNA sequencing and genomics provided new insights into lichen population genetics and physiology, reflecting how factors like habitat fragmentation, pollution, and climate warming affect their viability (KISTENICH et al. 2019). All the above shows that the evolution of lichen threats research corresponds to environmental changes and other external factors, such as regulatory successes in pollution control, the rise of global climate change discussions, and growing conservation movements, all of which influenced where researchers directed their attention.

5.1.2. Geographic patterns of research output on threats to lichens

The production of research on threats to lichens is uneven geographically. Certain countries and regions contribute unequally to the topic. Analysis of authors and publication origins indicates that temperate, developed countries in the Northern Hemisphere dominate this field. Europe and North America stand out as hotspots of lichen threat research, having main research centres developed in their universities and other institutions. Several factors help to explain this pattern: these regions have long traditions of lichenology and possess the institutional and financial support for sustained research programs (PRADO et al. 2025). The United States and Canada, for their part, have integrated lichen monitoring into national forest and air quality programs since the 1980s, resulting in a steady stream of data-rich studies (e.g.; the USDA Forest Service lichen biomonitoring network in forests across the U.S. contributes to many publications) (MCCUNE et al.1998, U.S. FOREST SERVICE 2025). In contrast, countries and regions in the Global South (e.g., tropical Asia, Africa, South America) are underrepresented in the bibliometric data on lichen threats. This is not necessarily due to a lack of threats – indeed, many of these regions host rich lichen floras that are likely experiencing pressure from deforestation, pollution, and climate change – but rather due to historically limited research capacity and funding in lichenology (FRYDAY et al. 2022).
This geographic disparity in publication output may also reflect differences in environmental priorities and funding: developed nations have been able to invest in long-term ecological monitoring (where lichens feature as indicators), whereas developing nations might prioritise other immediate conservation issues, with lichen-specific threats garnering less attention so far. This geographical pattern highlights a concentration of lichen conservation research in economically developed regions with established environmental science infrastructures and long-standing traditions in ecological monitoring (ZHAO and TAGHIZADEH-HESARY 2022, YAHR et al.

2024, AGARWAL 2025). The dominance of the United States, Canada, China, and Northern and Western Europe in lichen-related climate research reflects their greater research capacity, funding availability, and scientific infrastructure rather than their environmental performance. It is noteworthy that these regions are also among the largest contributors to global greenhouse gas emissions (IEA 2025, BOWN and CLAUSING 2025). Concerning to the geographic analysis, bibliometric analysis uses the authors affiliations irrelevant of the geographic position of the study site or the nationality (at birth) of the authors. The lichenological database Recent litearature on lichens (RLL 2025) sources were analysed for the geographic position of the study sites. Similarities were found, establishing the leading role of Europe, then North America. Some European countries (e.g., Poland, Slovakia, Switzerland) are better represented in RLL and the diversity of countries with high impact is more obvious based on the study of RLL.

Another factor influencing geographic patterns is the distribution of industrial pollution and climate change impacts. Regions that underwent early industrialisation (like Western Europe) experienced lichen declines from pollution sooner and thus started relevant research earlier (e.g.; the famous disappearance of lichens in London during the 19th–20th century induced British studies) (HAWKSWORTH and MCMANUS 1989).

5.2. An updated checklist and a conservation risk category system for lichens in Kenya

Approximately 90 literature sources were surveyed from 1988 to 2024 (Kanyungulu et al. 2026), following the first synthesis "*Macrolichens of East Africa*" by SWINSCOW and KROG (1988), revealing the current occurrence of 725 species (incl. 172 crustose microlichen species, see Appendix 7). Based on 42 mostly journal publications and online sources the current occurrence of approximately 209 previously known macrolichen species were confirmed. After the necessary nomenclatural revision a checklist of 553 macrolichen taxa (including 5 varieties) was compiled.

Thus, so far 548 macrolichen species of 96 genera were recorded from Kenyan ecosystems. A conservation risk category system was established for Kenyan lichens and applied to 553 taxa of foliose and fruticose macrolichens. The species are listed alphabetically with annotations and grouped by risk categories. Distribution and habitat follow where the distribution in Kenya (K) is well elaborated, where possible. The habitat is described by substrate, vegetation type and altitudinal range (in brackets) where the species can be found. The frequency of the species refers to their frequency in Kenya / East Africa and is termed as either very rare, rare, common locally, fairly common or common.

5.2.1. Species under Extreme Risk (in Kenya) [ER(K)]

The 39 species (7%) listed in the category "*Species under Extreme Risk (in Kenya) [ER(K]*" are predominantly known from the time and place of original description, and the Kenyan type specimens (holotype, isotype, paratype) originate from several decades ago and dates back before 1988. It is a category that might contribute to the future identification of species belonging potentially to the IUCN category CR – Critically Endangered.

Crespoa inhaminensis (C.W. Dodge) Lendemer & B.P. Hodk. – K.: Western Province. Mozambique (Sousa, 1937 – holotype), S-Africa (Table Mt). Corticolous, saxicolous; mountain rocks, on *Coffea* sp.(0–1000 m a.s.l.); very rare. — [DODGE 1959, KIRIKA et al. 2016c]

Crespoa schelpei (Hale) Lendemer & B.P. Hodk. – K.: Nairobi. Mozambique (Schelpe, 1954 – holotype). Corticolous; lowland–montane forest (c. 100–2000 m a.s.l.); very rare. — [KIRIKA et al. 2016c]

Dictyonema krogiae Lücking & Timdal – K.: Mt Kenya (Krog, 1972 – holotype). Corticolous; moist site, montane forest (2000 m a.s.l.); very rare. — [LÜCKING and TIMDAL 2016]

Digitothyrea divergens (Henssen) P.P. Moreno & Egea, syn.: *Thyrea divergens* Henssen – K.: Eastern Province. Turkana Lake, Koobi Fora (Hindmarsh, 1983 – holotype), Cabo Verde, Mexico, Yemen. Saxicolous (calc.); exposed site, near-desert (1800 m a.s.l.); very rare. — [HENSSEN 1986, SWINSCOW and KROG 1988]

Dirinaria coccinea (Müll. Arg.) D.D. Awasthi – K. Tchamtéi (Hildebrandt, 1877 – lectotype). Angola, South Africa. Corticolous, ramicolous; costal sites (below 1000 m a.s.l.); very rare. — [MÜLLER 1885, AWASTHI 1975, SWINSCOW and KROG 1988]

Flavoparmelia pachydactyla (Hale) Hale – K.: Athi Plains (Liechtenstein, ? –holotype). Rhodesia (Zimbabwe). Saxicolous; exposed site (1750 m a.s.l.); very rare. — [HALE 1972, SWINSCOW and KROG 1988]

Fuscopannaria ignobilis (Anzi) P.M. Jørg. – K. North Africa, Europe. Corticolous; submontane zone (c. 1000 m a.s.l.), very rare. — [SWINSCOW and KROG 1988]

Hyperphyscia cochlearis Scutari – K.: Rift Valley (Moberg, 1979 – paratype). South Africa, Argentina, Brazil, Ecuador, Taiwan. Corticolous; natural, artificial habitats (450–2000 m a.s.l.); very rare. — [SCUTARI 1997, Hyperphyscia cochlearis 2025]

Hypotrachyna kenyana Kirika, Divakar & Lumbsch – K.: Rift Valley (Kirika, 2016 – holotype), Cherangani Hills, Mt Elgon. T? Corticolous, saxicolous, terricolous, muscicolous; montane–alpine forests (2760–3670 m a.s.l.), rare. — [KIRIKA et al. 2019]

Hypotrachyna nyandaruaensis Kirika, Divakar & Lumbsch – K.: Nyeri Country, Aberdares National Park (Kirika, 2018 – holotype). Corticolous; *Erica* woodland (2920–3010 m a.s.l.); rare. — [KIRIKA et al. 2019]

Hypotrachyna scytophylla (Kurok.) Hale – K. T. Asia. Corticolous; planted pine forest (2400–2500 m a.s.l.); very rare. — [SWINSCOW and KROG 1988]

Klauskalbia flabellata (Fée) S.Y. Kondr., Lőkös, Farkas & Hur, syn.: *Heterodermia flabellata* (Fée) Awasthi – K. Pantropical. Ramicolous; lava flow (1000 m a.s.l.); very rare. — [SWINSCOW and KROG 1988]

Pannaria planiuscula P.M. Jørg. – K: Rift Valley Province (Maas Gesternaus, 1949 – holotype). South Africa (Almborn, 1953 – paratype). Corticolous; moist ravines (760–820 m a.s.l.); very rare. — [JØRGENSEN 2003]

Parmeliella triptophylloides P.M. Jørg. – K.: Rift Valley Province (Maas Gesteranus, 1949 – holotype). Corticolous; humid, (low altitude hills) densely wooded ravine, shaded (900 m a.s.l.); very rare. — [JØRGENSEN 2003]

Parmotrema apricum (Krog & Swinscow) Krog & Swinscow – K (Krog & Swinscow, 1972 – holotype). Corticolous; shrubs, well-lit dry site (c.1000 m a.s.l.); very rare. — [SWINSCOW and KROG 1988]

Parmotrema cryptoxanthum (des Abb.) Hale – K. T. South Africa, Madagascar NE of Ankazobe, Forêt d'Ambohitantely (Abbayes, 1956 – lectotype, REN). Corticolous; shady, moist habitats, lower montane forest (1550–2100 m a.s.l.); rare. — [ABBAYES 1961, SWINSCOW and KROG 1988]

Parmotrema durumae (Krog & Swinscow) Krog & Swinscow – K (Krog & Swinscow, 1974 – holotype). T, U. Corticolous; mangroves, low coastal hills forest, lowland zone (0–1100 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Parmotrema jacarandicola (Krog & Swinscow) Krog & Swinscow – K.: Rift Valley, Nakuru (Gilenstam, 1968 – holotype, isotype; Santesson, Gilenstam – paratypes). Corticolous (*Jacaranda mimosifolia*); open, cultivated sites (1900 m a.s.l.); very rare. — [KROG and SWINSCOW 1981, SWINSCOW and KROG 1988]

Parmotrema kwalense (Krog & Swinscow) Krog & Swinscow – K.: Coast Province, Kwale District (County) (Krog & Swinscow, 1972 – holotype, paratype). Corticolous, ramicolous; mangrove (near sea level); very rare. — [KROG and SWINSCOW 1981, SWINSCOW and KROG 1988]

Parmotrema pardi (Krog & Swinscow) Krog & Swinscow – K.: Eastern Province, Machakos (Krog & Swinscow, 1974 – holotype, isotypes; Coast Province, Taita District (County) – paratypes). Saxicolous (acidic); exposed sites, montane zone (1650–1750 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Parmotrema pigmentiferum (Krog & Swinscow) Krog & Swinscow – K.: Coast Province, Kilifi District (County) (Krog & Swiscow, 1974 – holotype, isotypes) T. Corticolous; mangroves, miombo (0–70 m a.s.l.); very rare. — [KROG and SWINSCOW 1981, SWINSCOW and KROG 1988]

Parmotrema subcoloratum (Hale) Hale – K.: Nyanza Province, Kisumu-Londiani, Tinderet F.R. (Maas Gesteranus, 1949 – holotype), Zaire (Congo – Degelius, 1960). Corticolous; montane forest (1700–2500 m a.s.l.); rare. — [HALE 1965, SWINSCOW and KROG 1988]

Parmotrema taitae (Krog & Swinscow) Krog & Swinscow – K.: Coastal Province – Taita Hills (Nordal, 1973 – holotype). Saxicolous; granitic rock (c. 2000 m a.s.l); very rare. — [KROG and SWINSCOW 1981, SWINSCOW and KROG 1988]

Peltula santessonii Swinscow & Krog – K.: Kenya. Coast Province, Taita District (County), Tsavo N. P. (Santesson, 1971 – holotype). Zimbabwe. Brazil. Saxicolous; exposed sites, lowland zone (400 m a.s.l.); very rare. — [SWINSCOW and KROG 1979, SWINSCOW and KROG 1988, PELTULA SANTESSONII 2025]

Phyllopeltula corticola (Büdel & R. Sant.) Kalb, syn.: *Peltula corticola* Büdel & R. Sant. – K.: Machakos (Santesson, 1970 – holotype). Seychelles, Aldabra, Namibia. Hawaii, California, Puerto Rico, Venezuela, Asia. Corticolous (*Adansonia digitata*); dry savannah vegetation (800 m a.s.l.); very rare. — [BÜDEL 1987, SWINSCOW and KROG 1988, APTROOT and SCHUMM 2010]

Pseudoparmelia singularis Krog & Swinscow – K: Machakos (Swinscow, 1977 – holotype), Abardare Range (Swinscow – paratype). Saxicolous; exposed site, montane zone (1750–2100 m a.s.l.); very rare. — [KROG and SWINSCOW 1987, SWINSCOW and KROG 1988]

Punctelia toxodes (Stirt.) Kalb & M. Götz. – K.: seen by Kalb from unknown time and loc. U, South Africa, Réunion, Central and South America, Asia, China, Mongolia, India, Nepal (Himalaya), Japan. Tropical and temperate regions. Corticolous/muscicolous; submontane zone (800–2300 m a.s.l.); rare. — [KALB 2007]

Pyxine maculata Swinscow & Krog – K.: Nakuru (Swinscow, 1972 – holotype). South Africa. Saxicolous (1300–1900 m a.s.l.); rare. — [SWINSCOW and KROG 1975, SWINSCOW and KROG 1988, PYXINE MACULATA 2025]

Ramalina maritima Krog & Swinscow – K.: Coast Province, Kilifi (Krog & Swinscow, 1974 – holotype), T. Corticolous; shrubs in mangrove (near sea level); common locally. — [KROG and SWINSCOW 1976, SWINSCOW and KROG 1988, RAMALINA MARITIMA 2025]

Relicina echinocarpa (Kurok.) Hale – K.: Coast Province (Kirika 4432, Kirika & Mugambi 3567). Japan: Mt Hikosan (Kurokawa, 1963 – holotype). Corticolous; rare. — [KUROKAWA 1965, KIRIKA et al. 2017b]

Scytinium palustre (P.M. Jørg.) Otálora, P.M. Jørg. Wedin – K.: Mt Elgon National Park (Pócs and Szabó, 1992 –holotype). Humicolous on plants and mosses; semi-aquatic, ±submerged in swamp (*Carex runssorensis*-bogs), alpine region (3800–3880 m); very rare. — [JØRGENSEN 1994]

Scytinium subfragrans (Degel.) Otálora, P.M. Jørg. & Wedin, syn.: *Collema subfragrans* Degel. – K. Australia, New Zealand. Corticolous; shaded ravine (2500–2700 m a.s.l); very rare. — [SWINSCOW and KROG 1988, SCYTINIUM SUBFRAGRANS 2025]

Usnea aristata Motyka – K (Maas Gesteranus, 1949 – holotype). E. Corticolous, ramicolous; montane–ericaceous zone (3000–3500 m a.s.l.); rare. — [MOTYKA 1961, SWINSCOW and KROG 1988]

Usnea liechtensteinii J. Steiner – K.: Ulu-Kenia (Liechtenstein and Pospischill, 1896 –lectotype). Mexico. Saxicolous; exposed sites (1000–1800 m a.s.l); rare. — [SWINSCOW and KROG 1988, Clerc 2011]

Usnea roseola Vain. – K. Japan, Tristan da Cunha. Corticolous; relatively dry, mist-affected sites, montane zone (1450–1850 m a.s.l.); very rare. —[SWINSCOW and KROG 1988]

Xanthoparmelia boyeri Elix – K.: Mt Kenya (Mahaney & Boyer, 1983 – holotype). Saxicolous; nival zone (above 5000 m a.s.l.); very rare. — [ELIX 2002, BUSSMANN 2006]

Xanthoparmelia kenyana (Essl.) O. Blanco, A. Crespo, Elix, D. Hawksw. & Lumbsch – K.: Ngong Hills (Krog, 1972 – holotype). Saxicolous; exposed sites, montane zone (1900– 2300 m a.s.l.); rare. — [SWINSCOW and KROG 1988, XANTHOPARMELIA KENYANA 2025]

Xanthoparmelia krogiae Hale & Elix, syn.: *Pseudoparmelia endochromatica* Krog & Swinscow – K. Zanzibar (Tanzania). South Africa. Saxicolous (sandstone); (near sea level); rare. — [SWINSCOW and KROG 1988, XANTHOPARMELIA KROGIAE 2025]

Xanthoparmelia nakuruensis (Essl.) O. Blanco, A. Crespo, Elix, D. Hawksw. & Lumbsch – K.: Rift Vallley Province, Nakuru (Maas Gesteranus, 1947–1950? – holotype). Saxicolous; exposed, upland site (c. 2000–3000 m a.s.l.); very rare. — [ESSLINGER 1977, SWINSCOW and KROG 1988]

5.2.2. Species under Significant Risk (in Kenya) [SR(K)]

The 197 species and two varieties (36%) listed in the category "*Species under Significant Risk (in Kenya) [SR(K)]*" are rare in Kenya / rare in East-Africa, however, they have seldom a distribution record outside Africa. It is a category that might contribute to the future identification of species belonging potentially to the IUCN category EN – Endangered.

Anaptychia ethiopica Swinscow & Krog – K.: Mt Kenya; E. Saxicolous; subalpine–upper alpine zone (3350–4380 m a.s.l.); rare. — [FRISCH 1999, FRISCH and HERTEL 1998, SWINSCOW and KROG 1988]

Bryoria motykae (D. Hawksw.) Brodo & D. Hawksw. – K.: Mt Kenya; T. Terricolous, saxicolous; slightly eutorphicated sites at upper ericaceous to alpine zone (3350–4330 m a.s.l.); rare. — [FRISCH 1999, FRISCH and HERTEL 1998, SWINSCOW and Krog 1988]

Bulborrhizina africana Kurok. – K.: SE part. Mwingi District (Kitui County). Mozambique. Terricolous (also vagrant), corticolous, saxicolous; semi-arid to arid regions, *Acacia* / *Commiphora* / *Vellozia* shrubland (600–980 m a.s.l.); rare. — [KIRIKA et al. 2015, KUROKAWA 1994]

Bulbothrix decurtata (Kurok.) Hale – K.: Coast Province, Ngangao. Africa. Saxicolous (sandstone); montane rocky vegetation (1600–1900 ? m a.s.l.); rare. — [HALE and KUROKAWA 1964, KIRIKA et al. 2017a]

Notes: Molecular phylogenetic analyses (Kirika et al. 2017a) proved that some specimens treated as *B. tabacina* (Mont. and Bosch) Hale by SWINSCOW and KROG (1988) may belong to *B. decurtata* (Kurok.) Hale (saxicolous black-tipped isidiate species described from Transvaal, South Africa), but see notes also under *B. sublaevigatoides* (Dodge) Kirika, Divakar and Lumbsch.

Bulbothrix goebelii (Zenker) Hale – K. Pantropical. Corticolous; edge of mangrove (0–1000 m a.s.l.); very rare. — [SWINSCOW and KROG 1988, BULBOTHRIX GOEBELII 2025]

Bulbothrix kenyana Kirika, Divakar & Lumbsch – K.: Eastern and Rift valley Provinces. T. Corticolous, saxicolous; *Acacia* / *Commiphora* shrubland, secondary vegetation, dry thickets, forests (800–1850 m a.s.l.); rare. — [SWINSCOW and KROG 1988, KIRIKA et al. 2017a, FARKAS et al. 2023]

Notes: Its occurrences were reported from Tanzania based on earlier collections (Farkas, 1986, Pócs, 1988) (FARKAS et al. 2023).

Bulbothrix meizospora (Nyl.) Hale – K. Cameroon, Pakistan, Nepal, India. Corticolous; moist but well lit sites (2000 m a.s.l.); very rare. — [SWINSCOW and KROG 1988]

Bulbothrix ventricosa (Hale & Kurok.) Hale – K. South Africa, Mexico, Panama, Venezuela. Corticolous; riverside trees (1250 m a.s.l.); very rare. — [SWINSCOW and KROG 1988]

Canoparmelia kakamegaensis Garrido-Huéscar, Divakar & Kirika – K.: Kakamega County (Kirika, 2013 – holotype, EA). Corticolous; tropical rain forest (1760 m a.s.l.); very rare. — [GARRIDO-HUÉSCAR et al. 2022]

Canoparmelia rodriguesiana (Hue) Elix – K. Southern and western Africa, Madagascar. Saxicolous; exposed and dry sites (1300–1750 m alt.); rare. — [SWINSCOW and KROG 1988]

Cetrelia braunsiana (Müll. Arg.) W.L. Culb. & C.F. Culb. – K. Asia, New Zealand. Corticolous; open montane forest (2000–2400 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Cladonia dubia Abbayes – K. West Africa. Lignicolous; inselberg (2370 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Cladonia leucophylla Ahti & Krog – K. T. Lignicolous, muscicolous, terricolous; lower montane forest (1800–2400 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Cladonia pachyclados (Vainio) Ahti –- K, T. Malawi, Madagascar, Reunion. Corticolous, muscicolous, terricolous (1800–2100 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Cladonia praetermissa A.W. Archer; syn.: *Cladonia praetermissa* var. *modesta* (Ahti & Krog) Kantvilas & A.W. Archer – K. Cool temperate Australia, New Zealand. Central and Southern America. Terricolous; heathland, lowland–lower montane forest ((200–)1900 and 2100 m a.s.l.); rare. — [SWINSCOW and KROG 1988, KANTVILAs 1991, CLADONIA PRAETERMISSA 2025]

Coccocarpia erythroxyli (Spreng.) Swinscow & Krog – K. E, T, U. Tropical and temperate regions, some arctic stations. Corticolous/muscicolous; shady sites, montane forests (1800–3000 m a.s.l.); common locally. — [SWINSCOW and KROG 1988]

Coccocarpia flavicans Arv. – K. T. Angola, South America, the Philippines. Corticolous; mist-affected forests (1300–2100 m a.s.l.); rare. — [SWINSCOW and KROG 1988, COCCOCARPIA FLAVICANS 2025]

Dirinaria complicata D.D. Awasthi– K. T, U. Madagascar. Corticolous (artificial habitats), scrub, woodland (1000–2000 m a.s.l.); rare. — [Swinscow and Krog 1988]

Dufourea africana (Almb.) Frödén, Arup & Søchting – K. U. Corticolous; open sites, woodland, scrubland (2500–3000 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Enchylium conglomeratum (Hoffm.) Otálora, P.M. Jørg. & Wedin, syn.: *Collema conglomeratum* Hoffm. var. *crassiusculum* (Malme) Degel. – K. Europe, the Americas, Asia(?). Corticolous; montane zone (2550 m a.s.l.); very rare. — [SWINSCOW and KROG 1988]

Enchylium tenax (Sw.) Gray, syn.: *Collema tenax* (Sw.) Ach. – K. Cosmopolitan. Terricolous; shaded forest (2650 m a.s.l.); very rare. — [SWINSCOW and KROG 1988]

Endocarpon albidulum (Müll. Arg.) Zahlbr. – K. Cuba. Saxicolous (calcareous); wet, shady site (2100 m a.s.l.); very rare. — [SWINSCOW and KROG 1988]

Endocarpon johnstonii (Müll. Arg.) Stizenb. – K. U. Mauritius. Saxicolous, terricolous; exposed sites (1100–1900 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Erioderma mollissimum (Samp.) Du Rietz – K. Europe, Macaronesia, the Americas. Corticolous; sheltered, moist sites, montane forest (2100 m a.s.l.); very rare. — [SWINSCOW and KROG 1988]

Eschatogonia triptophyllina (Nyl.) Kalb – K.: Eastern Province. Pantropical. Corticolous; rainforest (2018 m a.s.l.); very rare. — [KIRIKA et al. 2012a]

> ***Eumitria baileyi*** Stirt. var. ***pinnatifida*** Swinscow & Krog – K. T. Angola. Corticolous; open, sheltered–exposed sites, woodland (1500–1800 m a.s.l.); rare. — [SWINSCOW and KROG 1988]
>
> *Note:* This variety differs in secondary chemistry, frequency and distribution compared to *Eumitria baileyi* Stirt. Hopefully, future molecular studies based on a larger amount of specimens can answer if these differences should separate this taxon as an independent species.

Flavoparmelia rutidota (Hook. f. & Taylor) Hale – K. Australia, the Americas. Saxicolous; low alpine moorland (3600 m a.s.l.); very rare. — [SWINSCOW and KROG 1988]

Flavopunctelia praesignis (Nyl.) Hale – K. North and Central America. Corticolous; well lit sites (2100 and 2350 m a.s.l.); very rare. — [SWINSCOW and KROG 1988]

Fuscopannaria praetermissa (Nyl.) P.M. Jørg. – K.: Mt Kenya. Temperate zone. Muscicolous, humicolous /corticolous (*Senecio keniodendron*), terricolous; upper afroalpine zone (4110-4460 m a.s.l.); rare. — [FRISCH 1999]

Gabura fascicularis (L.) P.M. Jørg., syn.: *Collema fasciculare* (L.) Wigg. var. *fasciculare*; *C. fasciculare* (L.) Wigg. var. *microcarpum* (Müll. Arg.) Degel. – K. Tropical subtropical and temperate regions. Corticolous; exposed–moist sites, woodland (1500– 3400 m.a.s.l.); rare. — [SWINSCOW and KROG 1988]

Heterodermia loriformis (Kurok.) Swinscow & Krog – K. T. Corticolous, ramicolous; exposed sites (1000–1900 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Heterodermia pseudospeciosa (Kurok.) W.L. Culb. – K. North America, Asia, Australia. Tropics, subtropics. Saxicolous; riversides (1400–2100 m a.s.l.); very rare. — [SWINSCOW and KROG 1988]

Hyperphyscia isidiata Moberg – K. Congo, Zimbabwe, the Americas, Australia. Corticolous; open sites (800–1600 m a.s.l.); rare. — [SWINSCOW and KROG 1988, HYPERPHYSCIA ISIDIATA 2025]

Hypogymnia physodes (L.) Nyl. – K.: Mt Kenya. Northern hemisphere. Corticolous, lignicolous, muscicolous, saxicolous; well-lit sites, subalpine–alpine zones (3000–above 4000 m a.s.l.); rare. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Hypogymnia tubulosa (Schaer.) Hav. – K.: Mt Kenya. E. Northern hemisphere. Corticolous, lignicolous, ramicolos, muscicolous, saxicolous; well-lit sites, ericaceous–alpine zone (3000–4430 m a.s.l.); rare. — [SWINSCOW and Krog 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Hypotrachyna africana (Hale ex W.L. Culb. & C.F. Culb.) Divakar, A. Crespo, Sipman, Elix & Lumbsch – K.: Ngong Hills. T. E-Africa only. Corticolous; artificial habitats, elfin forest (1300–2340 m a.s.l.); rare. — [ALSTRUP et al. 2010, HYPOTRACHYNA AFRICANA 2025]

Hypotrachyna croceopustulata (Kurok.) Hale – K. North and Central America, West Indies. Corticolous; ericaceous zone (2900 m a.s.l.); very rare. — [SWINSCOW and KROG 1988]

Hypotrachyna damaziana (Zahlbr.) Krog & Swinscow – K. South America, Australia. Corticolous; open woodland (1900 m a.s.l.); very rare. — [SWINSCOW and KROG 1988]

Hypotrachyna fissicarpa (Kurok.) Hale – K. U. South Africa. Saxicolous, muscicolous; open sites, montane–ericaceous zone (2000–3350 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Hypotrachyna horrescens (Taylor) Krog & Swinscow – K. Temperate, (tropical) regions. Corticolous; montane forest (2000–2400 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Hypotrachyna leiophylla (Kurok.) Hale – K. T. Southern Africa. Corticolous; *Erica* bushland submontane–montane-alpine forests (2100–4200 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Hypotrachyna meridionalis Kirika, Divakar & Lumbsch – K.: Mt Elgon, Mt Kenya (Kirika, 2017 – holotype), Chile. Corticolous; *Erica* bushland, montane–alpine forests (3200–4200 m a.s.l.); rare. — [KIRIKA et al. 2019]

Hypotrachyna microblasta (Vainio) Hale – K. Tropical America, West Indies, Southeast Asia. Corticolous; lower montane forest (1850–2000 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Hypotrachyna polydactyla (Krog & Swinscow) Nash – K. T. North America. Corticolous, saxicolous; lower montane forest (1900–2400 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Hypotrachyna spathulata (Kurok.) Krog & Swinscow – K. T. Southern Africa. Saxicolous, corticolous; well-lit, artificial habitats (1900–3000 m a.s.l.); fairly common. — [SWINSCOW and KROG 1988]

Hypotrachyna spumosa (Asah.) Krog & Swinscow – K. Pantropical. Corticolous; open woodland (1350–1900 a.s.l.); rare. — [SWINSCOW and KROG 1988]

Hypotrachyna sublaevigata (Nyl.) Hale. – K. E. Zaire (Congo), Liberia. Central and South America, India. Corticolous; montane zone (2000–2300 m a.s.l.); very rare. — [SWINSCOW and KROG 1988]

Imshaugia aleurites (Ach.) S.L.F. Mey., syn.: *Parmeliopsis aleurites* (Ach.) Nyl. – K. Temperate, boreal regions. Lignicolous; montane–ericaceous zone (2600–3400 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Kroswia crystallifera P.M. Jørg. – K.: Nyeri District (County): Naru Moru (1972). Réunion (1996), South Africa (1962, 1970). Sri Lanka (1964), India (1975), Taiwan (2001), Paleotropical. Corticolous; damp, montane forests (400–2200 m a.s.l.); rare. — [JØRGENSEN 2002]

Leptogium asiaticum P.M. Jørg. – K. E, T. Angola, Asia, Australia. Corticolous; lower montane forest (1600–2000 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Leptogium brebissonii Mont. – K. E, U. Canary Islands, Europe. Corticolous; in shady sites, submontane forests (1100–2500 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Leptogium digitatum (A. Massal.) Zahlbr. – K. E. South Africa. South America. Corticolous; sheltered site, montane forest (c. 2800 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Leptogium marginellum (Sw.) Gray. – K. T, U. Tropical America, West Indies, Philippines, Australia. Corticolous, terricolous; shaded banks, open woodland (2000–2300 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Leptogium sessile Vain. – K. T, U. South Africa. The Americas. SE Asia. Corticolous, lignicolous; woodland, wayside trees, montane zone (1100–2300 m a.s.l.); rare. — [SWINSCOW and KROG 1988; LEPTOGIUM SESSILE 2025]

Leptogium vesiculosum (Sw.) Malme – K. T. Tropical America, West Indies. Corticolous; montane forest (1500–2200 m a.s.l.); very rare. — [SWINSCOW and KROG 1988]

Leucodermia lutescens (Kurok.) Kalb – K. T, U. Pantropics, subtropics. Corticolous; sheltered places (c. 1800 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Lobaria discolor (Bory ex Delise) Hue – K. T. Madagascar, Reunion, South America, Indonesia, Australia. Corticolous; montane forest (c. 2200 m a.s.l.); very rare. — [SWINSCOW and KROG 1988, LOBARIA DISCOLOR 2025]

Lobarina scrobiculata (Scop.) Nyl. ex Cromb. – K. Cosmopolitan. Corticolous; ericaceous zone (c. 3400 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Melanelixia subargentifera (Nyl.) O. Blanco, A. Crespo, Divakar, Essl., D. Hawksw. & Lumbsch. – K.: Mt Kenya. Temperate, boreal region (northern hemisphere). Saxicolous (±calcareous lava); alpine–subnival zone (3550–4380 m a.s.l); rare. — [FRISCH and HERTEL 1998, FRISCH 1999, MELANELIXIA SUBARGENTIFERA 2025]

Myelochroa aurulenta (Tuck.) Elix & Hale, syn.: *Hypotrachyna aurulenta* (Tuck.) Krog & Swinscow – K. E, T. Pantropical, warm temperate regions. Corticolous, saxicolous; lower montane forest (800–2200 m a.s.l); rare. — [SWINSCOW and KROG 1988]

Nephroma isidiosum (Nyl.) Gyeln. – K. T. Russia, Siberia, Alaska. Muscicolous, saxicolous, corticolous; shady montane forest (c. 2200 m a.s.l); very rare. — [SWINSCOW and KROG 1988, NEPHROMA ISIDIOSUM 2025]

Niorma hypoglauca (Nyl.) S.Y. Kondr., Kärnefelt, Elix, A. Thell, M.H. Jeong & Hur, syn.: *Teloschistes hypoglaucus* (Nyl.) Zahlbr. – K. E, T. Tropical America. Corticolous, ramicolous; exposed sites (1500–3100 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Pannaria conoplea (Ach.) Bory – K. Temperate regions (northern hemisphere), (pantropical). Corticolous; forests, montane–ericaceous zone (1800–3400 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Pannaria hookeri (Borrer) Nyl. – K.: Mt Kenya. The Americas, Norway, Sweden, Iceland, Austria, Italy, Russia, Greenland, New Zealand, Antarctica. Saxicolous, exposed sites (vertical cliffs), alpine–nival zone (3350–4650 m a.s.l); very rare. — [FRISCH and HERTEL 1998, FRISCH 1999, PANNARIA HOOKERI 2025]

Pannaria lurida (Mont.) Nyl. – K. Pantropical, subtropical. Corticolous; mist-affected hill; moist forest, montane zone (2200–3000 m a.s.l.); very rare. — [SWINSCOW and KROG 1988]

Paracollema italicum (B. de Lesd.) Otálora, P.M. Jørg. & Wedin, syn.: *Collema italicum* B. de Lesd. – K. Southern Europe. Corticolous; montane zone (2300 m a.s.l.); very rare. — [SWINSCOW and KROG 1988]

Parmelinella amazonica (Nyl.) A.S. Rodrigues, A.P. Lorenz & Canêz, syn.: *Canoparmelia amazonica* (Nyl.) Elix and Hale, *Pseudoparmelia amazonica* (Nyl.) Hale – K. T. West Africa, the

Americas, Taiwan. Corticolous, mangroves; low coastal hills (0–700 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Parmotrema aldabrense (C.W. Dodge) Hale – K. T. Aldabra Islands, Madagascar. Corticolous; mangroves, coastal lowlands (c.1000 m a.s.l.); common locally. — [SWINSCOW and KROG 1988]

Parmotrema araucariarum (Zahlbr.) Hale – K. South America. Corticolous; montane forest (2000–2100 m a.s.l.); very rare. — [SWINSCOW and KROG 1988]

Parmotrema bangii (Vainio) Hale – K. T. Zaire (Congo), Rwanda, Canary Islands, South America. Corticolous; montane forests and inselbergs (1500–3200 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Parmotrema commensuratum (Hale) Hale – K.: Mt Kenya, Sirimon. The Americas. Corticolous; xerotropical upland forest (1500–2500 m a.s.l.); very rare. — [KIRIKA et al. 2018, PARMOTREMA COMMENSURATUM 2025]

Parmotrema cristiferum (Taylor) Hale – K. T, U. Pantropical, subtropics. Corticolous; dry or mist-affected lowland areas (300–1450 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Parmotrema defectum (Hale) Hale – K. U. South Africa (Almborn, 1953 – holotype) Madagascar. Saxicolous; dry, exposed sites (1750– 2100 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Parmotrema dilatatum (Vainio) Hale – K. T. West Africa, South America, Asia. Corticolous; mist-affected sites, lowland zone (300–900 m a.s.l); rare. — [SWINSCOW and KROG 1988]

Parmotrema direagens (Hale) Hale – K. E, T. South Africa,·Asia. Corticolous; well-lit sites, lower montane zone (1500–2600 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Parmotrema erubescens (Stirton) Krog & Swinscow – K. South America, Australia. Corticolous; well-lit site, montane zone (1400 m a.s.l.); very rare. — [SWINSCOW and KROG 1988]

Parmotrema eunetum (Stirton) Hale – K. E, T, U. West Africa, Asia, West Indies. Corticolous, (saxicolous); mist-affected inselbergs, montane forest, low alpine zone (1600–3800 m a.s.l.); common. — [SWINSCOW and KROG 1988]

Parmotrema gardneri (Dodge) Sérus. – K. T, U. Pantropics. Corticolous; mangroves, lowlands, hills, and inselbergs (0–2000 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Parmotrema indicum Hale – K. E, T, U. Asia. Corticolous, saxicolous; fairly dry, well-lit sites, mist-affected hills, upland areas (1450–2600 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Parmotrema louisianae (Hale) Hale – K. North America. Corticolous; shrubs in a dry, well-lit site, lowland–submontane zone (1000 m a.s.l.); very rare. — [SWINSCOW and KROG 1988]

Parmotrema maclayanum (Müll. Arg.) Hale – K. T, U. West and South Africa, Madagascar, Asia, South America. Corticolous, saxicolous; well-lit sites, artificial, natural habitats, dry woodland, montane forest (900–2200 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Parmotrema mellissii (Dodge) Hale – K. T. Pantropical, warm temperate regions. Corticolous, montane forest (2000–2400 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Parmotrema nyasense (C. W. Dodge) R.S. Egan, syn.: *Parmotrema xanthinum* (Müll. Arg.) Hale – K. Malawi (Nyasaland) (Brass – holotype), Congo (Zaire). Asia, the Americas. Corticolous, (saxicolous); mist-affected woodland, well-lit hillside, montane zone (1400–2700 m a.s.l.); very rare. — [DODGE 1959, SWINSCOW and KROG 1988]

Parmotrema parahypotropum (W. Culb.) Hale – K. Asia, Australia. Corticolous; mangroves, woodland (sea level –300 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Parmotrema permutatum (Stirton) Hale – K. E, T, U. Asia, Australia, South America, West Indies. Corticolous; well-lit sites, artificial, natural habitats, submontane– montane zone (1100–2400 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Parmotrema pilosum (Stizenb.) Krog and Swinscow – K. E, U. South Africa, South America, Australia. Corticolous, (saxicolous); well-lit sites, solitary trees, artificial habitats, submontane–montane zone (1300–2000 m a.s.l.); fairly common. — [SWINSCOW and KROG 1988]

Parmotrema poolii (C.W. Dodge) Krog & Swinscow – K. T. Madagascar, Asia, Australia. Corticolous, saxicolous; submontane–montane forest (900–2300 m a.s.l); rare. — [SWINSCOW and KROG 1988]

Parmotrema praesorediosum (Nyl.) Hale – K. E, T, U. Pantropical, southern temperate regions. Corticolous, saxicolous; fairly dry, well-lit sites, lowland–montane zone (700–1800 m a.s.l); rare. — [SWINSCOW and KROG 1988]

Parmotrema pseudocrinitum (Abbayes) Hale – K. E, T, U. South Africa. South America, Asia, Australia. Corticolous, (saxicolous); parks and gardens, mist-affected woodland, lowland–montane zone (700–2600 m a.s.l); common. — [SWINSCOW and KROG 1988, PARMOTREMA PSEUDOCRINITUM 2025]

Parmotrema pseudograyanum (Hale) Sérus. – K. E, T, U. South, Central, and West Africa. Central America. Saxicolous; dry, well-lit sites, montane zone (1400–2300 m a.s.l.); rare. — [SWINSCOW and KROG 1988, PARMOTREMA PSEUDOGRAYANUM 2025]

Parmotrema ravum (Krog & Swinscow) Sérus. – K. E, T, U. Southeastern, southwestern, central Africa. Corticolous; bushed grassland, open woodland, submontane–montane zone (1250–1800 m a.s.l); fairly common. — [SWINSCOW and KROG 1988]

Parmotrema soyauxii (Müll. Arg.) Hale – K. T, U. West and South Africa, Madagascar. Saxicolous (acidic); on fully exposed sites, montane zone (1000–2100 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Parmotrema stuhlmannii (C.W. Dodge) Krog & Swinscow – K. T, U. South Africa. Saxicolous; dry, well-lit sites, montane zone (1500–2100 m a.s.l.); rare. — [SWINSCOW and KROG 1988, PARMOTREMA STUHLMANNI 2025]

Parmotrema subisidiosum (Müll. Arg.) Hale – K. E, T, U. Pantropical, temperate regions. Corticolous, saxicolous; mist-affected woodland, montane forest (1800–2400 m a.s.l.); common. — [SWINSCOW and KROG 1988]

Parmotrema subsumptum (Nyl.) Hale – K. E, T. Pantropical, warm temperate regions. Corticolous (saxicolous); montane forest (1400–2100 m a.s.l.); fairly common. — [SWINSCOW and KROG 1988]

Parmotrema subtinctorium (Zahlbr.) Hale – K. E, T. Pantropical, temperate regions. Corticolous; well-lit sites, artificial habitats, mist-affected woodland, montane zone (1300–2300 m a.s.l.); common. — [SWINSCOW and KROG 1988]

Parmotrema sulphuratum (Nees and Flotow) Hale – K. Pantropical. Corticolous; low coastal hill (480 m a.s.l.); very rare. — [SWINSCOW and KROG 1988]

Parmotrema tinctorum (Nyl.) Hale – K. E, T, U. Pantropical; temperate regions. Corticolous (saxicolous); mangroves, coastal hills, well-lit upland habitat (c. 2700 m a.s.l.); common. — [SWINSCOW and KROG 1988]

Parmotrema uberrimum (Hue) Hale – K. T, U. Corticolous; dry, well-lit woodland, lowland–montane zone (0–2000 m a.s.l.); common locally. — [SWINSCOW and KROG 1988]

Parmotrema umbrosum (Krog & Swinscow) Krog & Swinscow – K. U. Malawi. Corticolous; lower montane forest (1600–2100 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Parmotrema zollingeri (Hepp) Hale – K. T. Pantropical. Corticolous; woodland, forest, lowland–submontane zone (0–1000 m a.s.l.); fairly common. — [SWINSCOW and KROG 1988]

Peltigera cichoracea Delise ex Jatta – K. E, T. W-Africa. Asia. Muscicolous / terricolous, corticolous; montane forest (2400–3000 m a.s.l.); rare. — [SWINSCOW and KROG 1988, PELTIGERA CICHORACEA 2025]

Peltigera continentalis Vitik. – K.: Mt Kenya. Asia. Terricolous, muscicolous, humicolous; alpine zone (4200–4260 m a.s.l.); common locally. — [FRISCH 1999, PELTIGERA CONTINENTALIS 2025]

Peltigera lambinonii Goffinet – K.: Mt Kenya. Central and South Africa. Australia. Muscicolous, saxicolous, terricolous; alpine zone (3390–4210 m a.s.l.); very rare. — [GOFFINET and HASTINGS 1995, FRISCH 1999, PELTIGERA LAMBINONII 2025]

Peltigera polydactylon (Neck.) Hoffm. – K. T. Northern hemisphere, temperate, (tropical). Muscicolous / corticolous; forest; subalpine–alpine zone (3000–3500 m a.s.l.); very rare. — [SWINSCOW and KROG 1988]

Peltula africana (Jatta) Swinscow & Krog. – K. Eritrea, Tenerife, South Africa. Saxicolous; dry partially shaded sites, montane zone (c.1900 m a.s.l.); common locally. — [SWINSCOW and KROG 1988]

Peltula euploca (Ach.) Poelt ex Ozenda & Clauzade. – K. E, U. Pantropical, subtropics, temperate region. Saxicolous; dry sites, montane zone (1000–2100 m a.s.l.); common. — [SWINSCOW and KROG 1988]

Peltula impressa (Vain.) Swinscow & Krog, syn.: *Peltula lingulata* (Vainio) Swinscow & Krog – K. U. Ivory Coast, South Africa. Saxicolous; submontane–montane zone (600–1000 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Phaeophyscia fumosa Moberg – K. E, T. India. Corticolous; montane–ericaceous zone (2600–3100 m a.s.l.); rare. — [SWINSCOW and KROG 1988, MAURYA et al. 2024]

Phaeophyscia hirsuta (Mereschk.) Essl. – K. North America, Europe. Corticolous; well-lit sites, submontane–montane zone (1200–2000 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Phyllopsora buettneri (Müll. Arg.) Zahlbr. – K.: Kakamega. (Santesson, 1970). T. U. Madagascar. Philippines, Papua-New Guinea, Northern Australia, Society Islands (Tahiti). Corticolous (?); humid sites, montane forests (900–2800 m a.s.l.); fairly common. — [BRAKO 1991]

Phyllopsora buettneri var. ***glauca*** (B. de Lesd.) Brako – K.: Mt Kenya, Shimba Hills (Krog, Swinscow, 1972–1974). T. U. Madagascar. Central and South America. Papua New Guinea. New Zealand. Corticolous (?); woodlands, forests, (coastal–) montane zone (480–2100 m a.s.l.); common locally. — [BRAKO 1991]

Note: Phyllopsora buettneri var. *glauca* (B. de Lesd.) Brako differs from *Phyllopsora buettneri* (Müll. Arg.) Zahlbr. in secondary chemistry and pruinosity. Hopefully, future extended molecular studies can answer if these differences should separate this taxon as an independent species.

Phyllopsora furfuracea (Pers.) Zahlbr. – K.: Coastal Province (Kalb & Schrögl, 1985). Pantropical, (temperate, subtropical). Corticolous (muscicolous/saxicolous); humid, ±shady sites, forests, lowland–montane zones ((0–)350(–2200) m a.s.l.); common. — [BRAKO 1991]

Phyllopsora haemophaea (Nyl.) Müll. Arg. – K. E, T. Tropical South America, Japan. Corticolous; lowland forests, fog-induced vegetation, coastal–montane zones (300–2500 m a.s.l.); common locally. — [SWINSCOW and KROG 1988]

Physcia atrostriata Moberg – K. T, U. Sudan. Pantropical (temperate). Corticolous; open sites, submontane–montane zone (800–2000 m a.s.l.); rare. — [SWINSCOW and KROG 1988, PHYSCIA ATROSTRIATA 2025]

Physcia biziana (A. Massal.) Zahlbr. – K. E. Europe, western United States, Mexico. Temperate, (tropical). Corticolous, montane zone (1500–2100 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Physcia crispa Nyl. – K. T. Pacific Islands. Corticolous; lowland sites (500 m a.s.l.); very rare. — [SWINSCOW and KROG 1988]

Physcia erumpens Moberg – K. E, T, U. South Africa. SW North America, Mexico, South America. SE Asia, Australia, New Zealand. Corticolous (saxicolous); coastal, lowland–subalpine zone (0–3100 m a.s.l.); common. — [SWINSCOW and KROG 1988, PHYSCIA ERUMPENS 2025a, b]

Physcia flava Müll. Arg., syn.: *Dirinaria flava* (Müll. Arg.) C.W. Dodge – K. T. Mozambique, Ascension Island. Terricolous; natural, open woodland, lava under shrubs, montane zone (1000–1700 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Physcia fragilescens Zahlbr. – K. E, T, U. Java. Corticolous (saxicolous); open sites, montane(–subalpine) zone (800–2700 m a.s.l.); common. — [SWINSCOW and KROG 1988]

Physcia integrata (Nyl.) Arnold – K. E, T. South Africa. Central and South America. SE Asia, Australia, New Zealand. Corticolous, saxicolous; open sites, costal, lowland–alpine zone (0–3600 m a.s.l.); rare. — [SWINSCOW and KROG 1988, PHYSCIA INTEGRATA 2025]

Physcia krogiae Moberg – K. E, T, U. Pantropical, subtropical regions. Corticolous; open sites, montane zones (1000–2100 m a.s.l.); common. — [SWINSCOW and KROG 1988]

Physcia stellaris (L.) Nyl. – K. U. Cosmopolitan. Corticolous, ramicolous; montane zone (1200–2300 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Physcia tribacia (Ach.) Nyl. – K. E, T. Temperate regions. Saxicolous; exposed sites, montane–alpine zone (1900–4000 m a.s.l.); common. — [SWINSCOW and KROG 1988]

Physcia tribacioides Nyl. – K. U. Europe, North America, New Zealand. Corticolous; open sites (1200–2000 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Physcia undulata Moberg – K. E. W and S Africa, Madagascar. The Americas, Australia, New Zealand. Corticolous, ramicolous; open sites, lowland–subalpine zone (500– 3000 m a.s.l.); common locally. — [SWINSCOW and KROG 1988, PHYSCIA UNDULATA 2025]

Physcia verrucosa Moberg – K. E, T, U (holotype). Somalia. Corticolous, ramicolous; montane zone (900–2800 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Physciella chloantha (Ach.) Essl. – K. Europe (Switzerland – holotype), North America. Corticolous (saxicolous); open, well-lit sites, montane zone (c. 2000 m a.s.l.); very rare. — [SWINSCOW and KROG 1988]

Physconia distorta (With.) J.R. Laundon – K. E, U. Temperate, boreal regions. Corticolous; solitary, wayside trees, montane–subalpine zone (2500–3250 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Physma byrsaeum (Afzel. ex Ach.) Tuck. – K. T. Pantropical. Corticolous; mist-affected woodland, mangrove, coastal–montane zone (0–900 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Placopsis gelida (L.) Linds. – K.: Mt Kenya. Circumpolar temperate–arctic, (tropical). Saxicolous, muscicolous; exposed sites, alpine zone (3350–4000 m a.s.l.); rare. — [FRISCH and HERTEL 1998, FRISCH 1999, SMITH et al. 2009]

Placopsis parellina (Nyl.) I.M. Lamb – K.: Mt Kenya. Circumpolar (exc. Europe). Saxicolous, muscicolous; exposed sites, alpine zone (3350–4000 m a.s.l.); rare. — [ALMBORN 1966, FRISCH and HERTEL 1998, FRISCH 1999, PLACOPSIS PARELLINA 2025]

Polyblastidium albicans (Pers.) S.Y. Kondr., Lőkös and Hur, syn.: *Heterodermia albicans* (Pers.) Swinscow and Krog – K. E. Canary Islands, South Africa, tropical and warm temperate America. Saxicolous, corticolous; on partly shaded sites, lower montane–montane forests (1000–2000 m a.s.l); rare. — [SWINSCOW and KROG 1988]

Polyblastidium chilense (Kurok.) Kalb, syn.: *Heterodermia chilensis* (Kurok.) Swinscow & Krog – K. Southern Africa, S America, Thailand, Australia, New Zealand. Terricolous (Chile – holotype), muscicolous / saxicolous, corticolous; lowland–subalpine zone (300–300 m a.s.l.); rare. — [KUROKAWA 1973, SWINSCOW and KROG 1988, ELIX 2011]

Polyblastidium magellanicum (Zahlbr.) Kalb, syn.: *Heterodermia magellanica* (Zahlbr.) Swinscow and Krog – K. E. South and Central America. Corticolous; montane forest (1800–3000 m a.s.l); rare. — [SWINSCOW and KROG 1988]

Polyblastidium propaguliferum (Vain.) Kalb, syn.: *Heterodermia reagens* (Kurok.) Elix – K.: Mt Kenya, Chogoria, Sirimon. Corticolous; montane-subalpine forests (2460–3050 m a.s.l.) rare. — [KIRIKA et al. 2018]

Polycauliona candelaria (L.) Frödén, Arup and Søchting, syn.: *Xanthoria candelaria* (L.) Th. Fr. – K.: Mt Elgon. Northern temperate region, (tropics). Corticolous (giant *Senecio* trees); alpine zone (3580–4050 m a.s.l); rare. — [PÓCS and SZABÓ 1993]

Protoparmeliopsis peltata (Lam. and DC.) Arup, Zhao Xin and Lumbsch, syn.: *Rhizoplaca peltata* (DC) Leuckert and Poelt – K. E. North America, Europe, Asia. Saxicolous; exposed site, alpine zone (3600-4300 m a.s.l); rare. — [SWINSCOW and KROG 1988]

Pseudocyphellaria intricata (Delise) Vain. – K. Pantropical, temperate regions. Corticolous; damp, shady site, montane forest (1900–2900 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Pseudoparmelia usambarensis (J. Steiner and Zahlbr.) Krog and Swinscow – K. E, T, U. Western Africa. Saxicolous; exposed site (1300–2300 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Punctelia constantimontium Sérus. – K. Zimbabwe, South Africa, South America. Corticolous; artificial habitats (1600–1800 m a.s.l.); very rare. — [SWINSCOW and KROG 1988]

Punctelia punctilla (Hale) Krog – K.: Rift valley. Southern Africa, South America. Saxicolous; dry, well lit sites (1900 m a.s.l.); common locally. — [SWINSCOW and KROG 1988]

Punctelia semansiana (W. Culb. and C. Culb.) Krog – K. E, T. North and Central America. Corticolous, saxicolous; submontane zone (c. 2600 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Punctelia stictica (Duby) Krog – K. E. Europe, Africa, the Americas. Saxicolous; subalpine–alpine zones (3250–4100 m a.s.l.); very rare. — [SWINSCOW and KROG 1988]

Pyxine convexior (Müll. Arg.) Swinscow and Krog – K. T. Australia. Corticolous; partial shade (1000 m a.s.l.); very rare. — [SWINSCOW and KROG 1988]

Pyxine copelandii Vain. – K. Philippines, Bonin Islands, Australia. Corticolous; in mangroves (0–700 m a.s.l.); common locally. — [SWINSCOW and KROG 1988]

Pyxine kibweziensis Swinscow and Krog – K.: Machakos, Kibwezi (Swinscow and Krog, 1972 – holotype). T. Madagascar (Ankarana Special Reserve, herbarium record – F, Widhelm and Randriamanantena, 2019!). Saxicolous; partial shady sites (100–1000 m a.s.l.); rare. —

[SWINSCOW and KROG 1975, SWINSCOW and KROG 1988, PYXINE KIBWEZIENSIS 2025]

Pyxine lilacina Swinscow and Krog – K.: Taita Hills (Swinscow and Krog, 1973 – holotype). U. Zimbabwe, South Africa. Saxicolous; partially–fully sunny sites (1100–1700 m a.s.l.); rare. — [SWINSCOW and KROG 1975, SWINSCOW and KROG 1988, PYXINE LILACINA 2025]

Pyxine lyei Swinscow and Krog – K. U. (East Africa only). Saxicolous; hot, dry, fully exposed sites (1200–1900 m a.s.l.); common locally. — [SWINSCOW and KROG 1988]

Pyxine nubila Moberg – K. E. Saudi Arabia, Tasmania. Corticolous, saxicolous; shady sites (1800–2000 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Pyxine vermiformis Swinscow and Krog – K.: Coast Province, Taita District (County), Tsavo N. P. (Swinscow and Krog, 1972 – holotype). T. Zimbabwe. Saxicolous; (lava) partly shaded by trees (c. 1000 m a.s.l.); rare. — [SWINSCOW and KROG 1975, SWINSCOW and KROG 1988, PYXINE VERMIFORMIS 2025]

Ramalina consanguinea Müll. Arg. – K. T. Corticolous; coastal sites (c. 400 m a.s.l.); common locally. — [SWINSCOW and KROG 1988]

Ramalina ecklonii (Spreng.) Meyen and Flot., syn.: *R. sprengelii* Krog and Swinscow – K. T. Southern Africa. Corticolous; montane forest (2000–3000 m a.s.l); rare. — [SWINSCOW and KROG 1988]

Ramalina fecunda Krog and Swinscow – K. T. Corticolous; mangroves, low coastal hills (c. 400 m a.s.l.); common locally. — [SWINSCOW and KROG 1988]

Ramalina holstii Krog and Swinscow – K. T. Venezuela. Corticolous; shrubland (c. 1000 m a.s.l.); rare. — [SWINSCOW and KROG 1988, RAMALINA HOLSTII 2025]

Ramalina reducta Krog and Swinscow – K.: Mt Kenya. S-America (1986), Australia (1983). Corticolous, ramicolous (*Erica arborea*); subalpine–alpine zones (3350– above 4000 m a.s.l); very rare. — [FRISCH and HERTEL 1998, FRISCH 1999, RAMALINA REDUCTA 2025a, b]

Ramalina tenella Müll. Arg. – K. South America, Australia, New Hebrides. Ramicolous; mangroves, low coastal hills (c. 400 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Remototrachyna rhabdiformis (Kurok.) Divakar and A. Crespo, syn.: *Hypotrachyna rhabdiformis* (Kurok.) Hale – K. Central and South America, Asia. Corticolous / muscicolous; lower montane forest (2100 m a.s.l.); very rare. — [SWINSCOW and KROG 1988]

Scytinium californicum (Tuck.) Otálora, P.M. Jørg. and Wedin, syn.: *Leptogium californicum* Tuck. – K. North America. Saxicolous; sprayed, inundated sites (2100 m a.s.l); very rare. — [SWINSCOW and KROG 1988]

Scytinium gelatinosum (With.) Otálora, P.M. Jørg. and Wedin – K.: Mt Kenya. Europe, North America, India. Temperate (tropical). Muscicolous/saxicolous, terricolous; wet sites, upper afroalpine zone (4110–4380 m a.s.l.); common. — [FRISCH 1999, SCYTINIUM GELATINOSUM 2025]

Scytinium intermedium (Arnold ex Malbr.) Otálora, P.M. Jørg. and Wedin – K.: Mt Kenya. North, Central America, (N-)Europe. Corticolous (*Senecio keniodendron*), humicolous (*Alchemilla argyrophylla*); upper afroalpine zone (4200–4300 m a.s.l); fairly common. — [FRISCH 1999, SCYTINIUM INTERMEDIUM 2025]

Scytinium lichenoides (L.) Otálora, P.M. Jørg. and Wedin – K.: Mt Kenya. North and South America, Europe. Temperate (tropical) regions. Muscicolous/saxicolous; wet, shady sites (overhanging rockwall), upper alpine zone (4210m–4220 m a.s.l.); rare. — [FRISCH 1999, SCYTINIUM LICHENOIDES 2025]

Stereocaulon anomalum I.M. Lamb – K. T, R. Zaire (Congo), Madagascar (Humbert, 1948 – holotype). Saxicolous; open sites, montane forest (1300–2200 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Stereocaulon delisei Bory ex Dub. – K.?South Africa, oceanic Europe, Madeira, tropical America, New Zealand. Terricolous; subalpine zone (0-3000 m a.s.l.); very rare. — [SWINSCOW and KROG 1988]

Stereocaulon humbertii P.A. Duvign. – K. T, U. Zaire (Congo). Saxicolous; montane–alpine zone (3500–4700 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Stereocaulon rugulosum I.M. Lamb – K. U. Saxicolous; exposed sites, montane–subalpine zone (3000–3600 m a.s.l.); common. — [SWINSCOW and KROG 1988]

Sticta afromontana Kaasalainen and Rikkinen – K.: Taita Hills. T. Lignicolous, ramicolous forests lower montane –ericaceous zone (1800–3510 m a.s.l.); rare. — [KAASALAINEN et al., 2023a]

Sticta cyphellulata (Müll. Arg.) Hue – K. T. Australasia. Corticolous; shady sites, montane zone (c. 2000 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Sticta xanthotropa (Kremp.) D.J. Galloway, syn.: *S. weigelii* (Ach.) Vainio var. *xanthotropa* (Krempelh.) Hue – K. U. Central and South America (Sonoran Desert, Brazil). Corticolous, muscicolous, saxicolous, terricolous; scrub, forest (1500–3400 m a.s.l.); common locally. — [KREMPELHUBER 1876, SWINSCOW and KROG 1988, GALLOWAY and THOMAS 2004]

Umbilicaria haumaniana Frey. – K.: Mt Kenya National park. T, Zaire (Congo). Saxicolous; alpine zone (3750 m a.s.l); rare. — [CZECZUGA et al. 1992, UMBILICARIA HAUMANIANA 2025]

Umbilicaria subglabra (Nyl.) Harm. – K. T. South Africa. Europe, Asia, Australia, New Zealand. Saxicolous; alpine zone (4150–4900 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Usnea cristata Motyka – K. T, U. Corticolous, ramicolous, lignicolous; wayside, well-lit sites, open woodland (0–2500 m a.s.l.); fairly common. — [SWINSCOW and KROG 1988]

Usnea elata Motyka – K. U. Zaire (Congo, "Africa centralis", W of Lake Tanganjika: Guillemé, 1898 – holotype), South Africa. Corticolous, ramicolous, lignicolous; sunny–partial shady sites, open woodland (1000–1500 m a.s.l.); very rare. — [MOTYKA 1936, SWINSCOW and KROG 1988, USNEA ELATA 2025]

Usnea goniodes (Stirt. ex Vain.) Swinscow and Krog – K. U. South Africa. Ramicolous; shrubs, mist-affected woodland (1500–2000 m a.s.l); rare. — [SWINSCOW and KROG 1988]

Usnea leprosa Motyka – K. E, T, U. South Africa. Ramicolous, (saxicolous); dry, open, woodland and scrub (1000–2500 m a.s.l.); common locally. — [SWINSCOW and KROG 1988]

Usnea nodulosa Swinscow and Krog – K. U. Ramicolous; hot, dry bushland (1000–1500 m a.s.l.); common locally. — [SWINSCOW and KROG 1988]

Usnea perhispidella J. Steiner – K.: Machakos (Liechtenstein and Pospischill, 1896 – holotype), T, U. Malawi, South Africa. Cental and South America, Asia. Ramicolous; dry, open woodland, scrub (1000–1500 m a.s.l.); common. — [STEINER 1897, SWINSCOW and KROG 1988, TRUONG et al. 2013, USNEA PERHISPIDELLA 2025]

Usnea pulvinata Fr. – K. T. Cameroon, Zimbabwe, Madagascar, South Africa, Australia. Saxicolous; exposed sites (2000–2300 m a.sl.); rare. — [SWINSCOW and KROG 1988]

Usnea ruwenzoriana Motyka – K. U. Zaire (Congo). Corticolous, ramicolous; alpine region (3000–3500 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Usnea sorediosula (Müll. Arg.) Motyka – K. E, T, U. Zaire (Congo). Corticolous, ramicolous; open sites, mist-affected woodland (1000–2000 m a.s.l.), rare. — [SWINSCOW and KROG 1988]

Usnea subcristata C.W. Dodge – K. T,?U. Corticolous, ramicolous; open sites, mist-affected woodland (c. 1500 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Usnea submollis J. Steiner – K. E T, U. Cameroon, South Africa. South America. Ramicolous; forests, montane–ericaceous zone (1500–3500 m a.s.l.); common locally. — [SWINSCOW and KROG 1988, USNEA SUBMOLLIS 2025]

Usnea torulosa (Müll. Arg.) Zahlbr. – K. T, U. New Zealand, Australia. Corticolous; dry, open woodland, scrub (1000–2250 m a.s.l.); rare. — [SWINSCOW and KROG 1988, USNEA TORULOSA 2025]

Usnea welwitschiana Motyka – K. Angola. Saxicolous; exposed, sunlit, hot sites, lava flows (1000–1800 m a.s.l.); common locally. — [SWINSCOW and KROG 1988]

Wolseleyidea swinscowii (Timdal and Krog) S.Y. Kondr., Farkas and Lőkös, syn.: *Phyllopsora swinscowii* Timdal and Krog – K. (coll. Santesson 1970). T (coll. Krog, 1988–1989), Mauritius. Corticolous (?); dry–humid montane rainforest (300–1900 m a.s.l.); very rare. — [TIMDAL and KROG 2001]

Xanthoparmelia amplexula (Stirton) Elix and Johnston – K. E. Australia. Saxicolous; montane zone (1880–1950 m a.s.l); rare. — [SWINSCOW and KROG 1988]

Xanthoparmelia annexa (Kurok.) Elix – K. E, T, U. Western and southern Africa. Saxicolous; exposed, dry sites (900–2300 m a.s.l.); common locally. — [SWINSCOW and KROG 1988, ALSTRUP et al. 2010]

Xanthoparmelia austroafricana (Stirton) Hale – K. U. South Africa. Saxicolous; montane zone (1200–2400 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Xanthoparmelia congensis (Stein) Hale – K. U. Central and South Africa. The Americas, Rep. Formosa (Taiwan), Australia, New Zealand. Tropical, (temperate). Saxicolous; montane zone (1000–2100 m a.s.l.); common locally. — [SWINSCOW and KROG 1988, XANTHOPARMELIA CONGENSIS 2025]

Xanthoparmelia cylindriloba M.D.E. Knox – K.: Mt Kenya, T. Saxicolous, terricolous; vagrant, upper afroalpine zone (1800–4430 m a.s.l.); rare. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998; FRISCH 1999]

Xanthoparmelia diadeta (Hale) Hale – K. T, U. South Africa. Saxicolous; montane zone (1800–2300 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Xanthoparmelia hypoleia (Nyl.) Hale – K. U. South Africa. Australia. Saxicolous; montane zone (2050–2500 m a.s.l.); very rare. — [SWINSCOW and KROG 1988, XANTHOPARMELIA HYPOLEIA 2025]

Xanthoparmelia lusitana (Nyl.) Krog – K. South Africa. Canary Islands, southwestern Europe. Saxicolous, (muscicolous); lava flows, rock outcrops, montane zone (900–2300 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Xanthoparmelia meruensis Krog and Swinscow – K. E, T. Saxicolous (lignicolous – burnt wood); monane–alpine zone (2600–3600 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Xanthoparmelia mexicana (Gyelnik) Hale – K. Southern United States, Mexico, Australia, New Zealand. Saxicolous; montane zone (1950 m a.s.l.); very rare. — [SWINSCOW and KROG 1988]

Xanthoparmelia microspora (Müll. Arg.) Hale – K.: Ngong Hills. South America (Colombia). Corticolous; montane zone (980 m a.s.l.); very rare. — [HALE 1990, ALSTRUP et al. 2010]

Xanthoparmelia salkiboensis Hale – K. T. Saxicolous (lava rocks), muscicolous; dwarf *Philippia* bush, subalpine–alpine zone (3600–4000 m a.s.l.); rare. — [HALE 1990, FARKAS et al. 2023]

Xanthoparmelia subtortula (Hale) Elix – K. U. Zimbabwe, Sout Africa. Saxicolous; dry, well-lit sites (1100–1900 m a.s.l.); rare. — [SWINSCOW and KROG 1988, XANTHOPARMELIA SUBTORTULA 2025]

Xanthoria elegans (Link) Th. Fr.– K.: Mt Kenya. T. Pantropical, arctic regions. Saxicolous; upper alpine–nival zone (3350–4990 m a.s.l.); rare. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

5.2.3. Species under Medium Risk (in Kenya) [MR(K)]

The 180 species and four varieties (33%) listed in the category "*Species under Medium Risk (in Kenya) [MR(K)]*" are mostly rare to fairly common or with old record(s) only, mostly collected before 2000 (prior to the beginning of molecular genetic research period).

It is a category that might contribute to the future identification of species belonging potentially to the IUCN category VU – Vulnerable.

Bryoria bicolor (Hoffm.) Brodo and D. Hawksw. – K.: Mt Kenya; T, U. Tropical to boreal region. Saxicolous, terricolous, muscicolous, humicolous and on *Helichrysum* stems; upper ericaceous to alpine zone (3500–4450 m a.s.l.); rare. — [FRISCH 1999, FRISCH and HERTEL 1998, SWINSCOW and KROG 1988]

Bryoria nadvornikiana (Gyeln.) Brodo and D. Hawksw. – K.: Mt Kenya; T, U. Tropical to boreal region, widespread. Corticolous, lignicolous and saxicolous; upper ericaceous and alpine zone (3350–4200 m a.s.l.); rare. — [FRISCH 1999, FRISCH and HERTEL 1998, SWINSCOW and KROG 1988]

Bulbothrix hypocraea (Vain.) Hale – K, T, U. Southern and western Africa, South America. Corticolous, (saxicolous); open sites (900–1750 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Bulbothrix suffixa (Stirt.) Hale –K. T (coll. Alstrup, 1996–2000). Pantropical. Corticolous; open forest (2100 m a.s.l.); rare. — [SWINSCOW and KROG 1988, ALSTRUP et al. 2010]

Bunodophoron melanocarpum (Sw.) Wedin – K.: Mt Kenya, T, U. Worldwide in tropical and temperate regions. Corticolous / lignicolous; moist montane forest (1700–3500 m a.s.l.); common locally. — [FRISCH 1999, SWINSCOW and KROG 1988]

Canoparmelia pustulescens (Kurok.) Elix – K. U. Western and southern Africa, India. Saxicolous; exposed and dry sites (900–1350 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Canoparmelia somaliensis (Müll. Arg.) Elix and Hale – K. T, U. Somalia, Zambia, Madagascar. Corticolous, ramicolous; dry, well lit sites (900–1900 m a.s.l.); common locally. — [SWINSCOW and KROG 1988]

Cladonia andesita Vain. – K, U. South America. Terricolous, saxicolous/muscicolous; ericaceous–alpine zone (3200–3900 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Cladonia cenotea (Ach.) Schaer. – K. T, U. Northern hemisphere boreal regions. Lignicolous / muscicolous; upper montane forest–ericaceous zone (3100–3500 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Cladonia chlorophaea (Flörke ex Sommerf.) Spreng. – K. E, T, U. Cosmopolitan. Terricolous; subalpine–alpine zone (3500–4000 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Cladonia crispata (Ach.) Flot. – K. T. Cosmopolitan. Terricolous; ericaceous zone (3000–3700 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Cladonia digitata (L.) Hoffm. – K. T, U. Northern hemisphere. Lignicolous; ericaceous zone (3100–3500 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Cladonia diplotypa Nyl. – K. T, U. Cameroon, Rwanda, Zaire (Congo). Terricolous, muscicolous, lignicolous; montane forest–ericaceous zone (1750–2500(–3400) m a.s.l.); common. — [SWINSCOW and KROG 1988]

Cladonia hedbergii Ahti – K.: Mt Kenya. T, U. Central Africa. Terricolous; ericaceous–alpine zone (2600–4000 m a.s.l.); common locally. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Cladonia intermediella Vain. – K.: Mt Kenya. E, T, U. Reunion, Mauritius. Terricolous, lignicolous; ericaceous–low alpine zone (3000–above 4000 m a.s.l.); common locally. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Cladonia macilenta Hoffm. – K.: Mt Kenya. T, U. Cosmopolitan. Lignicolous, terricolous; subalpine–alpine montane forest (900–above 4000 m a.s.l.); fairly common. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Cladonia ochrochlora Flörke – K. T. Cosmopolitan. Terricolus / muscicolous, ericaceous zone (3200–3500 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Cladonia pocillum (Ach.) O.J. Rich. – K. E, T, U. Cosmopolitan. Terricolous; alpine region (3600–4400 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Cladonia ramulosa (With.) J.R. Laundon – K. E, T, U. Cosmopolitan. Terricolous, lignicolous, saxicolous (outcrops); grassland (1200–3200 m a.s.l.); common. — [SWINSCOW and KROG 1988]

Cladonia rei Schaer. – K. E, T, U. Cosmopolitan. Terricolous / muscicolous; roadsides (1550–3360 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Cladonia squamosa Hoffm. – K. T, U. Cosmopolitan. Terricolous, lignicolous; montane–ericaceous–alpine zone (1900–4400 m a.s.l.); fairly common. — [SWINSCOW and KROG 1988]

Cladonia subradiata (Vain.) Sandst. – K. E, T, U. Tropical and warm temperate regions. Terricolous, lignicolous; montane forest (900–3000 m a.s.l.); fairly common. — [SWINSCOW and KROG 1988]

Cladonia subsquamosa Kremp. – K. E, T, U. South America. Terricolous / muscicolous; lignicolous; montane forest (1500–3000 m a.s.l.); fairly common. — [SWINSCOW and KROG 1988]

Coccocarpia adnata Arv. – K. Mauritius, Indonesia, Pacific Islands. Corticolous, ramicolous; dry sites, mangrove (sea level); rare. — [SWINSCOW and KROG 1988]

Coccocarpia dissecta Swinscow and Krog – K, T. Philippines, Pacific Islands. Corticolous, ramicolous; dry sites, mangrove (0–300 m a.s.l.); common locally. — [SWINSCOW and KROG 1988]

Coccocarpia palmicola (Spreng.) Arv. and D.J. Galloway – K. E, T, U. Tropics, subtropics, warm temperate regions. Corticolous/muscicolous; shady, sheltered sites, lowland–montane forests (0–2000 m a.s.l.); common locally. — [SWINSCOW and KROG 1988]

Coccocarpia stellata Tuck. – K. U. Mauritius, tropical and subtropical America. Corticolous/muscicolous, (terricolous); shady, sheltered sites, lowland–montane forest, (1300–3500 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Collema coilocarpum (Müll. Arg.) Zahlbr. – K. Tropical Asia and Pacific islands. Corticolous; hot dry habitats with ground moisture raising air humidity (0–1000 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Collema furfuraceum (Arnold) Du Rietz – K. E, T, U. Boreal, temperate, and tropical regions. Corticolous; sheltered woodland (1000–2200 m a.s.l.); common. — [SWINSCOW and KROG 1988]

Collema furfuraceum (Arnold) Du Rietz var. ***luzonense*** (Räsänen) Degel. – K. E, T. Temperate and tropical regions. Corticolous; sheltered woodland (1000–2200 m a.s.l.); common. — [SWINSCOW and KROG 1988]

Note: Collema furfuraceum (Arnold) Du Rietz var. *luzonense* (Räsänen) Degel. differs from *Collema furfuraceum* (Arnold) Du Rietz in microscopic morphology of the apothecium and its pruinosity. Hopefully, future molecular studies based on further specimens can answer if these differences should be treated at the species level.

Collema leptaleum Tuck. – K. T. Tropical, temperate regions. Corticolous; exposed sites, woodland (1100–2100 m.a.s.l.); rare. — [SWINSCOW and KROG 1988]

Collema leptaleum Tuck. var. ***biliosum*** (Mont.) Degel. – K. E, T, U. Tropical, temperate regions. Corticolous; exposed sites, woodland (1100–2100 m.a.s.l.); rare. — [SWINSCOW and KROG 1988]

Note: Collema leptaleum Tuck. var. *biliosum* (Mont.) Degel. morphologically differs from *Collema leptaleum* Tuck. in the presence and absence of isidia. Hopefully, future molecular studies based on a larger amount of specimens can suggest if these differences should separate this taxon as an independent species.

Collema pulcellum Ach. var. ***subnigrescens*** (Müll. Arg.) Degel. – K.: Ngong Hills. E, T, U. Tropical, temperate regions. Pantropical. Corticolous; shady woodland, fog-induced shrubland, montane–lower alpine forest (0–2000(–?) m a.s.l.); rare. — [SWINSCOW and KROG 1988, ALSTRUP and CHRISTENSEN 2006]

Collema rugosum Kremp. – K.: Nairobi District (County), Ngong Hills. U. Tropical Asia and the Pacific islands. Corticolous; scattered, exposed trees, mangrove–upland forests (0–2100 m a.s.l.); rare. — [SWINSCOW and KROG 1988, CZECZUGA et al. 1992, ALSTRUP and CHRISTENSEN 2006]

Collema subflaccidum Degel. – K.: Mt Kenya. Cosmopolitan. Corticolous, ramicolous, saxicolous; shaded sites, montane-upper alpine zone (2500–4180 m a.s.l.); rare. — [SWINSCOW and KROG 1988, FRISCH 1999]

Dermatocarpon aequinoctiale (Hochst. ex Flot.) Müll. Arg. – K.: Mt Kenya, Mt Elgon, Embu District (County), Kirinyaga Distr, Aberdare Mts, Laikipia Distr., Nakuru District (County). E, T, U. Saudi Arabia. Saxicolous (under water); streams, moderately dry sites, montane–alpine zone

(2000–above 4000 m a.s.l.); rare. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999, DERMATOCARPON AEQUINOCTIALE 2025]

Dibaeis baeomyces (L. f.) Rambold and Hertel – K. T, U. Tropics, (cool) temperate regions. Terricolous; freshly exposed earth, roadsides, montane forests (2000–3000 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Dictyonema thelephora (Spreng.) Zahlbr. – K. T. Panropical. N-America (SE, coast). Corticolous; in shady sites, montane forest (2000 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Dirinaria confluens (Fr.) D.D. Awasthi – K. E, T, U. Pantropical, warm temperate regions. Corticolous; natural, (artificial) habitats at (1000–2000 m a.s.l.); common. — [SWINSCOW and KROG 1988]

Dirinaria leopoldii (Stein) D.D. Awasthi K. T. Western, central, southern Africa, tropical, subtropical America. Ramicoloous; shrubland (800–1000 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Emmanuelia patinifera (Taylor) Lücking, M. Cáceres and Ant. Simon, syn.: *Lobaria patinifera* (Taylor) Hue – K. E, T, U. Pantropical. Corticolous; sheltered sites, forests (1100–2300 m a.s.l.); fairly common. — [SWINSCOW and KROG 1988]

Enchylium polycarpon (Hoffm.) Otálora, P.M. Jørg. and Wedin, syn.: *Collema polycarpon* Hoffm. – K. E. Tropical, temperate regions. Saxicolous; exposed sites (1600–1900 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Erioderma meiocarpum Nyl. – K. E, R. T, U. Zambia, Asia. Corticolous; sheltered, moist sites, upper montane forest (3000–3200 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Eschatogonia prolifera (Mont.) R. Sant. – K. T. West Africa, tropical America. Corticolous / muscicolous; shaded sites, mist-affected forests (300–1000 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Eumitria baileyi Stirt. – K. T, U. Pantropical, warm temperate regions. Corticolous; open, sheltered–exposed sites, woodland (1000–2500 m a.s.l.); fairly common. — [SWINSCOW and KROG 1988]

Heterodermia podocarpa (Bél.) D.D. Awasthi – K. E, T, U. Pantropical. Ramicolous (bamboo) lowland shrubland, montane forest (450–3400 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Hyperphyscia adglutinata (Flörke) H. Mayrhofer and Poelt – K.: Rift Valley (1979). T, U. Tropical, temperate regions. Corticolous, ramicolous, saxicolous; natural, artificial habitats (100–2400 ma.s.l.); common. — [SWINSCOW and KROG 1988, SCUTARI 1997]

Hyperphyscia granulata (Poelt) Moberg – K. T, U. Zambia, Asia. Corticolous, ramicolous; partly shady, open sites (850–2470 m a.s.l.); fairly common. — [SWINSCOW and KROG 1988]

Hyperphyscia pandani (H. Magn.) Moberg – K. E, T, U. Pacific Islands, Mexico (Sonora). Corticolous, ramicolous; low montane–alpine zone (1100–3150 m a.s.l.); fairly common. — [SWINSCOW and KROG 1988, HYPERPHYSCIA PANDANI 2025]

Hyperphyscia pruinosa Moberg – K. U. S Africa, S America, the Philippines Australia. Corticolous, lignicolous; low montane–subalpine zone (1500–2900 m a.s.l.); rare. — [SWINSCOW and KROG 1988, HYPERPHYSCIA PRUINOSA 2025]

Hyperphyscia tuckermanii Lynge ex Moberg – K. Pantropical, pantemperate. Corticolous; open sites, lowland vegetation (c. 500 m a.s.l.); rare. — [MOBERG 1987, SWINSCOW and KROG 1988, HYPERPHYSCIA TUCKERMANII 2025]

Notes: According to INDEX FUNGORUM (2025) the recombined name of the taxon (as *Hyperphyscia tuckermanii* (Lynge) Moberg) is invalid, because the basionym *Phycia tuckermanii* Lynge (*Naturv. Skrifter, I. Math.-naturv. Klasse* (no. 16): 37, tab. IV, fig. 2, 1924) is invalid since in the original description Lynge used "*ad. int.*" and expressed his doubts concerning the morphological characters and discussed if these were due to habitat and other environmental effects, furthermore he decided with hesition on describing the species as a proper species. Moberg (1987) interpreted it differently and considered "*ad. int.*" as a "?", therefore he treated this case as a recombination. According to 36.1 (Shenzen Code) "*A name is not validly published when it is not accepted by its author in the original publication, ...*", but "*These provisions do not apply to names published with a question mark or other indication of taxonomic doubt, yet accepted by their author.*" The second part of Art. 36.1 was treated similarly by Art. 34.2 referred by Moberg (1987), according to the that time used Code of 1983. Thus according to Moberg the species was accepted by Lynge in countrary to his doubts. This nomenclatural matter should be further studied and solved beyond any doubt or uncertainty.

Hypogymnia bitteri (Lynge) Ahti – K.: Mt Kenya. E, U. Tropical, boreal region. Corticolous, muscicolus, lignicolous, saxicolous; well-lit sites, subalpine–alpine zones (3000–4450 m a.s.l.); rare. — [SWINSCOW and KROG 1988, CZECZUGA et al. 1992, FRISCH and HERTEL 1998, FRISCH 1999]

Hypotrachyna afrorevoluta (Krog and Swinscow) Krog and Swinscow – K.: Mt Kenya. E, T, U. Tropical, temperate regions, both hemispheres. Corticolous, ramicolous, muscicolous, saxicolous; mist-affected sites, montane–ericaceous–alpine zone (1900 to 3570 m a.s.l.); fairly common. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Hypotrachyna brevirhiza (Kurok.) Hale – K.: Mt Elgon. Pantropical. Corticolous (giant *Senecio* spp), ramicolous; ericaceous–alpine zone (3000–4050 m a.s.l.); rare. — [SWINSCOW and KROG 1988, PÓCS and SZABÓ 1993]

Hypotrachyna costaricensis (Nyl.) Hale – K. E, T. Pantropical. Corticolous; sheltered woodland, and montane forest (c. 2000 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Hypotrachyna densirhizinata (Kurok.) Hale – K.: Mt Kenya. E, T, U. Central and South America, West Indies. Corticolous, lignicolous, muscicolous, humicolous/saxicolous; open sites, upper montane–ericaceous zone (2600–above 4000 m a.s.l.); common. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Hypotrachyna ducalis (Jatta) Hale – K.: Mt Kenya. E, T, U. Central Africa, Asia. Corticolous, muscicolous, ramicolous, humicolous/saxicolous; exposed sites, montane–ericaceous–alpine zone (2400–above 4000 m a.s.l.); common locally. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Hypotrachyna endochlora (Leighton) Hale – K. E, T, U. Southern Africa, Madagascar, Europe, tropical America, Hawaii. Corticolous, terricolous; montane forest (1900–3000 m a.s.l.); common locally. — [SWINSCOW and KROG 1988]

Hypotrachyna formosana (Zahlbr.) Hale – K. E, T, U. Central and South America, Asia, West Indies, NewZealand. Corticolous, (saxicolous); parks, gardens, submontane forest (1500–2600 m a.s.l.); common. — [SWINSCOW and KROG 1988]

Hypotrachyna gondylophora (Hale) Hale – K. T. Subtropical, tropical America. Corticolous; montane–subalpine zone (2900–3000 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Hypotrachyna laevigata (Sm.) Hale – K. E, T, U. The Americas, Europe, New Zealand. Muscicolous, corticolous, ramicolous; well-lit sites, submontane–ericaceous–subalpine zone (1600–3400 m a.s.l.); common locally. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Hypotrachyna meyeri (Zahlbr.) Streimann – K.: Mt Kenya. U. South America. Corticolous, lignicolous, muscicolous, ramicolous, humicolous; open sites, upper montane–ericaceous–upper alpine zone (2800–above 4000 m a.s.l.); common locally. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Hypotrachyna minarum (Vainio) Krog and Swinscow – K. E, T, U. Pantropical, temperate regions. Corticolous, saxicolous; well-lit sites (1600–2700 m a.s.l.); common. — [SWINSCOW and KROG 1988]

Hypotrachyna orientalis (Hale) Hale – K.: Mt Kenya. E, T, U. Asia. Corticolous, ramicolous, lignicolous, muscicolous, saxicolous; ericaceous, montane–alpine forests (2000–4100 m a.s.l.); common. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Hypotrachyna producta Hale – K.: Mt Kenya. U. North and South America. Corticolous, ramicolous, lignicolous, muscicolous; well-lit sites, montane forest,ericaceous–lower afroalpine zone (2100–above 4000 m a.s.l.); common locally. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Hypotrachyna revoluta (Flörke) Hale – K. E, T. Pantropical, temperate regions. Corticolous; well-lit habitats, edge of forests, parks, roadsides (1900–3200 m a.s.l.); common. — [SWINSCOW and KROG 1988]

Hypotrachyna rockii (Zahlbr.) Hale – K.: Mt Kenya. T, U. Subtropical, warm temperate regions. Corticolous, ramicolous, lignicolous, muscicolous; montane–ericaceous– lower alpine zone (1900–above 4000 m a.s.l.); common locally. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Hypotrachyna sinuosa (Sm.) Hale – K.: Mt Kenya. E, T, U. Pantropical, temperate. Corticolous, ramicolous, lignicolous, muscicolous, saxicolous; upper montane–ericaceous–alpine zones (2600–4210 m a.s.l.); fairly common. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Hypotrachyna subfatiscens (Kurok.) Krog and Swinscow – K. T, U. Southern Africa. Pantropical, temperate. Corticolous, saxicolous, terricolous; lower montane forest (2000–2600 m a.s.l.); fairly common. — [SWINSCOW and KROG 1988, HYPOTRACHYNA SUBFATISCENS 2025]

Hypotrachyna swinscowi (Hale) Krog and Swinscow – K.: Mt Kenya. U. South America. Muscicolus, saxicolous; wet sites, alpine zones (3350–4460 m a.s.l.); common. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Klauskalbia obscurata (Nyl.) S.Y. Kondr., Lőkös, E. Farkas and Hur, syn.: *Heterodermia obscurata* (Nyl.) Trevis – K. E, T, U. Pantropical, temperate reqions. Saxicolous, muscicolous; partial shady site, lower montane–alpine zone (1100–3000 m a.s.l.); common. — [SWINSCOW and KROG 1988]

Lasallia papulosa (Ach.) Llano – K.: Mt Kenya. U. South Africa, North America, Mexico, Bermuda, Asia. Lignicolous, (saxicolous); upper montanet–lower alpine zone (3000–4000 m a.s.l.); common locally. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Lasallia pustulata (L.) Mérat – K.: Mt Kenya. T. South Africa. North and Central America, Europe, Asia. Saxicolous; exposed sites, alpine zone (3000–4200 m a.s.l.); rare. — [SWINSCOW and KROG 1988, CZECZUGA et al. 1992, FRISCH and HERTEL 1998, FRISCH 1999]

Lepidocollema marianum (Fr.) P.M. Jørg., syn.: *Pannaria mariana* (Fr.) Müll. Arg. – K. T. Pantropical. Corticolous; drier parts of mangroves; mist-affected forest (c. 1000 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Leprocaulon coriense (Hue) Lendemer and B.P. Hodk. – K.: Mt Kenya, Eastern Province. Paleotropical. Saxicolous, corticolous; montane forest (2465–2660 m a.s.l.); rare. — [KIRIKA et al. 2012a, KIRIKA et al. 2018]

Leptogium adpressum Nyl. – K.: Mt Kenya. E, T, U. North America, India. Muscicolous, corticolous, lignicolous, ramicolous; parks, gardens, woodlands, forests,–montane–alpine zones (1000–above 4000 m a.s.l.); rare. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Leptogium hibernicum M.E. Mitch. ex P.M. Jørg. – K. E, T, U. Europe, South America. Corticolous; mist-affected woodland; montane–subalpine forest (1800–3300 m a.s.l); fairly common. — [SWINSCOW and KROG 1988]

Leptogium laceroides B. de Lesd. – K.: Mt Kenya. E, T. The Americas, Tristan da Cunha, New Zealand. Corticolous, ramicolous (Erica shrubs), muscicolous; shady sites, forests, montane–alpine zone (3000–above 4000 m a.s.l.); rare. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Leptogium resupinans Nyl. – K.: Mt Kenya. E, U. Canary Islands, South America. Corticolous, muscicolous; shady sites (*Erica* shrubs), forests, subalpine–alpine zone (3000–above 4000 m a.s.l.); rare. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Leptogium tiinae Kaasal. and Rikkinen – K.: Taita Hills. T. Corticolous; open habitats, submontane zone (1350–1500 m a.s.l.); rare. — [KAASALAINEN et al. 2023b]

Leucodermia vulgaris (Vain.) Kalb, syn.: *Heterodermia vulgaris* (Vainio) Follmann and Redón – K. E, T, U. South Africa, tropical America. Corticolous (saxicolous); artificial, natural habitats, shady–humid sites, montane zone (1100–2200 m a.s.l.); fairly common. — [SWINSCOW and KROG 1988]

Melanelixia subaurifera (Nyl.) O. Blanco, A. Crespo, Divakar, Essl., D. Hawksw. and Lumbsch – K.: Mt Kenya. Temperate, boreal regions (northern hemisphere). Saxicolous; alpine–subnival zone (3350– 4430 m a.s.l.); very rare. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Melanohalea elegantula (Zahlbr.) O. Blanco, A. Crespo, Divakar, Essl., D. Hawksw. and Lumbsch, syn.: *Melanelia elegantul***a*** (Zahlbr.) Essl. – K.: Mt Kenya. Saxicolous, muscicolous;

alpine–subnival zone (3350–4450 m a.s.l.); fairly common. — [FRISCH and HERTEL 1998, FRISCH 1999]

Montanelia disjuncta (Erichsen) Divakar, A. Crespo, Wedin and Essl. – K.: Mt Kenya. Saxicolous; alpine–subnival zone (3350–4430 m a.s.l.); common locally. — [FRISCH and HERTEL 1998, FRISCH 1999]

Niorma chrysophthalma (L.) S.Y. Kondr., Kärnefelt, Elix, A. Thell, M.H. Jeong and Hur – K.: Ngong Hills. T, U. Pantropical, warmer temperate zone. Corticolous, ramicolous; exposed sites (1200–3100 m a.s.l.); common. — [SWINSCOW and KROG 1988, CZECZUGA et al. 1992]

Opeltiella fruticans (Poelt and Oberw.) S.Y. Kondr. – K.: Ngong Hills. Tropical Americas. Ramicolous; mist-affected hills (1300–2300 m a.s.l.); rare. — [SWINSCOW and KROG 1988, ALSTRUP et al. 2010]

Oxneria fallax (Hepp) S.Y. Kondr. and Kärnefelt – K.: Mt Kenya. E, T. U. Temperate (pantropical). Corticolous, lignicolous (*Senecio keniodendron*), saxicolous (calcareous lava); eutrophicated sites, montane–alpine zones (1000–4380 m a.s.l.); common. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Pannaria globulifera Hue (as ***P. fulvescens*** (Mont.) Nyl.) – K. E, T, U. South Africa (Cape region). Corticolous; montane forest (1550–3000 m a.s.l.); common. — [SWINSCOW and KROG 1988]

Note: *Pannaria fulvescens* (Mont.) Nyl. s.str. is a species confined to the South Pacific, the specimens so named in East Africa belong in *P. globuligera* Hue (JØRGENSEN 2003, JØRGENSEN and KASHIWADANI 2001).

Pannaria pannosa (Sw.) Nyl., syn.: *Parmeliella pannosa* (Sw.) Müll. Arg. – K. T, U. Pantropical, subtropical. Corticolous; forests, montane–subalpine zone (1100–3400 m a.s.l.); fairly common. — [SWINSCOW and KROG 1988]

Pannaria rubiginosa (Ach.) Delise – K.: Mt Kenya. E, T, U. Cool temperate region, cool tropics. Corticolous, ramicolous (*Erica*), (muscicolous); shady sites, forests, montane–alpine zones (1900–above 4000 m a.s.l); common. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Parmelia saxatilis (L.) Ach. – K.: Mt Kenya. Cosmopolitan. Saxicolous, muscicolous, lignicolous; ericaceous– afroalpine zone (3000–4430 m a.s.l); rare. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Parmelia sulcata Taylor – K.: Mt Kenya. E. Cosmopolitan. Saxicolous, muscicolous; alpine zone (3350–4430 m a.s.l.); rare. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Parmeliella nigrocincta (Mont.) Müll. Arg. – K. T. Pantropical, subtropics. Corticolous; montane forest (c. 2000 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Parmotrema epileucum (Hale) Kirika, Divakar and Lumbsch – K.: Eastern Province. T. Mozambique. Corticolous; dry, well lit sites, coastal hills, lowlands (300–1000 m a.s.l.); very rare. — [SWINSCOW and KROG 1988, KIRIKA et al. 2016c]

Parmotrema leonis (Krog and Swinscow) Krog and Swinscow – K.: Eastern Prvince, Machakos (Krog and Swinscow, 1974 – holotype), Mutito, Kitui, Ngomeini. T. Corticolous, saxicolous; well-lit sites (500–1400 m a.s.l.); common locally. — [KROG and SWINSCOW 1981, SWINSCOW and KROG 1988, ALSTRUP et al. 2010]

Parmotrema lobulascens (J. Steiner) Hale – K.: Mt Kenya. E, T, U. South and West Africa, Asia. Corticolous, lignicolous, muscicolous, ramicolous, saxicolous; wet sites, montane–alpine zone (1800–4180 m a.s.l.); common. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Parmotrema subschimperi (Hale) Hale – K.: Mt Kenya (Santesson – holotype, paratypes). E, T, U. Corticolous, saxicolous, muscicolous; ±shady site, montane forest, low alpine zone (1800–above 4000 m a.s.l.); common. — [HALE 1972, SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Parmotrema tsavoense (Krog and Swinscow) Krog and Swinscow – K.: Machakos (Swinscow, 1972 – holotype, isotype); Eastern Province – Makueni, Kiboko (Kirika, 2014 – specimen (F)). Saxicolous (volcanic rock); exposed site, montane zone (c. 1000 m a.s.l.); very rare. — [KROG and SWINSCOW 1981, SWINSCOW and KROG 1988, PARMOTREMA TSAVOENSE 2025]

Parmotrema zimbabwense (Hale) Kirika, Divakar and Lumbsch – K.: Coast and Eastern Province. South Africa. Saxicolous; exposed dry sites (900–1800 m a.s.l.); rare. — [SWINSCOW and KROG 1988, KIRIKA et al. 2016c]

Peltigera didactyla (With.) J.R. Laundon – K.: Mt Kenya. E, T, U. Cosmopolitan. Terricolous, muscicolous, humicolous, saxicolous; montane–alpine zone (1800–4450 m a.s.l.); common locally. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Peltigera rufescens (Weiss) Humb. – K.: Mt Kenya. E, U. Northern hemisphere. Terricolous, muscicolous, saxicolous; shady sites, alpine zones (3350–4200 m a.s.l.); common. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Peltigera rufescentiformis (Gyeln.) C.W. Dodge – K.: Mt Kenya, Mt Elgon. E, T, U. Muscicolous, saxicolous, corticolous (*Senecio keniodendron*), subalpine–alpine zone (3000–4260 m a.s.l.); common. — [SWINSCOW and KROG 1988, PÓCS and SZABÓ 1993, FRISCH and HERTEL 1998, FRISCH 1999]

Peltula umbilicata (Vain.) Swinscow and Krog. – K.: Kyalungwa. U. Ivory Coast, South Africa. Saxicolous; exposed sites, lowland–submontane zone (c. 1000 m a.s.l.); very rare. — [SWINSCOW and KROG 1988, ALSTRUP and CHRISTENSEN 2006]

Phaeophyscia adiastola (Essl.) Essl. – K.: Abardare National Park, Mt Kenya. E, T, U. North America. Corticolous (*Hagenia abyssinica*), (saxicolous); well-lit sites, montane–alpine zone (900–4110 m a.s.l.); common locally. — [SWINSCOW and KROG 1988, CZECZUGA et al. 1992, FRISCH and HERTEL 1998, FRISCH 1999]

Phaeophyscia endococcinodes (Poelt) Essl. – K.: Mt Kenya. E, T, U. North America, Asia, New Zealand. Saxicolous, muscicolous, humicolous; exposed–shady, wet sites, riversides, montane–alpine zones (1500–4450 m a.s.l.); common locally. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Phyllopsora chlorophaea (Müll. Arg.) Zahlbr. – K.: Mt Kenya (Swinscow, 1977). T. Mauritius, La Réunion. Central and South America, West Indies, Hawaii. Corticolous; shady sites, montane forests ((140–)1200–2300 m a.s.l.); rare. — [SWINSCOW and KROG 1988, BRAKO 1991, TIMDAL and KROG 2001]

Phyllopsora kiiensis (Vain.) Gotth. Schneid. – K. (coll. Santesson, 1970; Krog, 1972, Kirika and Lumbsch, 2013). T. South Africa. Thailand, Australia, New Caledonia. Corticolous; dry–sites, lowland –montane zone (280–1800 m a.s.l.); rare. — [TIMDAL and KROG 2001, PHYLLOPSORA KIIENSIS 2025]

Physcia adscendens H. Olivier – K.: Mt Kenya. E, T. Cosmopolitan. Corticolous, saxicolous; sheltered sites, upper afroalpine zone (2000–4380 m a.s.l.); rare. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Physcia aipolia (Ehrh. ex Humb.) Fürnr. – K.: Central Province, Thika. E, T, U. Cosmopolitan. Corticolous (saxicolous); natural and planted vegetation, parks, montane zone (1100–2000 m a.s.l.); common. — [SWINSCOW and KROG 1988, WILKINS et al. 1989]

Physcia alboplumbea (Taylor) Nyl. – K.: Mt Kenya. E, T. Cosmopolitan. Saxicolous; wet sites (periodically flooded), montane–alpine zone (1700–4450 m a.s.l.); common. — [SWINSCOW and KROG 1988, CZECZUGA et al. 1992, FRISCH and HERTEL 1998, FRISCH 1999]

Physcia caesia (Hoffm.) Fürnr. – K.: Mt Kenya. E, T. Cosmopolitan. Saxicolous, humicolous; eutrophicated sites, alpine zone (3500–4430 m a.s.l.); rare. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Physcia dubia (Hoffm.) Lettau – K.: Mt Kenya. E. Northern hemisphere. Saxicolous, humicolous; eutrophicated sites, upper alpine zone (3350–4330 m a.s.l.); rare. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Physconia muscigena (Ach.) Poelt – K.: Mt Kenya. E, T. Northern hemisphere. Muscicolous, humicolous, terricolous; alpine–upper alpine zones (3000–5000 m a.s.l.); rare. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Physconia perisidiosa (Erichsen) Moberg – K.: Mt Kenya. E. Europe. Muscicolous, saxicolous (calcareous lava); upper afroalpine zone (3250–4380 m a.s.l.); rare. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Platismatia glauca (L.) W.L. Culb. and C.F. Culb. – K.: Mt Kenya. T, U. Pantropical, subarctic regions. Corticolous, saxicolous; moorlands, woodlands, ericaceous–alpine zone (3200–4200 m a.s.l); common locally. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Polyblastidium casarettianum (A. Massal.) Kalb – K.: Mt Kenya, Chogoria, Sirimon. Neotropics. Temperate, (tropical Corticolous; montane–subalpine forests (2460–3050 m a.s.l.); common locally. — [KIRIKA et al. 2012a; KIRIKA et al. 2018, POLYBLASTIDIUM CASARETTIANUM 2025]

Polyblastidium hypoleucum (Ach.) Kalb, syn.: *Heterodermia hypoleuca* (Ach.) Trevis. – K. E, T, U. Asia, North America. Corticolous, ramicolous; natural, artificial habitats (1000–-2400 m a.s.l.); common. — [SWINSCOW and KROG 1988]

Pseudevernia furfuracea (L.) Zopf – K.: Mt Kenya. E. North Africa, Canary Islands, Europe. Saxicolous, corticolous; exposed site, upper alpine zone (3500–4430 m a.s.l.); rare. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Punctelia neutralis (Hale) Krog – K. E, T, U. Southern Africa. Corticolous; well-lit sites (1500–3400 m a.s.l.); common locally. — [SWINSCOW and KROG 1988]

Punctelia reddenda (Stirton) Krog – K. E. Pantropical, temperate regions – Europe, Africa, the Americas. Corticolous, (saxicolous); artificial habitats, montane forest (2000–3100 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Punctelia subpraesignis (Nyl.) Krog – K.: Ngong Hills, T, U. The Americas. Corticolous; submontane zone (1650–2500 m a.s.l.); rare. — [SWINSCOW and KROG 1988, ALSTRUP et al. 2010]

Pyxine cocoes **(Sw.)** Nyl. – K.: Tsavo N. Park East. E, T, U. Pantropical, subtropical, warm temperate regions. Saxicolous, corticolous, lignicolous; sunny, partial shady sites (0–2500 m a.s.l.); common. — [SWINSCOW and KROG 1988, CZECZUGA et al. 1992]

Pyxine consocians Vain., syn.: *P. physciaeformis* (Malme) Imsh. – K. T. Zambia, Brazil, Philippines, Australia. Corticolous/ramicolous; partial shady–exposed site, mangrove, coastal forest (0–2400 m a.s.l.); common locally. — [SWINSCOW and KROG 1988]

Pyxine coralligera Malme – K. E, T, U. Tropical America. Corticolous, saxicolous; (1300–2800 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Pyxine katendei Swinscow and Krog – K.: Mutito. E, U. (East Africa only). Corticolous; shrubs, artificial, natural habitats, sunny places, wayside trees (1000–2100 m a.s.l.); fairly common. — [SWINSCOW and KROG 1988, ALSTRUP et al. 2010]

Pyxine petricola Nyl. var. ***pallida*** Swinscow and Krog – K. T, U. African tropics (American tropics). Saxicolous, corticolous; exposed, partly shaded places, artificial, natural habitats (c. 2000 m a.s.l.); common. — [SWINSCOW and KROG 1988]

Note: Pyxine petricola Nyl. var. *pallida* Swinscow and Krog is suggested to be treated as a synonym of *Pyxine petricola* Nyl. by Kalb (1987). He devotes less importance to the mentioned difference in apothecium section morphology (stipe colour). We handled this variety separately since Krog and Swinscow (1988) evaluated this taxon independently characterising with a bit less restricted distribution. Hopefully, future molecular studies based on a larger amount of specimens can solve this problem.

Pyxine reticulata (Vain.) Vain. – K.: Rift Valley Province. E, T, U. Africa – south of the Sahara. Corticolous, saxicolous; open woodland, wayside trees (?1900–2500 m a.s.l.); common. — [SWINSCOW and KROG 1988, CZECZUGA et al. 1992]

Pyxine sorediata (Ach.) Mont. – K. E, T. Pantropical, warm temperate regions. Corticolous, saxicolous; near streams (in East Africa) (1600–2200 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Ramalina aspera Räsänen (Ach.) Mont. – K.: Mutito, Kitui. Africa, South America. Ramicolous; thornbush grassland (1000–1800 m a.s.l.); rare. — [SWINSCOW and KROG 1988, ALSTRUP et al. 2010]

Ramalina asperula Kremp. – K.: Kitui, T. South America. Corticolous (planted conifers); grassland (1000–2200 m a.s.l.); rare. — [SWINSCOW and KROG 1988, ALSTRUP et al. 2010]

Ramalina calcarata Krog and Swinscow – K. E, T, U. South America. Corticolous, ramicolous, lignicolous; fence posts, open woodland (1200–3400 m a.s.l.); common. — [SWINSCOW and KROG 1988, RAMALINA CALCARATA 2025]

Ramalina dendriscoides Nyl. – K. T. Pantropical, subtropics. Corticolous; dry shrub vegetation (900–1000 m a.s.l); rare. — [SWINSCOW and KROG 1988]

Ramalina disparata Krog and Swinscow – K. E, T, U. Corticolous, saxicolous, terricolous; open forest, woodland (1100–3100 m a.s.l.); fairly common. — [SWINSCOW and KROG 1988]

Ramalina exiguella Stirt. – K. Tropics, subtropics. Corticolous; dry shrubs, low coastal hills (300-400 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Ramalina fimbriata Krog and Swinscow – K.: Mt Kenya. E, U. Australia. Corticolous, ramicolous (*Erica arborea*, *Senecio keniodendron*), humicolous (*Alchemilla argyrophylla*); alpine zone (3350–4200 m a.s.l.); rare. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Ramalina hoehneliana Müll. Arg**.** – K. E, T, U (herbarium record – WIS, S.C., Bennett, 2016!). Africa. Corticolous; open sites, woodland, grassland (1800–2400 m a.s.l.); fairly common. — [SWINSCOW and KROG 1988, RAMALINA HOEHNELIANA 2025]

Ramalina inflata (Hook. f. and Taylor) Hook. f. and Taylor, syn.: *R. subpusilla* (Nyl.) Krog and Swinscow – K. E. Pantropical, subtropical regions. Ramicolous; open–shady sites, woodlands, montane forests (1700–2800 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Ramalina nervulosa (Müll. Arg.) Abbayes – K. T. Western and southern Africa. Asia, Australia. Corticolous; shrubs in mangroves; coastal hills (c. 400 m a.s.l.); common locally. — [SWINSCOW and KROG 1988]

Ramalina peruviana Ach. – K. T, U. Pantropical, warm temperate regions. Corticolous; dry vegetation, shrubland (1000–1800 m a.s.l.); fairly common. — [SWINSCOW and KROG 1988]

Ramalina pollinaria (Westr.) Ach. – K.: Mt Kenya. Temperate, boreal regions of the northern hemisphere. Corticolous; forests, montane–subalpine–alpine zone, (2900– above 4000 m a.s.l.); rare. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Ramalina polymorpha (Lilj.) Ach. – K.: Mt Kenya. T, E, U. Temperate, boreal, subarctic regions. Saxicolous; exposed, eutropicated sites, alpine zone (3350–above 4000 m a.s.l.); common. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Ramalina translucida Krog and Swinscow – K.: Mt Kenya, E, U. Saxicolous, ramicolous (*Erica arborea*); alpine zone (3400–4060 m a.s.l.); common locally. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Relicina limbata (Laurer) Hale, syn. *Pseudoparmelia sphaerospora* (Nyl.) Hale – K. T. Central Africa, Madagascar, the Americas. Corticolous; lower montane forest (1500–2200 m a.s.l.); common locally. — [SWINSCOW and KROG 1988]

Rhizoplaca melanophthalma (DC.) Leuckert and Poelt – K.: Mt Kenya. E. Europe, North and South America, Asia. Saxicolous; exposed sites, upper alpine–nival zone (3350–4990 m a.s.l); rare. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Roccella babingtonii Mont., syn.: *R. endocrocea* M. Choisy – K. (herbarium records – F, Kirika et al., 2012–2014!). T. Corticolous (saxicolous); coastal region, inland forest (0–1500 m a.s.l.); common locally. — [SWINSCOW and KROG 1988, ROCCELLA BABINGTONII 2025]

Note: It was suggested that the *R. endocrocea* M. Choisy specimens should be treated under *R. babingtonii* Mont. (TEHLER et al. 2010).

Roccella montagnei Bél. – K. E, T. India. Corticolous (saxicolous); mist-affected inland habitats, coastal region (0–1000 m a.s.l); common locally. — [SWINSCOW and KROG 1988]

Rostania callibotrys (Tuck.) Otálora, P.M. Jørg. and Wedin, syn: *Collema callibotrys* Tuck. – K. T, U. Pantropical, warm temperate regions. Corticolous, ramicolous; shaded–exposed sites, shrubland, woodland (1200–2100 m a.s.l.); common. — [SWINSCOW and KROG 1988]

Stereocaulon atlanticum (I.M. Lamb) I.M. Lamb – K. T, U, R. Zaire (Congo), South Africa, Azores. Tropical America. Saxicolous; exposed sites, montane–subalpine zone (2500–3500 m a.s.l.); common locally. — [SWINSCOW and KROG 1988]

Stereocaulon claviceps Th. Fr. – K. U, R. South Africa, tropical America, Asia. Saxicolous; exposed sites, montane–alpine zone (3000–4100 m a.s.l.); rare. — [SWINSCOW and KROG 1988, STEREOCAULON CLAVICEPS 2025]

Stereocaulon corticatulum Nyl. – K.: Mt Kenya. T, U, R. Congo, South Africa, tropical America, Azores, New Zealand. Saxicolous (lava rocks); exposed, boggy sites, montane–alpine zone (3350–4060 m a.s.l.); rare. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999, STEREOCAULON CORTICATULUM 2025]

Stereocaulon meyeri Stein – K.: Mt Kenya. T, U. Central and South Africa, Madagascar, South America. Saxicolous; shady–exposed, wet sites, montane–lower alpine zones, (2600–4200 m a.s.l.); common. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Stereocaulon nigromaculatum P.A. Duvign. – K. T, U. Central Africa. Saxicolous, terricolous; partial shady sites, montane–subalpine zone (2300–4000 m a.s.l.); fairly common. — [SWINSCOW and KROG 1988]

Stereocaulon pomiferum P.A. Duvign. – K.: Mt Kenya. U. Central Africa, Asia, tropical America. Saxicolous; exposed site, Montane–lower alpine zone (2500–4500 m a.s.l.); fairly common. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Stereocaulon ramulosum Raeusch. – K. T, U. Pantropical, temperate zone. Saxicolous; exposed sites, montane–subalpine zone (3000–4000 m a.s.l.); common. — [SWINSCOW and KROG 1988]

Stereocaulon vesuvianum Pers. – K.: Mt Kenya. T, U. Pantropical, arctic and antarctic regions. Saxicolous, muscicolous; exposed sites, montane–alpine zone (2600–4450 m a.s.l.); common. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Sticta kunthii Hook. – K.: Eastern Province, Chogoria route. Neotropics. Corticolous; forest, montane zone (2687 m a.s.l.); common locally. — [KIRIKA et al. 2012a]

Sticta variabilis Ach. – K.: Mt Elgon 1992, T. Pantropical. Corticolous, ramicolous; submontane–paramo (1550–3900 m a.s.l.); rare. — [FARKAS 2003, STICTA VARIABILIS 2025]

Umbilicaria africana (Jatta) Krog and Swinscow – K.: Mt Kenya. E, T, U. Zaire (Congo). Saxicolous; exposed sites, ericaceous–nival zones (3000–above 5000 m a.s.l.); common. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Umbilicaria cinereorufescens (Schaer.) Frey. – K.:Mt Kenya. E, T, U. Europe, Greenland, North America. Saxicolous; exposed sites, alpine–upper alpine zone (3350–4600 m a.s.l.); fairly common. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Umbilicaria decussata (Vill.) Zahlbr. – K.: Mt Kenya. E, T, U. Europe, the Americas, Asia, Australia, New Zealand, the Antarctic region. Saxicolous; alpine–nival zones (3350–5000 m a.s.l.); fairly common. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Umbilicaria umbilicarioides (Stein) Krog and Swinscow – K.: Mt Kenya. E, T, U. South Africa, Zaire (Congo), Patagonia, the Antarctic region. Saxicolous; slightly eutrophicated site, ericaceous–alpine zones (3350–4600 m a.s.l.); common. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Umbilicaria vellea (L.) Michx. – K.: Mt Kenya, U. The Americas, Europe, Africa, Asia. Temperate, (tropical). Saxicolous; alpine zone (3350– 4450 m a.s.l.); rare. — [FRISCH and HERTEL 1998, FRISCH 1999, UMBILICARIA VELLEA 2025]

Usnea albomaculata Motyka – K.: Mt Kenya. E, T; U. Tropical Africa. Corticolous, ramicolous (*Erica arborea*); well-lit, open sites, montane forest, lower alpine–ericaceous zone (2500–above 4000 m a.s.l.); common. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Usnea articulata (L.) Hoffm. – K. E, T, U. Pantropical, cool temperate regions. Corticolous, lignicolous, ramicolous (*Erica arborea*), saxicolous; open, well-lit sites, alpine moorland , lower alpine–nival zones, (1000–4600 m a.s.l.); common. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Usnea bicolorata Motyka – K.: Mt Kenya. E, T. Zaire (Congo). Corticolous, ramicolous (*Erica arborea*); open sites, alpine zone (1900–above 4000 m a.s.l.); common locally. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Usnea bornmuelleri J. Steiner – K.: Mt Kenya. E, T, U. Central and western Africa. Saxicolous; eutrophicated sites, montane–alpine zone (2400–4200 m a.s.l.); common. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Usnea chloreoides (Vain.) Motyka – K. T, U. Corticolous; ramicolous; hot, dry, sheltered localities (0–1500 m a.s.l.); rare. — [SWINSCOW and KROG 1988]

Usnea complanata (Müll. Arg.) Motyka – K.: Kitui. E, T, U.? Africa. Corticolous, ramicolous; artificial sites, open habitats, (1000–1800 m a.s.l.); common. — [SWINSCOW and KROG 1988, ALSTRUP et al. 2010]

Usnea gigas Motyka – K. T, U. Zaire (Congo), Madagascar. Corticolous/lignicolous, ramicolous; wayside localities, open woodland (1000–2000 m a.s.l.); common locally. — [SWINSCOW and KROG 1988]

Usnea haumanii Motyka – K.: Mt Kenya, T, U. Lignicolous, (corticolous), saxicolous, ramicolous (*Erica arborea*), exposed sites, alpine zone (3000–4200 m a.s.l.); rare. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Usnea maculata Stirt. – K.: Mt Kenya. E, T, U. Sudan, Zaire (Congo), Madagascar, South Africa. Australia. Saxicolous; eutrophicated sites, alpine zone (3350–4210 m a.s.l.); common. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Usnea picta (J. Steiner) Motyka – K.: Mt Kenya, Chogoria, Sirimon. T. Corticolous, ramicolous; exposed sites, hillsides, open valleys, montane forests (1500–3100 m a.s.l.); common locally. — [SWINSCOW and KROG 1988, KIRIKA et al. 2018]

Usnea sanguinea Swinscow and Krog – K.: Nyeri County, T. Corticolous, ramicolous; tropical rainforest, montane zone (2454 m a.s.l.); common locally. — [SWINSCOW and KROG 1988, FARKAS et al. 2023]

Usnea subeciliata (Motyka) Swinscow and Krog – K.: Mt Kenya. E. Ramicolous, (Erica arborea), lignicolous (*Senecio keniodendron*); alpine zone (3000–4110 m a.s.l.); rare. — [SWINSCOW and KROG 1988, FRISCH 1999, FARKAS et al. 2023]

Note: The specimen VBI 6214 originally identified as *U. abyssinica* Motyka is revised as *U. subeciliata* (rev. E. Farkas, 2025)

Usnea subflorida (Zahlbr.) Motyka – K.: Mt. Kenya. T, E, U. Zaire (Congo). Corticolous, ramicolous (Erica arborea); well-lit sites, montane–alpine zone (1600–4100 m a.s.l.); common. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999, USNEA SUBFLORIDA 2025]

Wolseleyidea ochroxantha (Nyl.) S.Y. Kondr., Farkas and Lőkös, syn.: *Phyllopsora corallina* (Eschweiler) Müller Argoviensis var. *ochroxantha* (Nylander) Brako, *Ph. martinii* Swinscow and Krog – K.: Coastal Province (coll. Krog and Swinscow 1972). T. Pantropical. Corticolous; shady sites, fog-induced coastal woodland, lowland to montane region ((0–)350(–2000) m a.s.l.); very rare. — [SWINSCOW and KROG 1988, BRAKO 1991, TIMDAL and KROG 2001]

Xanthoparmelia africana Hale – K.: Mt Kenya, T, U. South Africa. Saxicolous, muscicolous; exposed, eutrophicated sites, alpine zone (3560–4460 m a.s.l.); common. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Xanthoparmelia atroventralis (Hale) Hale – K.: Mt Kenya, T. South Africa. Saxicolous/ muscicolous; alpine zone (3500–4400 m a.s.l.); common locally. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Xanthoparmelia phaeophana (Stirton) Hale – K. E, U. Southern Africa. Saxicolous; montane–alpine zone (900–3500 m a.s.l.); common. — [SWINSCOW and KROG 1988]

Xanthoparmelia subramigera (Gyelnik) Hale – K. E, T, U. Southern Africa, Canary Islands, the Americas, Asia, New Zealand. Saxicolous (400–3000 m a.s.l.); common. — [SWINSCOW and KROG 1988, XANTHOPARMELIA SUBRAMIGERA 2025]

Xanthoparmelia tinctina (Maheu and A. Gillet) Hale – K.: Mt Kenya. E, T, U. Southern and northern Africa, Macaronesia. The Americas, Europe, Australia, New Zealand. Saxicolous, muscicolous (lignicolous); exposed sistes, upper afroalpine zone (2000–4200 m a.s.l.); fairly common. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Xanthoparmelia verruculifera (Nyl.) O. Blanco, A. Crespo, Elix, D. Hawksw. and Lumbsch – K.: Ngong Hills. T, U. North America, Europe, northern hemisphere. Saxicolous; montane zone (2000–2300 m a.s.l.); rare. — [ALSTRUP et al. 2010]

Xanthoparmelia weberi (Hale) Hale – K. T, U. Southern Africa, southern United States, Mexico, Australia, New Zealand. Saxicolous; montane zone (900–2200 m a.s.l.); fairly common. — [SWINSCOW and KROG 1988]

Xanthoria parietina (L.) Th. Fr. – K. T, U. Pantropical, temperate regions. Corticolous, ramicolous, (saxicolous); exposed sites, artificial, natural habitats (1500–2200 m a.s.l.); common. — [SWINSCOW and KROG 1988]

5.2.4. Species under Low Risk (in Kenya) [LR(K)]

The 77 species (14%) listed in the category "*Species under Low Risk (in Kenya) [LR(K)]*" are with relatively narrow distribution (usually not in all East African countries), scattered outside Africa / tropical zone, their habitats or documented localities are endangered potentially, thus threatened by the decrease of their populations in the near future.

It is a category that might contribute to the future identification of species belonging potentially to the IUCN category NT – Near Threatened.

Anzia afromontana R. Sant. – K.: Mt Kenya; E, T, U. South America. Saxicolous, corticolous, muscicolous; montane–subalpine zone (1800–above 4000 m a.s.l.); rare. — [FRISCH 1999, FRISCH and HERTEL 1998, KIRIKA et al. 2018, SWINSCOW and KROG 1988]

Bryoria fuscescens (Gyeln.) Brodo and D. Hawksw. – K.: Mt Kenya; T, U. Tropical to arctic region, widespread. Terricolous, corticolous; upper ericaceous–alpine zone (3200–4400 m a.s.l.); fairly common. — [FRISCH 1999, FRISCH and HERTEL 1998, SWINSCOW and KROG 1988]

Bulbothrix sensibilis (J. Steiner and Zahlbr.) Hale – K.: Rift-valley, coastal region. T. Africa, South America. Corticolous; artificial habitats (1500–1600 m a.s.l.); rare. — [KIRIKA et al. 2017a, SWINSCOW and KROG 1988]

Bulbothrix sublaevigatoides (Dodge) Kirika, Divakar and Lumbsch, syn.: *B. tabacina sensu* early authors not (Mont. and Bosch) Hale [East-African specimens] – K.: Eeast (Nuu Hill, Makueni) and West (Kakamega forest), E?, T, U. Congo (Zaire), Malawi, Mozambique. Corticolous, (saxicolous?); well lit sites (1000–3000 m a.s.l.); rare. — [ALSTRUP et al. 2010, DODGE 1959, KIRIKA et al. 2017a, SWINSCOW and KROG 1988]

Notes: Molecular phylogenetic analyses (Kirika et al. 2017a) proved that most of the Central and East African representatives of the specimens indentified as *B. tabacina* (Mont. and Bosch) Hale belong to *Parmelia* *sublaevigatoides* Dodge and that taxon was recombined as *B. sublaevigatoides* (Dodge) Kirika, Divakar and Lumbsch. Therefore the previously available distribution and habitat data must be reevaluated with great care.

Canoparmelia albaniensis (C.W. Dodge) Divakar and Kirika – K.: Mt Kenya, Kakamega, Nyeri, Kajiado, Baringo, Makueni counties (2013–2014). SE United States, Argentina, China. Corticolous, (saxicolous), urban habitats, well-lit, dry sites, lowland–lower montane forests (1100–2600 m a.s.l.); common locally. — [KIRIKA et al. 2022]

Canoparmelia concrescens (Vain.) Elix and Hale – K.: Western Province. T (coll. Alstrup 1996–2000), U (1970). Africa (Huilla, Serra da Xella, 1853-61, F. Welwitsch). S-America (Mexico), Thailand. Corticolous, ramicolous; montane forest (1050–2730 m a.s.l.); rare. — [KIRIKA et al. 2016c, TEMU and TIBUHWA 2024, CANOPARMELIA CONCRESCENS 2025]

Canoparmelia eruptens (Kurok.) Elix and Hale – K.: Coast Province, Taita County: Ngangao Forest. S Africa. Corticolous; lowland–montane forest (700–2000 m a.s.l.); rare. — [HALE and KUROKAWA 1964, KIRIKA et al. 2016c, 2022]

Canoparmelia nairobiensis (J. Steiner and Zahlbr.) Elix and Hale – K.: Nairobi (French Mission, Schröder, 1910 – holotype), Central and Western Province, Eldama Ravine, Lembus Forest. T, U. Western Africa. Argentina. Corticolous, (saxicolous); well lit sites, bushed grassland, woodland, artificial habitats, lower montane forest (1000–2600 m a.s.l.); fairly common. — [ZAHLBRUCKNER 1926, SCHRÖDER 1927, SWINSCOW and KROG 1988, KIRIKA et al. 2016c, 2022]

Catapyrenium squamulosum (Ach.) Breuss, syn.: *Dermatocarpella squamulosa* (Ach.) H. Harada – K.: Mt Kenya. S-Africa. Temperate regions – both hemispheres. Cosmopolitan. Terricolous, humicolous; subalpine and alpine zones (3350–above 4000 m a.s.l.); common. — [BREUSS 1993, FRISCH and HERTEL 1998, FRISCH 1999, CATAPYRENIUM SQUAMULOSUM 2025]

Cetraria aculeata (Schreb.) Fr. – K.: Mt Elgon, Mt Kenya. E, T. Northern hemisphere, Australia. Terricolous/saxicolous; subalpine–upper alpine zones (3350–above 4000 m a.s.l.); common locally. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Cladonia bacillaris Nyl. – K. T, U. Cosmopolitan. Lignicolous / muscicolous, terricolous; upper montane–ericaceous–alpine zones (2700–4600 m a.s.l.); common. — [SWINSCOW and KROG 1988]

Cladonia krempelhuberi (Vain.) Zahlbr. – K.: Mt Kenya. T. Canary Islands, Japan, New Zealand. Terricolous, muscicolous; rocky sites, ericaceous–low alpine zone (3000–3700 m a.s.l.); common locally. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Cladonia poecilоclada Abbayes – K.: Mt Kenya. E, T, U. South Africa. Terricolous, lignicolous; montane–ericaceous zone (1600–3300 m a.s.l.); common. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999]

Cladonia pyxidata (L.) Hoffm. – K.: Mt Kenya, Mt Elgon. E, T, U. Cosmopolitan. Terricolous, corticolous / muscicolous (*Erica arborea, Senecio keniodendron*), saxicolous; montane forest subalpine–alpine zone (2500–above 4000 m a.s.l.); rare. — [SWINSCOW and KROG 1988, PÓCS and SZABÓ 1993, FRISCH and HERTEL 1998, FRISCH 1999]

Coccocarpia pellita (Ach.) Müll. Arg. – K.: Mt Kenya: Chogoria. T, U. Tropics. Corticolous /muscicolous, saxicolous (lava); montane forest (1000-3000 m a.s.l.); fairly common. — [SWINSCOW and KROG 1988, KIRIKA et al. 2018]

Dirinaria aegialita (Afzel. ex Ach.) B.J. Moore – K.: Kitui. E, T, U. Pantropical. Corticolous, saxicolous (lava rock); open sites, parks, avenues, plantations, woodland (0–2000 m a.s.l.); common. — [SWINSCOW and KROG 1988, ALSTRUP et al. 2010]

Dirinaria picta (Sw.) Clem. and Shear – K.: Kathunga. E, T, U. Pantropical, subtropical. Ramicolous; shrubland (0–2000 m a.s.l.); common. — [SWINSCOW and KROG 1988, ALSTRUP et al. 2010]

Dolichousnea trichodeoides (Vain. ex Motyka) Articus – K.: Mt Kenya, Chogoria, Sirimon. E, K, T, U. Southern, western Africa. Corticolous; tropical montane forests (incl. orotropical cloudy forest, xerotropical upland forest (1000–3050 m a.s.l.); common. — [SWINSCOW and KROG 1988, KIRIKA et al. 2018]

Heterodermia allardii (Kurok.) Trass – K.: Mt Kenya, Chogoria, Sirimon. Neotropics. Corticolous; montane-subalpine forests (2460–3050 m a.s.l.); fairly common. — [KIRIKA et al. 2012a, KIRIKA et al. 2018]

Heterodermia borphyllidiata (Kalb and Meesim) M.F. Souza and Aptroot, syn.: *Leucodermia borphyllidiata* Kalb and Meesim– K.: Central Province: Nyeri District (County) (1985). Pantropical. Spain, China, Thailand. Corticolous, terricolous/muscicolous; montane tropical rainforests (1340–3570 m a.s.l.); rare. — [MONGKOLSUK et al. 2015]

Hyperphyscia syncolla (Tuck. ex Nyl.) Kalb – K.: Mutito. T, U. Madagascar, Somalia, the Americas. Tropical, temperate regions. Corticolous; fairly open sites, lowland–montane zone (500–2400 m a.s.l.); rare. — [SWINSCOW and KROG 1988, ALSTRUP et al. 2010]

Hypotrachyna catawbiensis (Degel.) Divakar, A. Crespo, Sipman, Elix and Lumbsch – K.: Central Province, Mt Kenya. The Americas, New Guinea. Corticolous; open rocky heath, ericaceous–alpine zones (2900–above 4000 m a.s.l.); rare. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999, KIRIKA et al. 2016a]

Hypotrachyna immaculata (Kurok.) Hale – K.: Mt Kenya, Chogoria, Sirimon. T, U. Southern Africa, South America, Australia. Corticolous; parks, wayside trees, well-lit sites, submontane forest (1250–2700 m a.s.l.); common locally. — [SWINSCOW and KROG 1988, KIRIKA et al. 2018]

Hypotrachyna vexans (Zahlbr. ex W.L. Culb. and C.F. Culb.) Divakar, A. Crespo, Sipman, Elix and Lumbsch – K.: Central Province, Mt Kenya. Central and South America, Asia. Corticolous; lower montane forest (1800–2100 m a.s.l.); common locally. — [SWINSCOW and KROG 1988, KIRIKA et al. 2016a]

Lecidea thaleriza Stirt., syn.: *Phyllopsora thaleriza* (Stirton) G. Schneider – K.: Nairobi. E, T. S. Africa. Corticolous; open woodland (1500–2000 m a.s.l.); rare. — [SWINSCOW and KROG 1988, ALSTRUP et al. 2010, LECIDEA THALERIZA 2025]

Leptogium austroamericanum (Malme) C.W. Dodge – K.: Mt Kenya, Chogoria, Sirimon. E, T. The Americas. Corticolous, saxicolous; mangroves, lowland-subalpine forest (0–3050 m a.s.l.); rare. — [SWINSCOW and KROG 1988, KIRIKA et al. 2018]

Leptogium burnetiae C.W. Dodge. – K.: Mt Kenya, Chogoria, Sirimon. E, T, U. Pantropical, temperate regions. Corticolous, ramicolous, lignicolous, muscicolous; humid sites, mist-affected woodland, upper alpine–montane forest (1500–4380 m a.s.l.); common. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999, KIRIKA et al. 2018]

Leptogium caespitosum (Taylor) Swinscow and Krog – K.: Taita, Mt Kasigau. E, T, U. South Africa. Corticolous; dry–shady sites, mist-affected woodland, montane zone (700–2500 m a.s.l.); rare. — [SWINSCOW and KROG 1988, KAASALAINEN et al. 2021a, KAASALAINEN et al. 2021b]

Leptogium furfuraceum (Harm.) Sierk – K.: Mt Kenya, Chogoria, Sirimon. E. Europe, North America, India. Corticolous; upper montane–subalpine forest (2450–3200 m a.s.l.); rare. — [SWINSCOW and KROG 1988, KIRIKA et al. 2018]

Leptogium javanicum Mont. – K.: Taita Hills. Tropical Asia, Pacific Islands. Corticolous, ramicolous; exposed sites, mist-affected hills, montane zone (2300 m a.s.l.); rare. — [SWINSCOW and KROG 1988, KAASALAINEN et al. 2021a]

Leptogium juressianum Tav. – K. Western Europe. Corticolous; mist-affected mountains, montane–subalpine zone (1000–3400 m a.s.l); rare. — [SWINSCOW and KROG 1988, KAASALAINEN et al. 2021a]

Leptogium krogiae Bjelland, Frisch and Bendiksby – K.: Taita Hills, Western and Central Province. E, T. Corticolous; mist-affected woodland–montane forest (1750–3300 m a.s.l.); fairly common. — [BJELLAND et al. 2017, KAASALAINEN et al. 2021a]

Lobaria retigera (Bory) Trevis. – K.: Taita. T, U. South Africa, Australia, New Zealand, Asia, North America (Alaska). Corticolous; sheltered montane forest (1000–3200 m a.s.l.); fairly common. — [SWINSCOW and KROG 1988, KAASALAINEN et al. 2021a]

Parmotrema abessinicum (Krempelh.) Hale – K.: Nairobi District (County) – Ngong Hills, Nyeri County, Mt Kenya. E, T, U. Central and South America, Thailand. Corticolous; dry, well-lit sites, artificial habitats, montane zone (900–2600 m a.s.l.); common. — [SWINSCOW and KROG 1988, CZECZUGA et al. 1992, FARKAS et al. 2023]

Parmotrema andinum (Müll. Arg.) Hale – K.: Nyeri County, Mt Kenya, Kajiado, Nairobi, Kitui. E, T, U. South America, Asia. Corticolous (saxicolous); dry, well-lit sites, open hillsides, parks, gardens, woodland (900–2454 m a.s.l.); common. — [SWINSCOW and KROG 1988, ALSTRUP et al. 2010, FARKAS et al. 2023]

Parmotrema cetratum (Ach.) Hale – K.: Ngong Hills. T. Temperate regions. Corticolous; well-lit, mist-affected hills (1400–2600 m a.s.l.); rare. — [SWINSCOW and KROG 1988, ALSTRUP et al. 2010]

Parmotrema hololobum (Hale) Hale – K.: Nyeri County, Mt Kenya. T, U. Corticolous; well-lit sites, mist-affected upland habitats (sea level–1800 m a.s.l.); fairly common. — [SWINSCOW and KROG 1988, FARKAS et al. 2023]

Parmotrema perlatum (Huds.) M. Choisy – K.: Mt Kenya, Chogoria, Sirimon, Ngong Hills. E, T. Temperate northern and southern hemispheres. Corticolous; mist-affected habitats, inselbergs, montane–ericaceous zone (1400–3100 m a.s.l.); rare. — [SWINSCOW and KROG 1988, ALSTRUP et al. 2010, KIRIKA et al. 2018]

Parmotrema rimulosum (Dodge) Hale – K.: Uasin Gishu County. T. South Africa. Australia. Corticolous; mist-affected woodland, montane forest (1800–2900 m a.s.l.); rare. — [SWINSCOW and KROG 1988, MCCARTHY 2020, FARKAS et al. 2023]

Parmotrema sancti-angelii (Lynge) Hale – K.: Mt Kenya, Chogoria, Sirimon. E, T, U. Pantropical. Corticolous (saxicolous); artificial habitats (parks and gardens), montane forest (1000–2900 m a.s.l.); rare. — [SWINSCOW and KROG 1988, KIRIKA et al. 2018]

Peltigera polydactyloides Nyl. – K.: Mt Kenya, Chongoria, Sirimon, Taita. E, T, U. West Africa. North America. Terricolous, muscicolous/ saxicolus, corticolous, ramicolous; montane-alpine forest (1300–4400 m a.s.l.); common. — [SWINSCOW and KROG 1988, FRISCH and Hertel 1998, FRISCH 1999, KIRIKA et al. 2018, KAASALAINEN et al. 2021a, PELTIGERA POLYDACTYLOIDES 2025]

Peltigera ulcerata Müll. Arg. – K.: Mt Kenya, Chogoria, Sirimon. E, T, U. Pantropical, temperate zone of the southern hemisphere. Terricolous, muscicolous, saxicolous, corticolous, ramicolous; montane–subalpine forest (1800–4110 m a.s.l.); rare. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999, KIRIKA et al. 2018]

Peltula patellata (Bagl.) Swinscow and Krog. – K.: Kyalungwa. E, K, U. Pantropical, subtropics, warm temperate regions. Saxicolous; sunny exposed places (1100–1900 m as.l.); rare. — [SWINSCOW and KROG 1988, ALSTRUP and CHRISTENSEN 2006]

Phaeophyscia confusa Moberg – K.: Uasin Gishu County. E, T, U. Corticolous, (saxicolous); open sites, wayside trees, woodland, montane–supalpine zone (1200–3500 m a.s.l.); common locally. — [SWINSCOW and KROG 1988, FARKAS et al. 2023]

Phyllopsora albicans Müll. Arg. – K.: Mt Kenya, Chogoria, Sirimon. T. Tropical America. Corticolous; shady sites, montane forests (1830–2870 m a.s.l.); rare. — [SWINSCOW and KROG 1988, TIMDAL and KROG 2001, KIRIKA et al. 2018]

Phyllopsora confusa Swinscow and Krog – K.: Mt Kenya, Chogoria, Sirimon. T. Pantropical, subarctic regions. Corticolous; montane–subalpine forests, cloud forests ((100–)1500–3500 m a.s.l.); rare. — [SWINSCOW and KROG 1988, BRAKO 1991, TIMDAL and KROG 2001, KIRIKA et al. 2018]

Phyllopsora mediocris Swinscow and Krog – K.: Mt Kenya, Chogoria, Marsabit. T. La Reunion, Mauritius. Corticolous; humid sites, forests, montane zone (900–2230 m a.s.l.); rare. — [TIMDAL and KROG 2001, KIRIKA et al. 2018]

Phyllopsora santensis (Tuck.) Swinscow and Krog – K.: Mt Kenya, Chogoria, U. Southern USA, Mexico. Corticolous; moist, shady sites, lowland–montane forests (350–2230 m a.s.l.); rare. — [SWINSCOW and KROG 1988, KIRIKA et al. 2018]

Physcia albata (F. Wilson) Hale – K.: Mt Kenya, Sirimon, Aberdare National Park. E, T, U. Australia, New Zealand. Corticolous, (saxicolous); montane–alpine forests (1500–4210 m a.s.l.); rare. — [SWINSCOW and KROG 1988, CZECZUGA et al. 1992, FRISCH and HERTEL 1998, FRISCH 1999, KIRIKA et al. 2018]

Physcia dilatata Nyl – K.: Ngong Hills. E, T, U. Central America. Corticolous, ramicolous, muscicolous, saxicolous; montane–alpine zone (1700–3500 m a.s.l.); common. — [SWINSCOW and KROG 1988, ALSTRUP et al. 2010]

Physcia dimidiata (Arnold) Nyl. (var. *ornata* (Nadv.) Moberg) – K.: Ngong Hills. E, T. Europe. Corticolous, lignicolous, saxicolous; montane–alpine zone (1500–3700 m a.s.l.); rare. — [SWINSCOW and KROG 1988, ALSTRUP et al. 2010]

Physcia poncinsii Hue – K.: Ngong. E, T, U. Madagascar, La Reunion, South Africa. The Americas, SE Asia, Australia, New Zealand. Tropical, subtropical. Corticolous, ramicolous, saxicolous; open sites, montane zones (1000–2400 m a.s.l.); common. — [SWINSCOW and KROG 1988, ALSTRUP et al. 2010, PHYSCIA PONCINSII 2025]

Polyblastidium microphyllum (Kurok.) Kalb, syn.: *Heterodermia microphylla* (Kurok.) Skorepa – K.: Mt Kenya, Chogoria. Rift Valley (1985). E. South Africa, South America, Asia, Australia, New Zealand .Corticolous, (saxicolous); wayside trees, lowland-montane forest (10–3000 m a.s.l.); common. — [SWINSCOW and KROG 1988, MONGKOLSUK et al. 2015, KIRIKA et al. 2018]

Pseudocyphellaria argyracea (Delise) Vain**.** – K.: Taita Hills (2009-2011), T, U. Pantropical. Corticolous / muscicolous, terricolous; damp, shady sites, montane forest, mist-affected woodland (500–2100 m a.s.l); rare. — [SWINSCOW and KROG 1988, KAASALAINEN et al. 2021a]

Pseudocyphellaria aurata (Ach.) Vain. – K.: Taita Hills (2009-2011), Ngong Hills (Nannfeldt, 1972). T, E, U. Pantropical, temperate regions. Corticolous, terricolous; damp, shady sites, montane forest (1100–2900 m a.s.l); common. — [SWINSCOW and KROG 1988, WEDIN 1994, ALSTRUP and CHRISTENSEN 2006, KAASALAINEN et al. 2021a]

Punctelia borreri (Sm.) Krog – K.: Ngong Hills, Uasin Gishu County, E, T, U. Pantropical, temperate – both hemispheres. Corticolous, (saxicolous); natural, artificial habitats (1400–3400 m a.s.l.); common. — [SWINSCOW and KROG 1988, ALSTRUP et al. 2010, FARKAS et al. 2023]

Punctelia rudecta (Ach.) Krog – K.: Mt Kenya, Sirimon. E, T, U. Tropical, temperate regions – both hemispheres. Corticolous, saxicolous; natural and artificial habitats, montane-subalpine forests (1500–3080 m a.s.l.); common. — [SWINSCOW and KROG 1988, KIRIKA et al. 2018]

Punctelia subrudecta (Nyl.) Krog – K.: Mt Kenya, Sirimon, E, T, U. Pantropical, temperate regions. Corticolous, rarely (saxicolous, muscicolous); natural and artificial habitats, montane-alpine forests (1500–3600 m a.s.l.); common. — [SWINSCOW and KROG 1988, KIRIKA et al. 2018]

Pyxine berteroana (Fée) Imshaug [as '*berteriana*'], syn. *Pyxine meissnerina* Nyl. – K.: Uasin Gishu County. T, U. Pantropical. Asia. Corticolous; artificial habitats (1000–2200 m a.s.l.); rare. — [SWINSCOW and KROG 1988, FARKAS et al. 2023]

Pyxine petricola Nyl. – K.: Ngong Hill, Kitui. E, T, U. Pantropical. Corticolous, saxicolous; exposed– partly shaded places, artificial, natural habitats (0–2000 m a.s.l.); common. — [SWINSCOW and KROG 1988, ALSTRUP et al. 2010]

Pyxine subcinerea Stirt. – K.: Ngong. E, T, U. Pantropical, warm temperate regions. Corticolous, saxicolous; artificial, natural habitats, shady sites (1100–2300 m a.s.l.); rare. — [SWINSCOW and KROG 1988, ALSTRUP et al. 2010]

Ramalina africana (Stein) C.W. Dodge – K.: Ngong, Kajiado. E, T, U. S America, Asia. Corticolous; natural, artificial habitats, dry, exposed, sunny places (800–2700 m a.s.l.); common. — [SWINSCOW and KROG 1988, ALSTRUP et al. 2010]

Ramalina pusiola Müll. Arg. – K.: Nyeri County. E, T, U. Brazil. Corticolous, ramicolous; lower montane–montane forest, mist-affected woodland (1400–2460 m a.s.l.); common. — [SWINSCOW and KROG 1988, FARKAS et al. 2023]

Relicina abstrusa (Vainio) Hale – K. Asia, the Americas, Australia. Corticolous; mangroves, low coastal hills (0–300 m a.s.l); rare. — [SWINSCOW and KROG 1988, KIRIKA et al. 2017b]

Relicina malaccensis (Nyl.) Kirika, Divakar and Lumbsch, syn.: *Pseudoparmelia malaccensis* (Nyl.) Hale – K. West Africa, Asia, Australia,. Corticolous; mangroves, well-lit sites, low coastal hills (0–500 m a.s.l.); common locally. — [SWINSCOW and KROG 1988, KIRIKA et al. 2017b]

Sticta andina B. Moncada, Lücking and Sérus. – K.: Taita Hills, Mt Vuria. The Americas, Azores. Corticolous; moist sites, submontane–montane zone (1300-2200 m a.s.l.); common locally. — [KAASALAINEN et al. 2023a]

Sticta aspratilis Kaasalainen and Rikkinen – K.: Taita Hills, Mt Elgon, T. Corticolous, ramicolous, (terricolous); lower montane–subalpine zone (1450–3720 m a.s.l.); common locally. — [KAASALAINEN et al. 2023a]

Sticta ciliata Taylor – K.: Taita Hills, Mt Sagalla. R, T. Europe, Colombia. Corticolous, (muscicolous); moist sites, submontane–montane zone (c. 1000 m a.s.l.); fairly common. — [KAASALAINEN et al. 2023a]

Sticta duplolimbata (Hue) Vain. – K.: Taita Hills. T. Western Pacific region. Corticolous, ramicolous; moist sites, forest, montane–subalpine zones (1800–3060 m a.s.l.); common locally. — [KAASALAINEN et al. 2023a]

Sticta limbata (Sm.) Ach. – K.: Mt Elgon (1992), Mt Kenya, E, T, U. Temperate, (tropical) regions. Corticolous, ramicolous, muscicolous, saxicolous (volcanic rocks), terricolous; secondary grassland, evergreen forests, subalpine vegetation, *Erica-Philippia* heath, subalpine-montane–subalpine zones (2300–3400 m a.s.l.); common. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999, FARKAS 2003]

Sticta marginalis Bory – K.: Taita Hills, Mt Kasigau. T, U. Réunion, Madagascar. Corticolous, lignicolous/humicolous, saxicolous; lower, middle montane forests (1450–2470 m a.s.l.); common. — [KAASALAINEN et al. 2023a]

Sticta umbilicariiformis Hochst. ex Flot. – K.: Mt Elgon. E, R, T, U. North America(?), Australia(?). Corticolous, ramicolous, saxicolous, muscicolous/terricolous; middle montane–subalpine zones (2540–3800 m a.s.l.); common locally. — [KAASALAINEN et al. 2023a]

Teloschistes exilis (Michx.) Vain. – K.: Ngong Hills, Nyeri County, foot of Mt Kenya. E, T, U. The Americas. Corticolous, ramicolous; sheltered, humid sites, tropical rainforest (1300–2500 m a.s.l.); common. — [SWINSCOW and KROG 1988, ALSTRUP et al. 2010, FARKAS et al. 2023]

Teloschistes perrugosus Müll. Arg. – K.: Kathunga, Kitui, Nairobi District (County)-Ngong Hills. E, T, U. South Africa, Mexico(?). Lignicolous, ramicolous; exposed sites, lowland–montane zones (0–2700 m a.s.l.); common locally. — [SWINSCOW and KROG 1988, CZECZUGA et al. 1992, ALSTRUP et al. 2010]

Usnea firmula (Stirt.) Motyka – K.: Mt Kenya, Chogoria, Sirimon. T. West Africa. Corticolous, ramicolous, lignicolous; shady sites, montane forest (2000– 3200 m a.s.l.); rare. — [SWINSCOW and KROG 1988, KIRIKA et al. 2018]

Usnea perplexans Stirt. – K.: Mt Elgon, Mt Kenya. E. Paleotropical, temperate. Ramicolous (*Erica arborea*), lignicolous, saxicolous; montane-alpine zones (1500–4430 m a.s.l.); rare. — [SWINSCOW and KROG 1988, PÓCS and SZABÓ 1993, FRISCH and HERTEL 1998, FRISCH 1999, FARKAS et al. 2023, USNEA PERPLEXANS 2025]

Note: The specimen VBI 6192 originally identified as *U. abyssinica* Motyka is revised as *U. perplexans* (rev. E. Farkas, 2025)

Xanthoparmelia kiboensis (Dodge) Krog and Swinscow – K.: Mt Kenya. E, T, U. Saxicolous, muscicolous, terricolous; ericaceous–alpine zones (3000–5000 m a.s.l.); common locally. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999, ZHURBENKO 2021]

5.2.5. Species under Negligible Risk (in Kenya) [NR(K)]

The 54 species (10%) listed in the category "*Species under Negligible Risk (in Kenya) [NR(K)]*" are regarded common in Kenya, occur in several East-African countries and other continents and most often involved in molecular genetic studies based on freshly collected samples.
It is a category that might contribute to the future identification of species belonging potentially to the IUCN category LC – Least Concern.

Bulbothrix isidiza (Nyl.) Hale – K: Central and Rift Valley Provinces. E?, T?, U?. African (?). Corticolous, saxicolous; well lit sites, dry forests, often in artificial habitats (1100–2700 m a.s.l.); fairly common. — [ALSTRUP et al. 2010, KIRIKA et al. 2017a, SWINSCOW and KROG 1988]

Candelaria concolor (Dicks.) Stein – K.: Mutito. E, T, U. Tropical and temperate. Corticolous; dry, sunny sites, open scrubs, woodlands (1000–2000 m a.s.l.); common. — [ALSTRUP et al. 2010 SWINSCOW and KROG 1988]

Candelaria fibrosa (Fr.) Müll. Arg. – K.: Ngong Hills. E, T, U. Tropical and subtropical areas. Corticolous; shady to exposed scrub, woodland (1000–2000 m a.s.l.); common. — [ALSTRUP et al. 2010, SWINSCOW and KROG 1988]

Canoparmelia caroliniana (Nyl.) Elix and Hale – K.: Western Province, Mt Kenya. E, T, U. W and S Africa, the Americas, Azores, Thailand. Corticolous; artificial habitats, bushed grassland, woodland (1000–1800 m a.s.l.); common. — [KIRIKA et al. 2016c, 2022, SWINSCOW and KROG 1988]

Canoparmelia ecaperata (Müll. Arg.) Elix and Hale – K.: Eastern Province: Makueni, Mt Kenya. E, T, U., W and S Africa, Asia. Corticolous, ramicolous, (terricolous); dry,well lit sites, low montane–-montane forests (700–2400 m a.s.l.); common. — [KIRIKA et al. 2016c, 2022; SWINSCOW and KROG 1988]

Canoparmelia texana (Tuck.) Elix and Hale – K.: Kitui, Ololua Forest, Namanga Hills, Kakamega Forest. E, T, U. Subtropical and temperate regions, not in Europe. Corticolous, (saxicolous);

artificial habitats, well lit sites, lower montane forests (1000–2800 m alt.); common. — [SWINSCOW and KROG 1988, ALSTRUP et al. 2010, KIRIKA et al. 2022]

Crespoa crozalsiana (B. de Lesd. ex Harm.) Lendemer and B.P. Hodk. – K.: Kamera Forest. T, U. Southern Europe, southern Africa, India, the Americas. Corticolous, saxicolous; artificial habitats, well lit sites, woodlands, lower montane forest (1000–2100 m a.s.l.); common. — [SWINSCOW and KROG 1988, ALSTRUP et al. 2010, KIRIKA et al. 2016c]

Dirinaria applanata (Fée) D.D. Awasthi – K.: Mutioto, Kitui. E, T, U. Pantropical. Corticolous (saxicolous); parks, avenues, plantations, woodland (0–2300 m a.s.l.); common. — [SWINSCOW and KROG 1988, ALSTRUP et al. 2010]

Flavoparmelia caperata (L.) Hale – K.: Mt Kenya, Chogoria, Sirimon. E, T, U. Cosmopolitan, temperate. Corticolous; artificial habitats, well lit sites, montane-low alpine (orotropical cloudy, xerotropical upland) forest (1500–3600 m a.s.l.); common. — [SWINSCOW and KROG 1988, KIRIKA et al. 2018, FARKAS et al. 2023]

Flavoparmelia soredians (Nyl.) Hale – K. T, U. Southern Africa, Europe, South America, New Zealand. Corticolous, lignicolous, saxicolous; artificial habitats, well lit sites, lower montane-lower alpine xerotropical upland, orotropical montane, orotropical bamboo, orotropical cloud) forest (1100 and 2900 m a.s.l.); common. — [SWINSCOW and KROG 1988, KIRIKA et al. 2018]

Flavopunctelia flaventior (Stirt.) Hale – K. E, T, U. Tropical and temperate regions. Corticolous, muscicolous, saxicolous; natural and artificial habitats, montane-alpine forests, moorlands (1600–above 4000 m a.s.l.); common locally. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999, KIRIKA et al. 2018]

Heterodermia comosa (Eschw.) Follmann and Redón – K.: Kitui, Ngong Hills, Taita Hills. E, T, U. Tropics. Ramicolous; sunny–partly shaded sites (1000–2500 m a.s.l.); common. — [SWINSCOW and KROG 1988, ALSTRUP et al. 2010, STAM et al. 2020]

Heterodermia diademata (Taylor) D.D. Awasthi – K.: Ngong Hills. Uasin Gishu County. E, T, U. Tropics. Corticolous, ramicolous, saxicolous; sheltered sites, artificial, natural habitats (1000–above 3500 m a.s.l.); common. — [SWINSCOW and KROG 1988, ALSTRUP et al. 2010, FARKAS et al. 2023]

Heterodermia isidiophora (Nyl.) D.D. Awasthi – K.: Ngong Hills. E, T, U. Pantropical. Corticolous, ramicolous, saxicolous; sheltered sites (950–2750 m a.s.l.); common. — [SWINSCOW and KROG 1988, ALSTRUP et al. 2010]

Heterodermia lepidota Swinscow and Krog – K.: Mt Kenya, Sirimon, Ngong Hills, Central Province: Nanyuki District (Laikipia County), Rift Valley Province: Kajiado District (County). E, U. Venezuela, the Galapagos Islands, Australia. Corticolous, ramicolous; partly shady sites, montane-subalpine forest (2000–3100 m a.s.l.); fairly common. — [SWINSCOW and KROG 1988, ALSTRUP et al. 2010, MONGKOLSUK et al. 2015, KIRIKA et al. 2018]

Heterodermia speciosa (Wulfen) Trevis. – K.: Rift Valley Province. E, T, U. Cosmopolitan. Corticolous (*Schinus molle*), (saxicolous); sheltered sites, natural, artificial habitats (1100–3600 m a.s.l.); common. — [SWINSCOW and KROG 1988, CZECZUGA et al. 1992, MOBERG 2012]

Hypotrachyna neodissecta (Hale) Hale – K.: Ngong Hills, Mt Kenya. E, T, U. Pantropical. Corticolous, saxicolous, terricolous, muscicolous; well-lit sites, montane forest (2000–4000 m a.s.l.); common locally. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999, ALSTRUP et al. 2010]

Hypotrachyna sorocheila (Vain.) Divakar, A. Crespo, Sipman, Elix and Lumbsch – K.: Mt Kenya, Central, Western Province. E, T, U. South America, Madeira, Asia (Indian Himalaya only), New Zealand. Corticolous, ramicolous, (terricolous/saxicolous), muscicolous, humicolous; montane–ericacous–lower alpine zone (2000–above 4000 m a. s. l.); common. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999, KIRIKA et al. 2016a]

Leptogium azureum (Sw.) Mont. – K.: Mt Kenya, Chogoria, Sirimon, Mt Elgon, Ngong Hills. E, T, U. Pantropical; temperate regions. Corticolous, muscicolous, (saxicolous); parks, and gardens, lowland-alpine forest (0–4050 a.s.l.); common. — [SWINSCOW and KROG 1988, PÓCS and SZABÓ 1993, ALSTRUP and CHRISTENSEN 2006, KIRIKA et al. 2018]

Leptogium burgessii (L.) Mont. – K.: Mt Kenya.Chogoria, Sirimon. E, T, U. Pantropical, temperate regions. Corticolous, muscicolous; shady sites, montane-subalpine/ericaceous forests (1900–3500 m a.s.l.); common. — [SWINSCOW and KROG 1988, KIRIKA et al. 2018]

Leptogium cochleatum (Dicks.) P.M. Jørg. and P. James – K.: Mt Kenya, Chogoria, Sirimon, Ngong Hills. E. Pantropical, temperate areas. Corticolous, muscicolous, terricolous, humicolous; wet sites, forests, montane–alpine zone (1400–4280 m a.s.l.); fairly common. — [SWINSCOW and KROG 1988, FRISCH 1999, ALSTRUP and CHRISTENSEN 2006, Kirika et al. 2018]

Leptogium coralloideum (Meyen and Flot.) Vain. – K.: Mt Kenya, Ngong Hills. E, T, U. Europe, Philippines, Papua New Guinea, Australia, New Zealand, Pantropical, warm temperate regions. Corticolous (saxicolous); parks, gardens, woodland, montane–alpine forest (0–above 4000 m a.s.l.); common. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999, ALSTRUP and CHRISTENSEN 2006]

Leptogium cyanescens (Ach.) Körb. – K.: Mt Kenya, Chogoria, Sirimon, Ngong Hills, Kamera Forest, Endarasha Hill, Taita Hills (Stam, 2013–2018). E, T, U. Pantropical, temperate regions (cosmopolitan). Corticolous; dry plains, moist evergreen montane forests, lowland-upper montane forest (0–3050 m a.s.l.); common. — [SWINSCOW and KROG 1988, ALSTRUP and CHRISTENSEN 2006, KIRIKA et al. 2018, STAM et al. 2020]

Leptogium phyllocarpum (Pers.) Mont. – K.: Endarasha Hill, Ngong Hills. E, T, U. Pantropical, subtropical. Corticolous; parks, gardens, shady woodland, montane forest (1000–3000 m a.s.l.); common. — [SWINSCOW and KROG 1988, ALSTRUP and CHRISTENSEN 2006]

Leucodermia boryi (Fée) Kalb – K.: Mt Kenya, Nyeri County, Ngong Hills. E, T, U. Pantropical, temperate regions. Corticolous, ramicolous, muscicolous, terricolous, saxicolous; shady sites, lowland–alpine zones (0–4260 m a.s.l.); common. — [SWINSCOW and KROG 1988, CZECZUGA et al. 1992, FRISCH and HERTEL 1998, FRISCH 1999, FARKAS et al. 2023]

Leucodermia leucomelos (L.) Kalb – K.: Mt Kenya, Chogoria, Sirimon, Ngong Hills, Kitui, Taita Hills (2013-2018), Vuria forest. E, T, U. Pantropical, temperate regions. Corticolous, saxicolous, terricolous; moist habitats, lowland–alpine zone (0–3500 m a.s.l.); common. — [SWINSCOW and KROG 1988, ALSTRUP et al. 2010, STAM et al. 2017, KIRIKA et al. 2018, STAM et al. 2020]

Lobaria pulmonaria (L.) Hoffm. – K.: Mt Kenya, Chogoria, Sirimo, Endarasha [Mt Kulal, 1947]. T, U. Temperate, boreal regions (northern hemisphere), (tropics), South America, Australia. Corticolous; sheltered montane forest (1800–3400 m a.s.l.); common. — [SWINSCOW and KROG 1988, CZECZUGA et al. 1992, ALSTRUP and CHRISTENSEN 2006, KIRIKA et al. 2018]

Nephroma tropicum (Müll. Arg.) Zahlbr. – K.: Mt Kenya. E, T, U. Pantropical. Corticolous, saxicolous / muscicolous; shady sites, montane–subalpine foreststs (1900–4410 m a.s.l.); fairly common. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999, KIRIKA et al. 2018]

Normandina pulchella (Borrer) Nyl. – K.: Mt Kenya, Ngong Hills. E, T, U. Pantropical, temperate regions. Corticolous, ramicolous (*Erica*), muscicolus, lichenicolous, saxicolous; wet, shady sites, streamsides, montane–alpine zones (2500–4260 m a.s.l); common. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999, ALSTRUP et al. 2010, STAM et al. 2020]

Parmelinella schimperiana Kirika and Divakar [part of *Parmelinella wallichiana* (Taylor) Elix and Hale (syn: *Pseudoparmelia wallichiana* (Taylor) Krog and Swinscow), identified earlier from Kenya]. – K.: Mt Kenya, Mutito, Makueni, Kitui, Ngong Hills, Coastal Province. E, T, U. Cameroon, Asia. Corticolous, muscicolous; natural and secondary vegetation, plantations, *Erica* *arborea* heath, montane–alpine zone (1100–above 4000 m a.s.l.); common. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999, ALSTRUP et al. 2010, KIRIKA et al. 2016b]

Parmotrema arnoldii (Du Rietz) Hale – K.: Mt Kenya, Chogoria, Sirimon. T, U. Madagascar, tropical America, Asia. Corticolous; lowland, montane–alpine forests (500–4000 m a.s.l.); common. — [SWINSCOW and KROG 1988, KIRIKA et al. 2018]

Parmotrema austrosinense (Zahlbr.) Hale – K.: Mt Kenya, Ngong Hills, Kitui, Uasin Gishu County. E, T, U. Pantropical, temperate regions. Corticolous (saxicolous) well-lit sites, natural and artificial sites (1000–3000 m a.s.l.); common. — [SWINSCOW and KROG 1988, ALSTRUP et al. 2010, FARKAS et al. 2023]

Parmotrema cooperi (Steiner and Zahlbr.) Sérus. – K.: Mt Kenya, Nyeri County, Mt Kenya. E, T, U. South and central Africa, Madagascar, Asia, Australia. Corticolous, (saxicolous); dry, well-lit sites, lowland–montane forest (0–3000 m a.s.l.); common. — [Swinscow and Krog 1988, Kirika et al. 2018, Farkas et al. 2023]

Parmotrema crinitum (Ach.) M. Choisy – K.: Ngong Hills. T, U. Pantropical, subtropics. Corticolous, (terricolous/saxicolous); mist-affected woodland, montane– ericaceous zone (1400–3400 m a.s.l.); fairly common. — [SWINSCOW and KROG 1988, ALSTRUP et al. 2010]

Parmotrema hababianum (Gyelnik) Hale – K.: Mt Kenya, Chogoria, Sirimon, Nyeri County. E, T, U. Asia, North and South America. Corticolous, ramicolous; dry, well-lit habitats, montane zone (800–2650 m a.s.l.); common. — [SWINSCOW and KROG 1988, KIRIKA et al. 2018, FARKAS et al. 2023]

Parmotrema lophogenum (des Abb.) Hale – K.: Mt Kenya, Chogoria, Sirimon.T. West Africa, Madagascar, New Zealand. Corticolous; montane-subalpine forest (1400–3050 m a.s.l.); common locally. — [SWINSCOW and KROG 1988, KIRIKA et al. 2018]

Parmotrema nilgherrense (Nyl.) Hale – K.: Mt Kenya, Nyeri County. E, T, U. Asia. Corticolous, saxicolous, lignicolous; montane–ericaceous–alpine zone (2000–above 4000 m a.s.l.); common. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999, FARKAS et al. 2023]

Parmotrema reticulatum (Taylor) M. Choisy, syn.: *Rimelia reticulata* (Taylor) Hale and A. Fletcher – K.: Mt Kenya, Chogoria, Sirimon, Nyeri County, Ngong Hills, Kamera. E, T, U. Pantropical, temperate regions. Corticolous, saxicolous, terricolous; natural, artificial habitats, submontane–subalpine forest (1000–3000 m a.s.l.); common. — [SWINSCOW and KROG 1988, ALSTRUP et al. 2010, KIRIKA et al. 2018, FARKAS et al. 2023]

Peltigera dolichorhiza (Nyl.) Nyl. – K.: Mt Kenya, Taita. T, U. Temperate regions – southern hemisphere, (pantropical). Corticolous, muscicolous; shady sites, montane–ericaceous–alpinezone (1300–above 4000 m a.s.l.); common. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999, KAASALAINEN et al. 2021a]

Peltigera praetextata (Flörke ex Sommerf.) Zopf. – K.: Mt Kenya, Mt Elgon, Taita. E, T, U. Northern hemisphere. Muscicolous, saxicolous, terricolous; shady, wet sites, montane–ericaceous–alpine zone (1300–4110) m a.s.l.); common. — [SWINSCOW and KROG 1988, PÓCS and SZABÓ 1993, FRISCH and HERTEL 1998, FRISCH 1999, KAASALAINEN et al. 2021a]

Phaeophyscia hispidula (Ach.) Essl. – K. Mt Kenya, Chogoria, Sirimon. E, T, U. Pantropical, subtropical. Corticolous, (saxicolous, terricolous/muscicolous); shady sites, submontane–subalpine zone (1500–3050 m a.s.l.); fairly common. — [SWINSCOW and KROG 1988, KIRIKA et al. 2018]

Polyblastidium japonicum (M. Satô) Kalb – K.: Mt Kenya, Chogoria, Sirimon. Ngong Hills. Africa, Asia, New Zealand. Corticolous, muscicolous, ramicolous (*Erica arborea*, *Senecio keniodendron*); open sites, upper alpine zone (3350–4200 m a.s.l); common. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999, ALSTRUP et al. 2010, KIRIKA et al. 2018]

Pseudocyphellaria clathrata (De Not.) Malme – K.: Taita Hills (2009-2011), Taita (2015-2016), Nairobi District (County), Ngong Hills. T, U. South America. Corticolous (*Schinus molle*); dense, moist (disturbed), riverside forests, montane forest, (1100 –2072 m a.s.l); fairly common. — [SWINSCOW and KROG 1988, CZECZUGA et al. 1992, ALSTRUP and CHRISTENSEN 2006, SUIJA et al. 2018, KAASALAINEN et al. 2021a]

Pseudocyphellaria crocata (L.) Vain. – K.: Mt Elgon (1992), Nairobi District (County), Ngong Hills. T, U. Cosmopolitan. Corticolous; ramicolous; shady, humid sites, woodland, montane forest, mist effected miombo, paramo, elfin forest, (500–3900 m a.s.l); common. — [SWINSCOW and KROG 1988, CZECZUGA et al. 1992, FARKAS 2003, ALSTRUP and CHRISTENSEN 2006]

Ramalina celastri (Spreng.) A. Massal – K.: Kajiado, Ngong Hills, E, T, U. Pantropical. Corticolous, lignicolous, ramicolous; shrubs, posts in natural and artificial habitats, sunny–moderately shady places (800–3400 m a.s.l.), common. — [SWINSCOW and KROG 1988, CZECZUGA et al. 1992, ALSTRUP et al. 2010]

Sticta ambavillaria (Bory) Ach. – K.: Mt Kenya, Chogoria, Sirimon, Taita Hills, Mt Elgon (1992), E, T, U. Zaire (Congo). Pantropical. Corticolous, muscicolous, ramicolous, terricolous/saxicolous;

secondary grasslands, forests, paramo vegetation, montane-subalpine zone (1900–above 4000 m a.s.l.); common. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999, FARKAS 2003, KIRIKA et al. 2018]

Sticta fuliginosa (With.) Ach. – K.: Taita Hills (2009-2011?), Ngong Hills, Mt Elgon (1988, 1992). E, T, R, U. Pantropical, circumpolar, temperate regions. Corticolous, muscicolous, ramicolous, saxicolous, lignicolous/humicolous; natural and artificial habitats, forests, paramo, montane-subalpine zones (1300–3900 m a.s.l.); common. — [SWINSCOW and KROG 1988, FRISCH 1999, FARKAS 2003, ALSTRUP and CHRISTENSEN 2006, KIRIKA et al. 2018, KAASALAINEN et al. 2021a, KAASALAINEN et al. 2023a]

Sticta sublimbata (J. Steiner) Swinscow and Krog– K.: Taita (2009-2011), Mt Elgon (1992). E, T, U. Tropics, subtropics, South America, Australia, New Zealand. Corticolous, ramicolous, saxicolous, muscicolous; coffee-banana plantations, secondary grasslands, moderately disturbed habitats, montane–elfin forest, (1300–2500 m a.s.l.); common locally. — [SWINSCOW and KROG 1988, FARKAS 2003, KAASALAINEN et al. 2021a, KAASALAINEN et al. 2023a]

Sticta tomentosa (Sw.) Ach. – K.: Taita (2009-2011), Mt Elgon (1992). E, T, U. Pantropical. Corticolous (*Erica* sp.), muscicolous, saxicolous; secondary grassland, montane rainforest, (1200–3300 m a.s.l.); common. — [SWINSCOW and KROG 1988, FARKAS 2003, KAASALAINEN et al. 2021a, KAASALAINEN et al. 2023a]

Sticta weigelii (Ach.) Vain. – K.: Ngong Hills, Mt Elgon (1992), Mt Kenya; Chogoria, Taita (2009-2011). E, T, U. Zaire (Congo). Pantropical, temperate regions. Corticolous, ramicolous, lignicolous/humicolous, saxicolous; secondary grassland, moist sites, forest, praramo, heath, submontane–subalpine zone (120–above 4000 m a.s.l.); common. — [SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999, FARKAS 2003, ALSTRUP and CHRISTENSEN 2006, KIRIKA et al. 2018, KAASALAINEN et al. 2021a]

Teloschistes flavicans (Sw.) Norman – K.: Nyeri County, Kitui. E, T, U. Pantropical, warmer temperate zone. Corticolous, ramicolous; sheltered, exposed sites, artificial, natural habitats, tropical rainforest (1100–3100 m a.s.l.); common. — [SWINSCOW and KROG 1988, ALSTRUP et al. 2010, FARKAS et al. 2023]

Usnea angulata Ach., syn.: *Usnea undulata* Stirt. – K.: Nyeri County, Mt Kenya; Chogoria, Sirimon. E, T, U. South Africa, Madeira. Pantropical, American temperate region. Corticolous, ramicolous; dry, open sites, scrub, tropical rainforest, montane forests (1000–2700 m a.s.l.); common. — [SWINSCOW and KROG 1988, FARKAS et al. 2023, KIRIKA et al. 2018, USNEA ANGULATA 2025]

Usnea exasperata (Müll. Arg.) Motyka – K.: Nairobi District (County), Ngong Hills, Mt Kenya, Chogoria, Sirimon. E, T, U, R. Zaire (Congo), South Africa. Corticolous, ramicolous; wayside trees, montane-subalpine cloudy forest (1000–3100 m a.s.l.); common. — [SWINSCOW and KROG 1988, CZECZUGA et al. 1992, ALSTRUP et al. 2010, KIRIKA et al. 2018]

Usnea rubicunda Stirt. – K.: Nyeri County, Mt Kenya. E, T, U. Pantropical, subtropical, temperate regions. Corticolous, lignicolous, ramicolous, (saxicolous); sheltered places, tracksides, tropical forests (1500–2500 m a.s.l.); common. — [SWINSCOW and KROG 1988, FARKAS et al. 2023]

5.2.6. Discussion on macrolichen species diversity

Lichen data from Kenya represent a broad taxonomic and ecological diversity across alpine rock surfaces, alpine and montane forests, dry savanna woodlands, and mangrove-lined coasts. High-altitude areas such as the Aberdare Mountains, Mt Elgon, Mt Kenya, and Kakamega Forest were identified as the most frequently visited areas (Figure 8) and parts of the Eastern Afromontane biodiversity hotspot (MYERS et al. 2000, MITTERMEIER et al. 2004, 2011, KIRIKA et al. 2018).

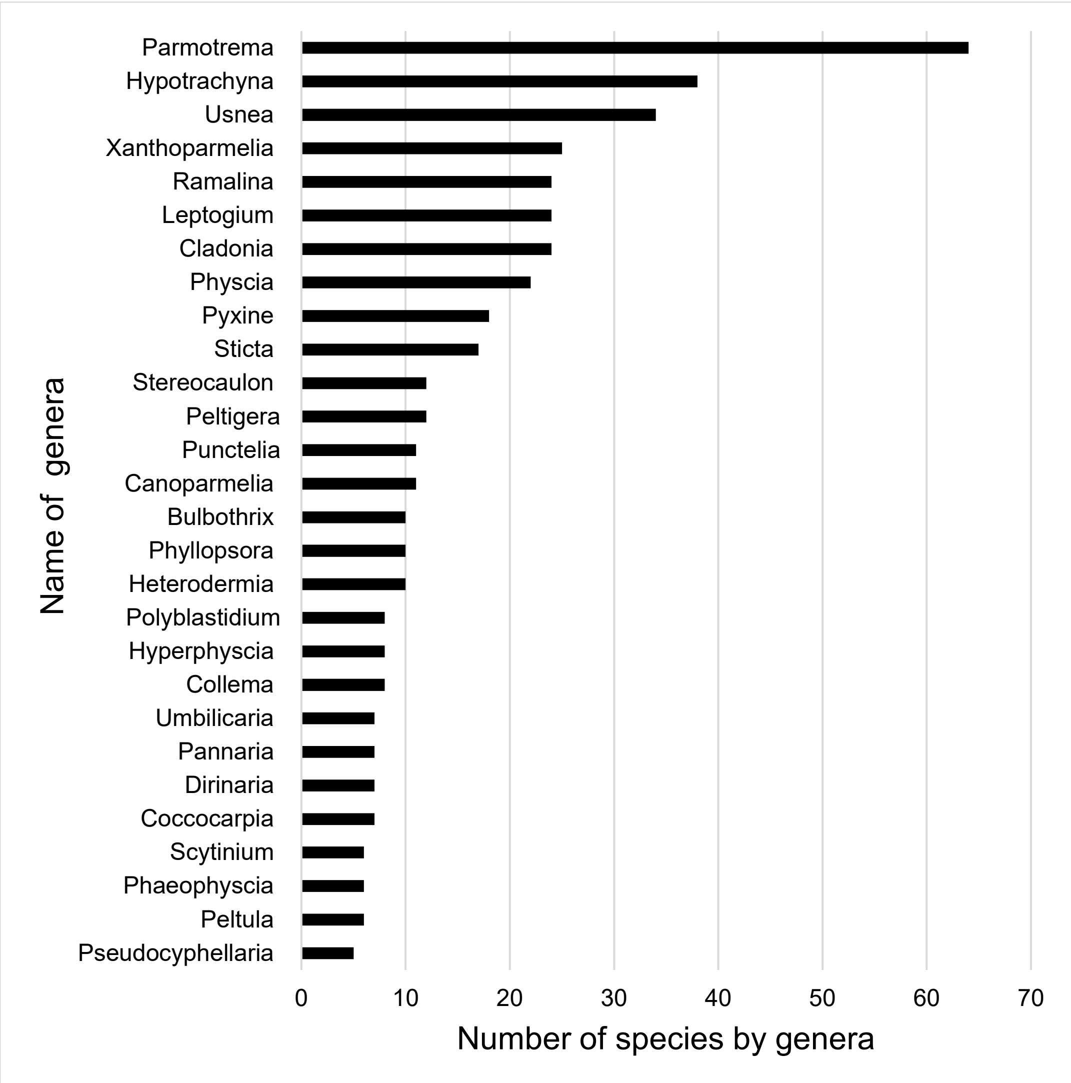

Figure 11. Species diversity in lichen genera in Kenya. The most frequent 28 of the 96 genera are illustrated.

The diversity of lichens in Kenya is presented in Figure 11. The number of species in genera is illustrated. The composition of Kenya's macrolichen flora is unevenly spread across genera. Over half of the genera are represented by only a single species (e.g., *Anzia*, *Cetrelia*, *Gabura*), a few genera are exceptionally species-rich, as shown in Figure 11. For example, *Parmotrema* is the most species-rich genus with 64 species, followed by *Hypotrachyna* (38 species) and *Usnea* (34 species), then further three genera (*Xanthoparmelia* – 25, *Leptogium* – 24, and *Ramalina* – 24). Together, the top 10 genera (approximately 10% of all genera in the dataset) account for roughly 58% of all macrolichen species of the country, indicating that a small subset of genera contains most of the species. Such an uneven genus-size distribution indicates that a few macrolichen lineages have undergone extensive diversification and became adapted the best to the Kenyan environment. However, they might have attracted collection bias from the researchers, though these genera are rich in species globally while the others have remained species-poor (FRODIN 2004, INATURALIST 2020, TONG et al. 2021).

5.2.7. Discussion on frequency of taxa

According to Table 2 more than half of the recorded species were classified as "rare" (42%) or "very rare" (13%). In addition to the rare categories, 9% of species were categorised as "fairly common", while 13% were considered "common locally". The remaining 23% of species classified as "common" contribute substantially to ecosystem functioning, including nutrient cycling, water regulation, and the provision of microhabitats for invertebrates (NASH 2008). While common species are often more resilient to disturbance, they are not protected against decline (OLIVER et al. 2015, LEPŠ and LISNER 2025).

Table 2. The frequency levels of species among all species expressed in percentages.

Frequency	**Number of species**	**Percentage (%)**
Very rare	73	13
Rare	235	42
Common locally	72	13
Fairly common	48	9
Common	125	23
Total number of taxa	553	100

Figure 12 presents the analysis of macrolichen frequency on conservation risk categories that reveals clear associations, which highlight vulnerability patterns within Kenya's lichen flora. Species classified under Extreme Risk (ER) were heavily dominated by the very rare frequency (64%), with an additional 33% considered rare. In the Significant Risk (SR) category, rare species were most prevalent (57%), though very rare taxa remained substantial (22%). Species under Medium Risk (MR) exhibited a more balanced profile, with rare species accounting for 41%, but with increasing proportions of common locally (18%) and common (24%) taxa. The Low Risk (LR) category was characterized by a greater representation of common taxa (30%), alongside 43% still categorized as rare. The Negligible Risk (NR) category was dominated by common species (80%), with only small contributions from common locally (7%) and fairly common (13%) taxa. Rare and very rare species were absent, suggesting that this category comprises widespread generalists with relatively secure populations under current conditions.

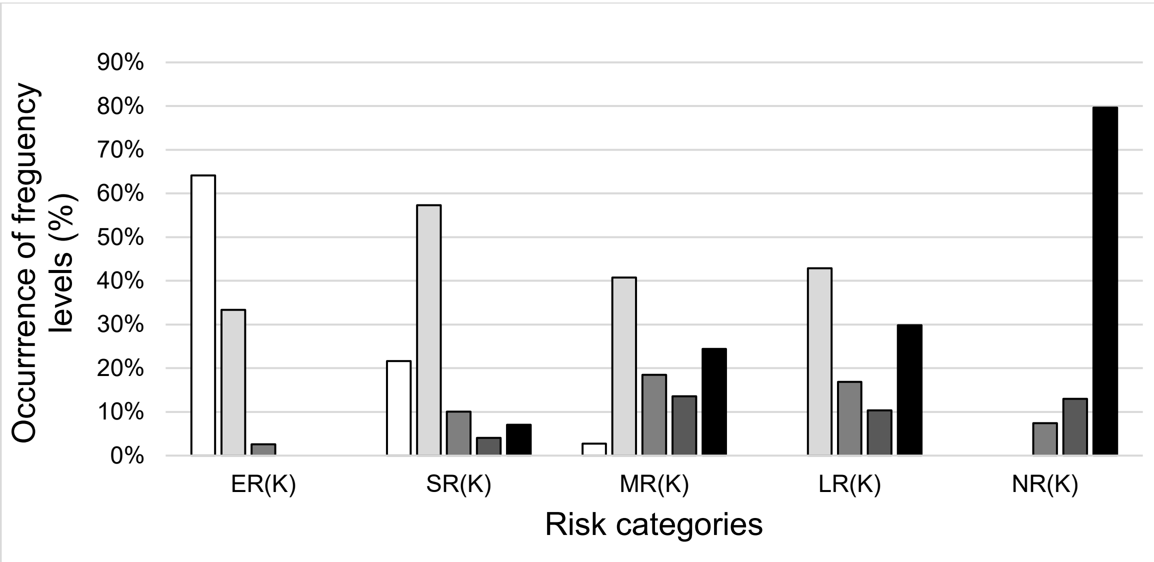

Figure 12. The frequency levels of species within risk categories expressed in percentages. Abbreviations: **ER (K)**, Species under Extreme Risk (in Kenya); **SR(K)**, Species under Significant Risk (in Kenya); **MR(K)**, Species under Medium Risk; **LR(K)**, Species under Low Risk (in Kenya); **NR(K)**, Species under Negligible Risk (in Kenya); **White**, very rare; **Pale gray**, rare; **Gray**, common locally; **Dark gray,** fairly common; **Black**, common.

Subtrate is a frequently analysed trait of lichen vegetation (e.g., ELLIS et al. 2021). Substrate analysis further highlights the ecological drivers of macrolichen diversity also in Kenya. Corticolous species were by far the most numerous, accounting for 385 records, emphasizing the pivotal role of tree bark and woody substrates. Saxicolous lichens, numbering 244 species, also form a substantial component of the flora, occupying rocky outcrops, cliffs, and montane environments. These habitats are particularly vulnerable to quarrying, infrastructure expansion, and the increasing effects of climate change. Terricolous taxa were comparatively scarce, with only 68 species, likely reflecting the disturbance-prone nature of soil surfaces in Kenya, which are subject to grazing, agriculture, and trampling (NJUGUNA et al. 2016, HOGUE and BREON 2022). Notably, 197 taxa were recorded across multiple substrates, reflecting a degree of ecological flexibility. Such generalist species may prove to be more resilient under environmental change.

Of additional interest are the 43 species found in "artificial habitats", such as walls, buildings, and other man-made substrates. The number of these cases showed and increasing tendency in categories toward the species with negligible risk. A few other species were growing on eutropicated sites and planted trees.

5.2.8. Conservation implications of the diverse macrolichen diversity

The findings have important implications for conservation and biodiversity monitoring of Kenyan macrolichens. First, due to the vast diversity of macrolichens across Kenya's varied ecosystems conservation efforts must be equally diverse. An effective lichen conservation strategy should focus on habitat variety, ensuring that montane cloud forests, humid coastal forests, and drier woodlands all remain protected. Several macrolichens, especially foliose and fruticose types, like *Parmotrema* and *Usnea*, thrive in old-growth montane and coastal forests, while other genera (e.g., *Xanthoparmelia*) are adapted to open savanna or alpine habitats (KIRIKA et al. 2018). This means that conservation plans need to include multiple ecosystem types and not to focus solely on well-known forests (ANTÓN-PARDO 2019, POTT 2014).

The genus richness, diversity, and distribution carry important conservation implications (HAWKSWORTH and LÜCKING 2017). The great diversity among the macrolichen species that has been noticed emphasises how diverse Kenya's biodiversity is across a variety of environments (KIRIKA 2012, KIRIKA et al. 2018b, LAWRENCE et al. 2023, NAEKU 2020). Not all genera are found in a single habitat; savannas, alpine zones, coastal woods, and montane forests all support a variety of taxa. As a result, an effective conservation strategy must prioritize lichen substrates throughout many ecosystems rather than concentrating on a single habitat type. Assessing the effects of policies (such as logging, land fragmentation, agriculture, grazing, and afforestation) on lichens is a necessary part of comprehensive management (BU et al. 2015, MITTERMEIER et al. 2011, PINNA et al. 2018, SCHEI et al. 2013). For example, to maintain full ecosystem function, tree species selection in reforestation should be emphasised for encouraging epiphyte colonisation. Similarly, grazing zones should be maintained to ensure minimal lichen disturbances.

In Figure 13, risk categories are characterised by their percentage frequencies among Kenyan macrolichens. Only about 7% of Kenya's macrolichen species are under Extreme Risk (ER), but a striking 36% fall under Significant Risk (SR) – meaning over one-third of all macrolichen species are considered to face significant risk of decline or extinction in Kenya. An additional 33% are in the Medium Risk (MR) category. Together, the MR, SR, and ER groups constitute roughly 76%

of all macrolichen species in the country, indicating that three out of five macrolichen species in Kenya could be regarded as threatened or vulnerable at some level. By contrast, only about 14% of species are classified under Low Risk (towards near-threatened), and 10% are under Negligible Risk. This proportional breakdown is cause for concern (that is) 76% of Kenyan macrolichens would fall into threatened categories if one compares these designations to IUCN Red List levels (with ER as a step towards Critically Endangered and SR towards Endangered). Meanwhile, the Negligible Risk 10% can be related to species of least concern in conservation terms. This suggests that many macrolichens in Kenya are almost rare, occur in specialized or shrinking habitats, or have not been documented in recent decades (*cf.* significantly minor lichenology research). It also reflects the data-deficient nature of lichenology in the region – numerous species are known from few collections, so a precautionary approach places them in higher risk categories.

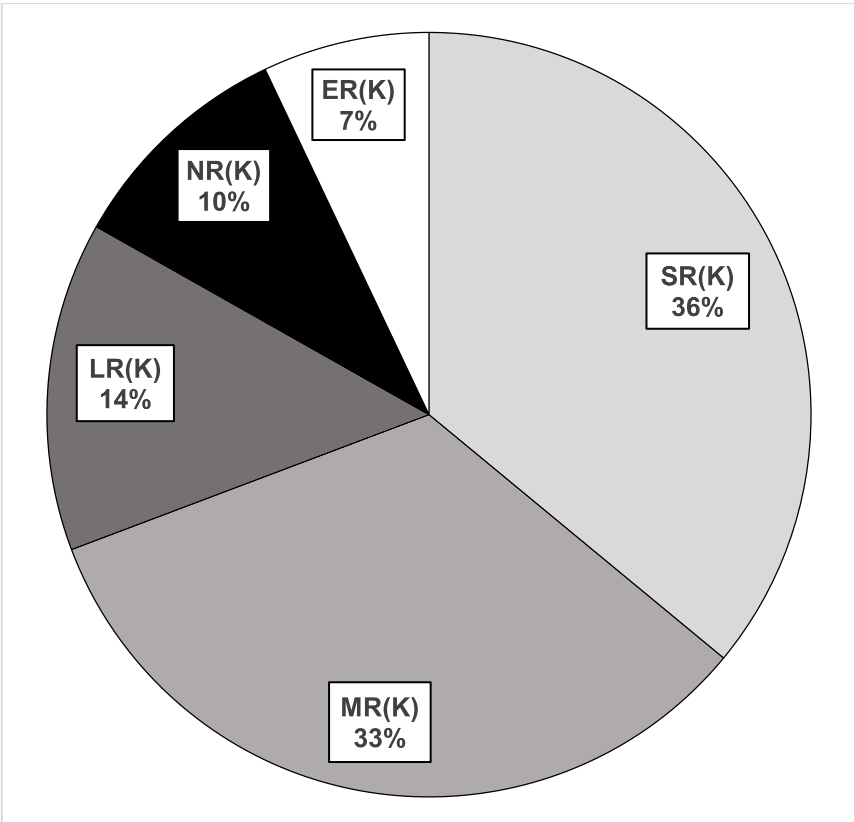

Figure 13. The proportion of the risk categories of macrolichens in Kenya. Abbreviations: **ER (K)**, Species under Extreme Risk (in Kenya); **SR(K)**, Species under Significant Risk (in Kenya); **MR(K)**, Species under Medium Risk; **LR(K)**, Species under Low Risk (in Kenya); **NR(K)**, Species under Negligible Risk (in Kenya).

5.3. New distribution records from East-African lichen collections

82 specimens were identified from Kenyan and Tanzanian lichen collections (Farkas et al. 2025). New records of Kenyan and Tanzanian specimens were identified and data of 57 species are

reported and evaluated, indicating that even the relatively well known East African region is far from fully explored.

Taxa are listed in alphabetical order. New distribution data are indicated by * (for Tanzania), ** (for East Africa). Lichenised fungi were identified by E. Farkas and C. N. Kanyungulu in 2025. Locality data are presented in abbreviated form (Makueni and Ngong for Kenya) and by their collection numbers (Tanzania). The precise collection data are listed in the Appendix 3. The detected lichen secondary metabolites are given (with further details in Appendix 3). HPTLC data are presented in plate records of analysed specimens (Appendix 8). The distribution and some of the most important morphological / anatomical characters of the species are analysed according to available literature data, especially in the case of distributional novelties.

Anzia afromontana R. Sant.

Tanzania: 89186/AQ (VBI 6253 – divaricatic acid, 2 fatty acids [HPTLC 2402/A2])

It is known from all countries of East Africa, also found in South America. Saxicolous, corticolous, muscicolous, tiny decorative species, rare, but extending to montane–subalpine zone (1,800–above 4,000 m a.s.l.) (FRISCH 1999, FRISCH and HERTEL 1998, KIRIKA et al. 2018, SWINSCOW and KROG 1988).

Bulbothrix kenyana Kirika, Divakar and Lumbsch

Tanzania: 90097/K (VBI 6254 – atranorin, salazinic acid [HPTLC 2501/B16])

This rare, corticolous, saxicolous species was described from Kenya (Kirika et al. 2017) and found also in Tanzania (FARKAS et al 2023). It grows in *Acacia* / *Commiphora* shrubland, secondary vegetation, dry thickets, forests (800–1,850 m a.s.l.) (KIRIKA et al. 2017, FARKAS et al. 2023). The current record is from somewhat higher elevation (1,950–2,100 m a.s.l.).

Coccocarpia adnata Arv.

Tanzania: 89217/EB (VBI 6255 – no lichen substances detected [2402/A16])

This rare corticolous, ramicolous species is known in East Africa from Kenya and Tanzania, also found in Mauritius, Indonesia and the Pacific Islands. It grows in dry sites and mangrove vegetation near sea level (SWINSCOW and KROG 1988, ALSTRUP and CHRISTENSEN 2006). The here reported specimen is from a dry site in higher elevation (880 m a.s.l.).

Dirinaria flava (Müll. Arg.) C. W. Dodge

Tanzania: 89217/AB (VBI 6256 – atranorin, divaricatic acid (?), terpenoid, ochraceous pigment, UV+ red [HPTLC 2402/A13, 2502/A3])

This rare, terricolous species is known in East Africa from Kenya and Tanzania, also found in Mozambique, and the Ascension Island. It grows innatural, open woodland, lava under shrubs, montane zone (1,000–1,700 m a.s.l.) (SWINSCOW and KROG 1988).

Dirinaria leopoldii (Stein) D. D. Awasthi

Tanzania: 89217/QQ (VBI 6257 – no HPTLC analysis, medullary red pigment +)

This rare, ramicolous species is known in East Africa from Kenya and Tanzania, also found in western, central and southern Africa, furthermmore in tropical and subtropical America. It is collected rarely, in shrubland (800–1,000 m a.s.l.) (SWINSCOW and KROG 1988). The current specimen was also found in a dry shrubland in Tanzania. Its conspicuous red pigment was observed in the medulla, the thallus is sorediate (Figure 14).

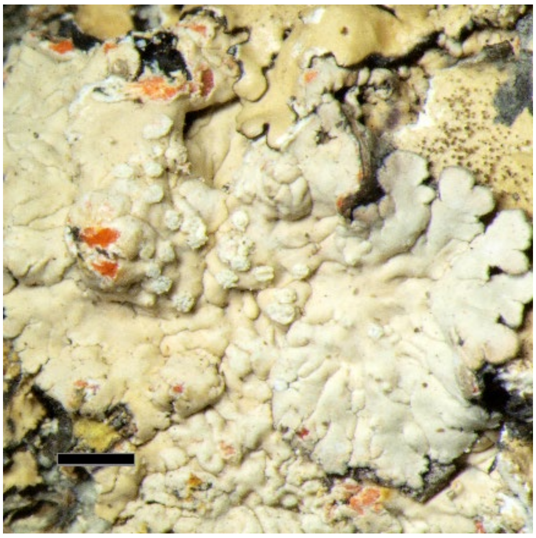

Figure 14. The thallus of *Dirinaria leopoldii* with soredia and medullary red pigment. Scale = 1 mm.

Dirinaria picta (Sw.) Clem. & Shear

Tanzania: 89217/EC (VBI 6258 – atranorin, divaricatic acid, terpenoids, fatty acid [2402/A17])

This common pantropical and subtropical ramicolous species is also known from all countries of East Afria. It grouw in shrubland (0–2,000 m a.s.l.) (SWINSCOW and KROG 1988, Alstrup et al. 2010).

Flavoparmelia caperata (L.) Hale

Tanzania: 90022/AB (VBI 6259 – usnic acid, protocetraric acid, caperatic acid [2402/B10])

This cosmopolitan species, well known from the temperate region, also found in all countries of East Africa from higher elevations (1,500–3,600 m a.s.l.). It is also found in artificial habitats, well lit sites, montane to low alpine forests (SWINSCOW and KROG 1988, KIRIKA et al. 2018, Farkas et al. 2023).

* ***Flavoparmelia pachydactyla*** (Hale) Hale

Tanzania: 90097/C (VBI 6260 – usnic acid, protocetraric acid [2025/A14, A15])

A very rare saxicolos species. Earlier konw from Kenya and Rhodesia (Zimbabwe). It was found in exposed sites (1,750 m a.s.l.) (HALE 1972, SWINSCOW and KROG 1988). The current specimen – consisting of several thalli (Figure 15) – was found in higher elevations up to 2,100 m a.s.l. as a new distribution record for Tanzania.

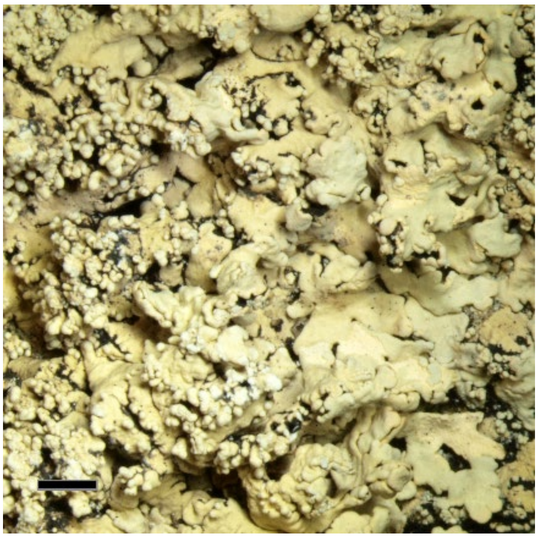

Figure 15. The thallus of *Flavoparmelia pachydactyla*. Scale = 1 mm.

Flavoparmelia soredians (Nyl.) Hale

Kenya: Ngong (VBI 6261 –usnic acid, stictic acid, salazinic acid [2304/A4])

This common East African species is found in Kenya, Tanzania and Uganda. It is also known from Southern Africa, Europe, South America and New Zealand. It grows on various substrates (corticolous, lignicolous, saxicolous), also in artificial habitats, well lit sites, lower montane–lower alpine xerotropical upland, orotropical montane, orotropical bamboo, orotropical cloud forests (1,100–2,900 m a.s.l.) (SWINSCOW and KROG 1988, KIRIKA et al. 2018).

Heterodermia speciosa (Wulfen) Trevis.

Tanzania: 89192/C (VBI 6262 – atranorin, zeorin [2402/A3]); 90008/P (VBI 6263 – atranorin, zeorin terpenoids [2402/B3; 2502/A9, A10, A11])

This commmon, cosmopolitan, corticolous (*Schinus molle*) and (saxicolous) species was known also from all countries af East Africa. It was found on sheltered sites, in both natural and artificial habitats (1,100–3,600 m a.s.l.) (SWINSCOW and KROG 1988, CZECZUGA et al. 1992, ALSTRUP et al. 2010).

** ***Hypogymnia subobscura*** (Vain.) Poelt

Tanzania: 90031/U (VBI 6264 – atranorin, oxphysodic acid, protocetraric acid [2402/B17, 2502/A13])

This saxicolous or terricolous species is better known from cooler regions of Europe (POELT 1962, HANSEN and MCCUNE 2010) and Norh America (GOWARD et al 2012, Brodo 2016). It is characterised by black mottling over the upper surface, a tendency to turn chestnut brown in high light, lobes (0.5-1.7 mm wide) often black bordered; lobe tips often sparsely perforate with a single small hole, medulla hollow; the cavity has a white medullary ceiling, and the frequent presence of laminal and or terminal lobules and subspherical isidia (Figure 16). New distribution record for Tanzania (Kilimanjaro Mts, 3,580 m a.s.l.) and East Africa.

Figure 16. The thallus of *Hypogymnia subobscura*. Scale = 1 mm.

Hypotrachyna densirhizinata (Kurok.) Hale

Tanzania: 89194/RB (VBI 6265 – atranorin, alectoronic acid [2402/A8]

This common species is known form all countries of East Africa and also occurs in Central and South America and West Indies. It is corticolous, lignicolous, muscicolous, humicolous / saxicolous, grows in open sites, upper montane–ericaceous zone (2,600–above 4,000 m a.s.l.) (SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999, ALSTRUP et al. 2010).

Hypotrachyna laevigata (Sm.) Hale

Tanzania: 89186/AN (VBI 6266 – atranorin, barbatic acid, 4-O-demethyl barbatic acid [2401/B17]

This species is known from all countries of East Africa and common locally. Also found in the Americas, Europe and New Zealand. It is muscicolous, corticolous, ramicolous, gorw in well-lit sites in the submontane–ericaceous–subalpine zone (1,600–3,400 m a.s.l.) (SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999).

* ***Hypotrachyna microblasta*** (Vainio) Hale

Tanzania: 89217/AA, QA (VBI 6267, 6268 – atranorin, usnic acid, barbatic acid (?), (galbinic acid) [2402/A12, A14-15, 2502/A2, A4])

From East African countries so far it was known only from Kenya, and also know from tropical America, the West Indies and Southeast Asia. It is corticolous in lower montane forest (1,850–2,000 m a.s.l.) (SWINSCOW and KROG 1988). The current record is ramicolous on *Xerophyta scabrida* and found in a relatively low elevation at 800 m a.s.l. (Figure 17). It represents a new distribution record for Tanzania.

Figure 17. The thallus of *Hypotrachyna microblasta*. Scale = 1 mm.

Hypotrachyna orientalis (Hale) Hale

Tanzania: 89194/APA, APB, M, BBA, BBB (VBI 6269–6973 – atranorin, barbatic acid, 4-O-demethyl barbatic acid [2402/A4-5, A9-11])

This common species is known from all East African countries and is also found in Asia. It is corticolous, ramicolous, lignicolous, muscicolous, saxicolous in ericaceous, montane–alpine forests (2,000–4,100 m a.s.l.) (SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999, ALSTRUP et al. 2010).

Hypotrachyna sorocheila (Vain.) Divakar, A. Crespo, Sipman, Elix & Lumbsch

Tanzania: 89149/U (VBI 6274 – atranorin, salazinic acid [2401/B5])

This common species is known form all East African countries, found also in South America, Madeira, Asia (Indian Himalaya only), New Zealand. It is corticolous, ramicolous, (terricolous/saxicolous), muscicolous, humicolous in montane–ericacous–lower alpine zone (2000–above 4000 m a. s. l.) (SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999, KIRIKA et al. 2016).

Hypotrachyna vexans (Zahlbr. ex W.L. Culb. & C.F. Culb.) Divakar, A. Crespo, Sipman, Elix and Lumbsch

Tanzania: 90030/U (VBI 6275 – atranorin, salazinic acid [2402/B12])

From East African countries it is found in Kenya and Tanzania. It is also known from Central and South America and Asia. It is a locally common, corticolous species and was know to grow in lower montane forest (1,800–2,100 m a.s.l.) (SWINSCOW and KROG 1988, ALSTRUP et al. 2010, KIRIKA et al. 2016). The current record is saxicolous in high elevation (3,550 m a.s.l.) of Kilimanjaro Mts.

* ***Montanelia* cf. *disjuncta*** (Erichsen) Divakar, A. Crespo, Wedin and Essl.

Tanzania: 90031/O (VBI 6276 – (atranorin), perlatolic acid [2402/B16]

This saxicolous species was originally known form Mt Kenya (Kenya) from East Afrca. It was found in alpine–subnival zone (3,350–4,430 m a.s.l.) (FRISCH and HERTEL 1998, FRISCH 1999). The current record (Figure 18) was found in similarly high elevations in the Kilimanjaro Mts., representing a new distribution record for Tanzania.

Figure 18. The thallus of *Montanelia disjuncta*. Scale = 1 mm.

Pannaria pannosa (Sw.) Nyl., syn.: *Parmeliella pannosa* (Sw.) Müll. Arg.

Tanzania: 89160/M (VBI 6277 – no secondary lichen metabolite detected (black unidentified at atranorin height) [2401/B14])

This pantropical, subtropical.corticolous species is fairly common in East Africa and found in Kenya, Tanzania and Uganda. It grows in various forests in montane tosubalpine zone (1,100–3,400 m a.s.l.) (SWINSCOW and KROG 1988, ALSTRUP and CHRISTENSEN 2006).

Parmotrema andinum (Müll. Arg.) Hale

Tanzania: 89031/E; 89180/S, 90097/N (VBI 6278–6280 – lecanoric acid [2401/A14-15]; atranorin, lecanoric acid [2401/B16; 2501/B17])

This common corticolous (saxicolous) species is known from all countries of East Africa, found also in South America and Asia. It grows in dry, well-lit sites, open hillsides, parks, gardens and woodlands (900–2,454 m a.s.l.) (SWINSCOW and KROG 1988, Alstrup et al. 2010, Farkas et al. 2023). One of the current records was somewhat lower elevation at 560–700 m a.s.l. in miombo vegetation in Tanzania.

Parmotrema araucariarum (Zahlbr.) Hale

Tanzania: 90021/AP (VBI 6281 –(atranorin), fatty acid [2402/B5])

This very rare corticolous species was known in East Africa from Kenya and Tanzania. It was also found in South America. It grows in montane forest (2,000–2,100 m a.s.l.) (SWINSCOW AND

KROG 1988, ALSTRUP et al. 2010, FARKAS et al. 2023). In case of the current specimen from Kilimanjaro it was collected from higher elevation (2,560 m a.s.l.) than earlier.

Parmotrema austrosinense (Zahlbr.) Hale

Kenya: Makueni; Tanzania: 89027/AU, 89157/Y (VBI 6282–6284 – atranorin, lecanoric acid [2304/A13, A15, A17; 2401/A8]; chloroatranorin, atranorin, zeorin terpenoid, lecanoric acid [2401/B10])

This common,corticolous (saxicolous) species is known from all East African countries. It is pantropical, and also found in the temperate regions. It grows in well-lit, natural and artificial sites (1,000–3,000 m a.s.l.) (SWINSCOW and KROG 1988, ALSTRUP et al. 2010, FARKAS et al. 2023). Here it is reported from further localities from Kenya and Tanzania.

Parmotrema crinitum (Ach.) M. Choisy

Tanzania: 90022/AA (VBI 6285 – atranorin, stictic acid, constictic acid [2402/B6]

This fairly common, corticolous, (terricolous/saxicolous) species is known in East Africa from Kenya, Tanzania and Uganda. It is pantropical, found also in the subtropics. It grows in mist-affected woodland in montane to ericaceous zone (1,400–3,400 m a.s.l.) (SWINSCOW and KROG 1988, ALSTRUP et al. 2010).

Parmotrema cristiferum (Taylor) Hale

Tanzania: 89031/ABA (VBI 6286 – atranorin, salazinicic acid [2401/A10]

This rare, corticolous species is known in East Africa from Kenya, Tanzania and Uganda. It is pantropical, found also in the subtropics. It grows in dry or mist-affected lowland areas (300–1,450 m a.s.l.) (SWINSCOW and KROG 1988).

Parmotrema eunetum (Stirton) Hale

Kenya: Makueni; Tanzania: 89031/ABB (VBI 6287, 6288 – atranorin, gyrophoric acid [2304/A11, A14]; atranorin, gyrophoric acid, 2 fatty acid [2401/A11]

This common, corticolous (saxicolous) species is known from all East African countries. Furthermore it is found in West Africa, Asia and West Indies. It grows in mist-affected inselbergs, montane forests in low alpine zone (1,600–3,800 m a.s.l.) (SWINSCOW and KROG 1988, FARKAS et al. 2023).

Parmotrema hababianum (Gyelnik) Hale

Kenya: Makueni, Ngong (VBI 6289, 6290 – atranorin, alectoronic acid, α-collatolic acid [2304/A7, A16]

This common, corticolous, ramicolous species is known from all East African countries. It is found also in Asia, North and South America. It grows in dry, well-lit habitats in montane zone (800–2,650 m a.s.l.) (SWINSCOW and KROG 1988, KIRIKA et al. 2018, ALSTRUP et al. 2010, FARKAS et al. 2023).

Parmotrema lobulascens (J. Steiner) Hale

Tanzania: 89147/M, 90022/P, 89194/RA (VBI 6291–6293 –atranorin, alectoronic acid, α-collatolic acid [2401/B3, 2402/A7, B7]

This common, corticolous, muscicolous, ramicolous, saxicolous, lignicolous species is known from all East African countries. It is know also from South and West Africa and Asia. It grows in wet sites in montane–alpine zone (1,800–4,180 m a.s.l.) (SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999).

Parmotrema nilgherrense (Nyl.) Hale

Tanzania: 89053/K, 89165/P (VBI 6294, 6295 –atranorin, α-collatolic acid, alectoronic acid, [2401/A16, B15])

This common, corticolous, saxicolous, lignicolous species is known from all East African countries and Asia.It grows in montane–ericaceous–alpine zone (2,000–above 4,000 m a.s.l.) (SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999, ALSTRUP et al. 2010, FARKAS et al. 2023).

* ***Parmotrema pilosum*** (Stizenb.) Krog and Swinscow

Tanzania: 90008/N (VBI 6296 – (atranorin), stictic acid [2402/B4])

This fairly common, corticolous, saxicolous species is known in East Africa from Kenya, Etthiopa and Uganda. It was found also in South Africa, South America and Australia. It grows in well-lit sites, solitary trees, artificial habitats in submontane to montane zone (1,300–2,000 m a.s.l.) (SWINSCOW and KROG 1988). Its collection from Kilimanjaro Mts (Figure 19) represents a new distribution record for Tanzania.

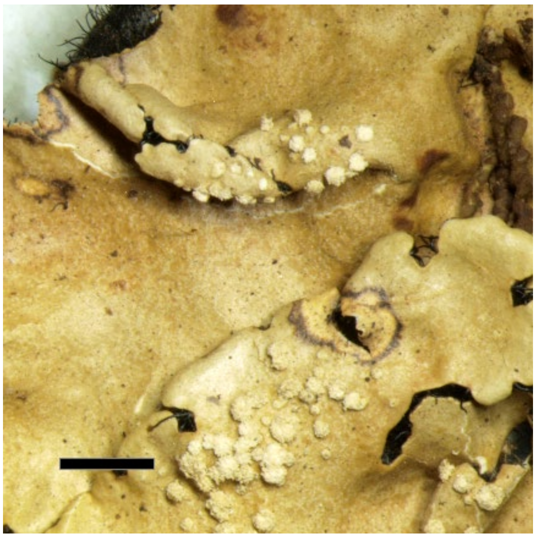

Figure 19. The thallus of *Parmotrema pilosum*. Scale = 2 mm.

Parmotrema poolii (C.W. Dodge) Krog and Swinscow

Tanzania: 89031/AP (VBI 6297 – atranorin, alectoronic acid, α-collatolic acid [2401/A13])

This rare, corticolous, saxicolous species is known in East Africa from Kenya and Tanzania. It is known also from Madagascar, Asia and Australia. It grows in submontane–montane forest (900–2,300 m a.s.l) (SWINSCOW and KROG 1988).

Parmotrema praesorediosum (Nyl.) Hale

Tanzania: 90031/F (VBI 6298 – atranorin, caperatic acid [2501/B14])

This rare, corticolous, saxicolous species is known from all East African countries. It is pantropical and found also in the southern temperate regions.It grows in fairly dry, well-lit sites in lowland–montane zone (700–1,800 m a.s.l) (SWINSCOW and KROG 1988). The here reported collection from the Kilimanjaro Mts was found in high elevation (3,580 m a.s.l.).

Parmotrema reticulatum (Taylor) M. Choisy

Kenya: Ngong; Tanzania: 89005/H,: 90022/M (VBI 6299–6301 – atranorin, salazinic acid [2304/A8-9; 2401/A5; 2402/B8; 2025/A12])

This common, corticolous, saxicolous, terricolous species is known from all East African countries. It is pantropical and found also in the temperate regions. It grows in natural, artificial habitats, submontane–subalpine forest (1000–3000 m a.s.l.) (SWINSCOW and KROG 1988, ALSTRUP et al. 2010, KIRIKA et al. 2018, FARKAS et al. 2023).

Parmotrema subschimperi (Hale) Hale

Tanzania: 89002/Z, 89011/B, 89158/D, 89224/CLA (VBI 6302–6305 – atranorin, norstictic acid, gyrophoric acid [2401/A2], atranorin, gyrophoric acid [2401/A9; 2402/B2, 2502/A8]; gyrophoric acid 2401/B11])

This common, corticolous, saxicolous, muscicolous species is known from all East African countries. It grows in more or less shady sites, montane forests in low alpine zone (1,800–above 4,000 m a.s.l.) (HALE 1972, SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999). One of its current record was collected in lower elevations (at 1,000–1,300 m a.s.l.) in Morogoro Region, Tanzania.

Parmotrema subisidiosum (Müll. Arg.) Hale

Tanzania: 89194/APC, 90022/T (VBI 6306, 6307 – atranorin, salazinic acid [2402/A6]; atranorin, fatty acid, salazinic acid [2402/B9])

This common, corticolous, saxicolous species is known from all East African countries. It is pantropical and found also in the temperate regions. It is found in mist-affected woodland and montane forest (1,800–2,400 m a.s.l.) (SWINSCOW and KROG 1988).

Parmotrema tinctorum (Nyl.) Hale

Tanzania: 89031/AK, 89217/QB, EA (VBI 6308–6310 – atranorin, lecanoric acid [2401/A12]; atranorin, ?, lecanoric acid [2502/A5,A6, A7])

This common, corticolous, saxicolous species is known from all East African countries. It is pantropical and found also in the temperate regions. It grows in mangroves, coastal hills, well-lit upland habitat (c. 2,700 m a.s.l.) (SWINSCOW and KROG 1988, FARKAS et al. 2023). The current records were collected in lower elevations (880–1,600 m as.l.) in the Arusha and Morogoro Regions, Tanzania.

Phaeophyscia confusa Moberg

Tanzania: 89011/J (VBI 6311 –no lichen secondary metabolite detected [2401/A6])

This locally common, predominanty corticolous species is known from all countries of East Africa, found in open sites, wayside trees, woodland, montane–supalpine zone (1200–3500 m a.s.l.). (SWINSCOW and KROG 1988, FARKAS et al. 2023).

Phaeophyscia endococcinodes (Poelt) Essl.

Tanzania: 89149/Z (VBI 6312 – skyrin yellow pigment, terpenoids [2401/B4])

This saxicolous, muscicolous, humicolous species is locally common in East Africa, found also in North America, Asia and New Zealand. It grows in exposed to shady, wet sites, at riversides, in montane to alpine zones (1500–4450 m a.s.l.) (SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999).

Phaeophyscia hispidula (Ach.) Essl.

Tanzania: 90096/O (VBI 6313 – no lichen secondary metabolite detected [2501/B15])

This farily common pantropical, subtropical, corticolous, (saxicolous, terricolous/muscicolous) species is known from all countries of East Africa. It grows in shady sites at submontane–subalpine elevations (1500–3050 m a.s.l.) (SWINSCOW and KROG 1988, KIRIKA et al. 2018). This Tanzanian specimen was collected from rocks.

Physcia erumpens Moberg

Kenya: Makueni (VBI 6314 – atranorin, zeorin [2304/B3]; atranorin, divaricatic acid, zeorin, terpenoids [2304/B4])

This common, predominanty corticolous species is known from all countries of East Africa, dstributed in South Africa, SW North America, Mexico, South America, SE Asia, Australia and New Zealand. It grows from the coastal regions to the lowland–subalpine zone (0–3100 m a.s.l.) (SWINSCOW and KROG 1988, PHYSCIA ERUMPENS 2025a, b).

Physcia poncinsii Hue

Kenya: Ngong (VBI 6315 – atranorin, zeorin [2304/A3])

This common, corticolous, ramicolous, saxicolous species is known from all East African countries. It is known other parts of Africa, from Madagascar, La Reunion andSouth Africa. Furthermore it occurs in the Americas, SE Asia, Australia and New Zealand, a tropical, subtropical species growing in montane zones (1,000–2,400 m a.s.l.) (SWINSCOW and KROG 1988, ALSTRUP et al. 2010, PHYSCIA PONCINSII 2025).

Physcia undulata Moberg

Kenya: Ngong (VBI 6316 – atranorin, zeorin, terpenoids [2304/A5-6])

This locally common corticolous, ramicolous species is known form Ethiopia and Kenya from East Africa, also from West and South Africa, Madagascar, the Americas, Australia, New Zealand. Earlier it was found in open sites in lowland to subalpine zone (500–3000 m a.s.l.)(SWINSCOW and KROG 1988, PHYSCIA UNDULATA 2025). The current record was collected from rocks in the Ngong Hill, Kenya.

Polyblastidium japonicum (M. Satô) Kalb

Tanzania: 89145/AB (VBI 6317 – atranorin, zeorin, terpenoids [2401/A17-B2])

This common corticolous, muscicolous, ramicolous (on *Erica arborea*, *Senecio keniodendron*) species found in Africa, all countries in East Africa, also in Asia and New Zealand (SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999, ALSTRUP et al. 2010, KIRIKA et al. 2018, FARKAS et al. 2023). It grows in open stites up to the upper alpine zone (1,800–4,200 m a.s.l).

Polyblastidium microphyllum (Kurok.) Kalb, syn.: *Heterodermia microphylla* (Kurok.) Skorepa

Tanzania: 89160/P (VBI 6318 – atranorin, zeorin, terpenoids [2401/B12-13])

This common corticolous and more seldom saxicolous species was previously found from East Africa in Ethiopia, Kenya and Tanzania. Known also in South Africa, South America, Asia, Australia and New Zealand (SWINSCOW and KROG 1988, ALSTRUP et al. 2010, MONGKOLSUK et al. 2015, Kirika et al. 2018). It grows on wayside trees, lowland to montane forests (10–3,000 m a.s.l.). This record was found on rocks in Tanzania.

Pseudocyphellaria argyracea (Delise) Vain.

Tanzania: 89224/CLB (VBI 6319 – lichen metabolites were not analysed)

It is widespread corticolous, ramicolous, muscicolous, terricolous, lignicolous, seldom saxicolous species in the tropics, from East Africa known and widely collected form the Comoro Islands, Madagascar and Tanzania, but has fewer records from Kenya and Uganda. It grows in damp, shady sites in montane forests, mist-affected woodland (500–2,300 m a.s.l) (SWINSCOW and KROG 1988). It was confirmed from Kenya by Kaasalainen et al. (2021a), from Tanzania by FARKAS (2003), ALSTRUP and CHRISTENSEN (2006) and the current collection.

Pseudocyphellaria dozyana (Mont. and v.d. Bosch) D.J. Galloway

Tanzania: 90022/OA (VBI 6320 – fatty acid, terpenoid [2402/B11])

It is a predominantly paleotropical species with scattered records, but wide distribution, but found also in the Galapagos Island in Eastern Pacific and Ecuador, furthermore from Cuba and Jamaica (PSEUDOCYPHELLARIA DOZYANA 2025). Corticolous on living and dead treas and shrubs in primary and secondary rainforest (550–2000 m a.s.l.) (GALLOWAY 1994). Earlier East African records were known from Tanzania (FARKAS 2003). The current record from Kilimanjaro grows in somewhat higher elevation (at 2,600 m a.s.l.) in ericacous heath.

Punctelia stictica (Duby) Krog

Kenya: Ngong (VBI 6321 – gyrophoric acid [2304/A2])

This very rare saxicolous species is known in East Afroca from Ethiopia and Kenya, also form other parts of Africa, furthermore from Europe, and the Americas. It occurs in subalpine–alpine zones (3,250–4,100 m a.s.l.) (SWINSCOW and KROG 1988).

Pyxine convexior (Müll. Arg.) Swinscow and Krog

Kenya: Makueni (VBI 6322 – (atranorin) 2304/A12

In East Africa it has been found very rarely in Kenya and Tanzania on bark in partial shade (1,000–1270 m a.s.l.) (SWINSCOW and KROG 1988). Confirmed by this current record from Kenya. It occurs also in Australia.

Ramalina africana (Stein) C.W. Dodge

Kenya: Makueni (VBI 6323 – 2304/A10 (usnic acid), sekikaic acid, norstictic acid

This corticolous species is known also from South America and Asia. It is common in East Africa in both natural and artificial habitats at dry, exposed, sunny places (800–2,700 m a.s.l.) (SWINSCOW and KROG 1988). Confirmed from the Kenyan Ngong District (near Kajiado – ALSTRUP et al. 2010) and from Makueni County (at Sultan Hamud) by the current record.

Umbilicaria cinereorufescens (Schaer.) Frey

Tanzania: 90030/M (VBI 6324 – (norstictic acid), gyrophoric acid [2402/B13])

This saxicolous species grows in Europe, Greenland, North America. It is fairly common in East Africa at exposed sites, in alpine–upper alpine zone (3,350–4,600 m a.s.l.) (SWINSCOW and KROG 1988) Confrimed from Mt. Kenya at the end of 1990s (FRISCH and HERTEL 1998, FRISCH 1999) and from Tanzania by the current record.

Umbilicaria umbilicarioides (Stein) Krog and Swinscow

Tanzania: 90031/TA (VBI 6325 – norstictic acid [2402/B15])

This common saxicolous species is known from South Africa, Zaire (Congo), Patagonia and the antarctic region. In East Africa it grows at sligthly eutrophicated sites in the ericaceous–alpine zone (3,350–4,600 m a.s.l.) (SWINSCOW and KROG 1988). Confirmed from Mt. Kenya at the end of 1990s (FRISCH and HERTEL 1998, FRISCH 1999) and from the Kilimanjaro Mts by current record.

*** *Usnea aristata*** Mot.

Tanzania: 89149/UA (VBI 6326); 89194/BBC (VBI 6327 – usnic acid, fumarprotocetraric acid [2502/A17])

MOTYKA (1961) described this very rare corticolous, ramicolous species from Kenya, also know from Ethiopia. It grows in montane–ericaceous zone (3,000–3,500 m a.s.l.) (MOTYKA 1961, SWINSCOW and KROG 1988), and the here identified specimen (Figure 20) represents a new distribution record for Tanzania.

Figure 20. The thallus of *Usnea aristata*. Thicker main branches and fine, tapering branches with soredia, isidiate soredia and fibrils (left). Blackening basis (right). Scales = 1 mm.

Usnea bornmuelleri J. Steiner

Kenya: Makueni 2000 (VBI 6328 – usnic acid, protocetraric acid [2304/B2])

It is known from East, Central and West Africa mostly from montane and low alpine zone (2,400-4200 m a.s.l.), however, this record originates from somewhat lower elevation from Kiou Hill, Kenya (SWINSCOW and KROG 1976, 1988). Its analgesic role was reported recently from the same collection (KANYUNGULU and FARKAS 2025)

Xanthoparmelia africana Hale

Tanzania: 90031/T; 89149/E, 89151/B (VBI 6329–6331 – usnic acid, salazinic acid [2402/B14, 2304/B14, 2401/B6, B8-9])

It is known from Eastern and Southern Africa in the alpine zone (3,400–4,300 m a.sl.) (SWINSCOW and KROG 1988, FRISCH and HERTEL 1998, FRISCH 1999, HALE 1990, FARKAS et al. 2023)

Xanthoparmelia kiboensis (Dodge) Krog and Swinscow

Tanzania: 89151/E (VBI 6332 – usnic acid, salazinic acid [2401/B7]

Known from countries of East Africa: Ethiopia, Kenya, Tanzania, Uganda (SWINSCOW and KROG 1988, HALE 1990). It grows on rocks, mosses and soil in higher elevation in the ericaceous and alpine zones from 3,000 to 5,000 m a.s.l.

* ***Xanthoparmelia phaeophana*** (Stirton) Hale

Tanzania: 89027/AQ (VBI 6333 – usnic acid, succinprotocetraric acid/fumarportocetraric acid (protocetraric acid) [2401/A7])

It is widely spread in Africa (HALE 1990), known from Ethiopia, Kenya and Uganda from East Afrrica (SWINSCOW and KROG 1988). The here presented specimen (Figure 21) is a new distribution record for Tanzania.

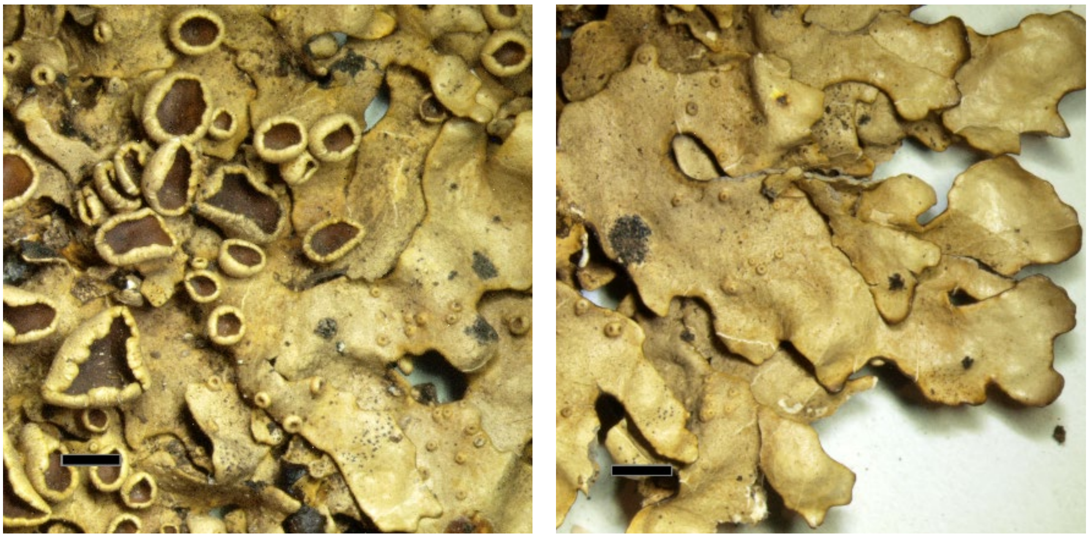

Figure 21. The thallus of *Xanthoparmelia phaeophana*. Scale = 2 mm.

Xanthoparmelia tinctina (Maheu and A. Gillet) Hale

Tanzania: 89002/X, 89004/AB (VBI 6334, 6335 – usnic acid, salazinic acid [2401/A3-A4])

It is a widespread species in the tropics and warm temperate regions. It has a relatively recent record from Tanzania (ALSTRUP et al. 2010).

New distribution records were established for 57 lichen species in East Africa. Seven species: *Flavoparmelia pachydactyla* (Hale) Hale, *Hypogymnia subobscura* (Vain.) Poelt, *Hypotrachyna microblasta* (Vainio) Hale, *Montanelia disjuncta* (Erichsen) Divakar, A. Crespo, Wedin and Essl., *Parmotrema pilosum* (Stizenb.) Krog and Swinscow, *Usnea aristata* Mot. and *Xanthoparmelia phaeophana* (Stirton) Hale are new for Tanzania. *Hypogymnia subobscura* (Vainio) Poelt is a new distribution record also for East Africa.

5.4. Traditional knowledge studies

Semi-structured interviews were conducted in 4 study areas in Kenya (Figure 9, Appendix 4, 45) and citizens of these areas (both urban and rural) from different age groups were interviewed on their understanding of the biological nature and morphology of lichens, their habitats, their use and possible applications (KANYUNGULU and FARKAS 2025). Subsequently, conservation ways of nature and lichens were also discussed and if people thought lichens to be threatened, possible ways of conservation were also asked.

Concerning the general knowledge on lichens, only two respondents (Resp. 37 and 57, Appendix 4) mentioned the "symbiotic relation" of the partners in lichens. Some regarded them fungi (Resp. 20, Appendix 4), algae or mosses (Resp. 36, Appendix 4). Most often foliose forms were recognised as lichens, sometimes foliose and fruticose were both mentioned (Resp. 10 and 27, Appendix 3), and those living on leaves (foliicolous lichens – Resp. 28, Appendix 4) was only known by a forest warden, in age group 36–45. Their direct attachment to substrate without roots was mentioned in one case (Resp. 56, Appendix 4). In Narok the local name of lichens was known as "narara" with the meaning "part or extension of the bark" (Resp. 33 and 39, Appendix 4). Lichens belonging to cryptogamic organisms and being autotrophs was only known by an urban citizen with BA degree (Resp. 58, Appendix 4). Their ecological requirements, namely for microclimate and their extreme tolerancy was noted by a rural person of certificate and an urban biology teacher (Resp. 48 and 54, respectively, Appendix 4).

According to demographic results, few respondents (including the highest number of people between 18–25 years) from the urban locations had no basics of lichens and their conservation (Table 3, Appendix 5). This could be related to the lack of background knowledge in biology, the lack of exposure to natural ecosystems, or the lack of interest.At the same time, more respondents from rural areas had more knowledge on lichens and conservation (in total of knowledge groups little, medium and high) compared to urban respondents (Figure 22.). The results also depicted a proficiency in lichenology for most of the rural people which might be a result of access to natural ecosystems and the transfer of knowledge from forefathers on the use and conservation measures of surrounding environments. Most of the people in such areas treasure such knowledge and pass it to their following generations as wealth, especially the medicinal use of substances originating from various organisms including lichens (DEVKOTA et al. 2017, SUPYAN et al. 2021).

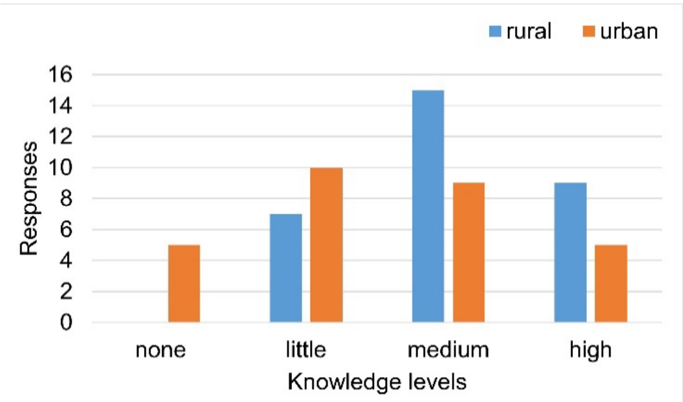

Figure 22. Responses about the knowledge of lichens from rural and urban sites within the study areas.

Traditional knowledge transmission to newer generations is a key to the preservation of cultures. Additionally, studies show that this wisdom is the basis of conservation, since there is a strong correlation between the knowledge of a particular plant species and conservation awareness (IBRAHIM et al. 2022, SUSANTO and NUMATA 2023). The transition is determined by the receptive nature of the new generation. As it has been established recently (SUPYAN et al. 2021), and confirmed also by the current results (Table 3), there is a gap between old and young regarding knowledge. According to the demographic relations of the analysis, the results show that the young seem to have a limited knowledge of ecosystems compared to their older generation that have proficiency in the same. This might be brought about by the digital era, modernization, and changing literacy trends. Concentrating on recent, novel matters can result in thedeclineof traditional knowledge. Most of the knowledge is concentrated in the age groups 26–35 and 36–45 with the highest level in 26–35 years. The age group 46 and above recorded the lowest numbers as most of them were not willing to share their knowledge due to busy schedules and only one had proficient knowledge of lichens and conservation. Fortunately their knowledge ranged from little to high with most of them having little to medium knowledge and no cases for lack of knowledge. This calls for integrating traditional and modern education in conserving both culture and the environment (HUNTINGTON 2018).

Table 3. Knowledge of lichens across different age groups in Kenya in the numbers of respondents (n=60).

Knowledge of lichens	**Age**			
	18–25	**26–35**	**36–45**	**46 and above**
None	5	0	0	0
Little	7	7	4	3
Medium	3	8	6	3
High	0	8	5	1

Knowledge, traditional or modern has a direct impact on the pro-environmental activities / behaviour and attitudes of a community (SUSANTO and NUMATA 2023). According to the research done (Figure 23), a few uneducated people know about the biological/symbiotic nature of lichens (cf. HAWKSWORTH and GRUBE 2020) and about conservation matters which might be related to traditional knowledge passed by their forefathers and their direct contact with the environment. However, several people with certificates (two) and bachelors (one) reported no knowledge on lichens. At the same time, there was no record of a lack of knowledge of lichens or conservation among uneducated people or postgraduates. In the case of the uneducated group, it was hypothesized that most of them live near the natural ecosystems and thus learn through apprenticeship from their parents; while the postgraduate knowledge would originate from their close to nature professional activity. According to ALBUQUERQUE et al. (2021) traditional knowledge and modern education have to find a point of convergence on the topic of conservation to maximize knowledge on the subject matter including lichens and increase awareness of pro-environmental activities.

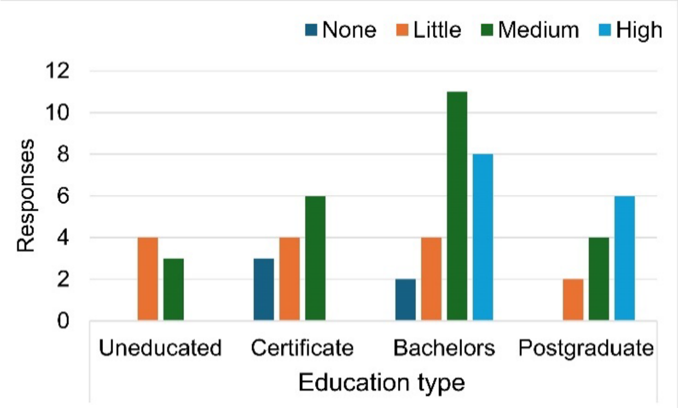

Figure 23. Knowledge of lichens across different literacy levels in Kenya.

Lichens, especially in Kenyan ecosystems and human life have diverse uses as shown in Table 4. Their use was region and environment-specific, for example, near conservation facilities (forests of Kakamega, Karura and Ngong), people could recognize the role of lichens in biodiversity, and as habitats for insects (Response 8 and 10, appendix 3), while in most of the rural areas, lichens are either passively collected with firewood or used independently to light and maintain the fire (Resp. 10, 24, 30, 34, 59, 51, Appendix 4, Figure 24). Among the maa groups in Narok County, lichens are used as dyes (e.g. hair dye – Resp. 34, Appendix 4) in some of the life passage rituals. A substantial number of people did not know about lichen uses, especially the age group of 18–25 (Appendix 5). Lichens were also regarded as having parasitic nature, especially those living on tree bark (corticolous ones) on specific valuable timber where according to the respondents, lichens (e.g., *Parmotrema austrosinense, P. eunetum, P. hababianum, P. reticulatum, Punctelia stictica, Pyxine convexior, and Ramalina africana* as identified by HPTLC) (Figure 25) were scraped off and burnt.

Table 4. The role of lichens known in Kenyan communities in the numbers of mentions by respondents.

Role of lichens	Respondents
Not aware	28
Lighting fire	11
Ecosystem diversity	10
Plant parasites	3
Dyes	3
Protect tree barks	2
Insect habitats	2
Bioindicators	2
Research	1
Medicinal use	1
Food for animals	1

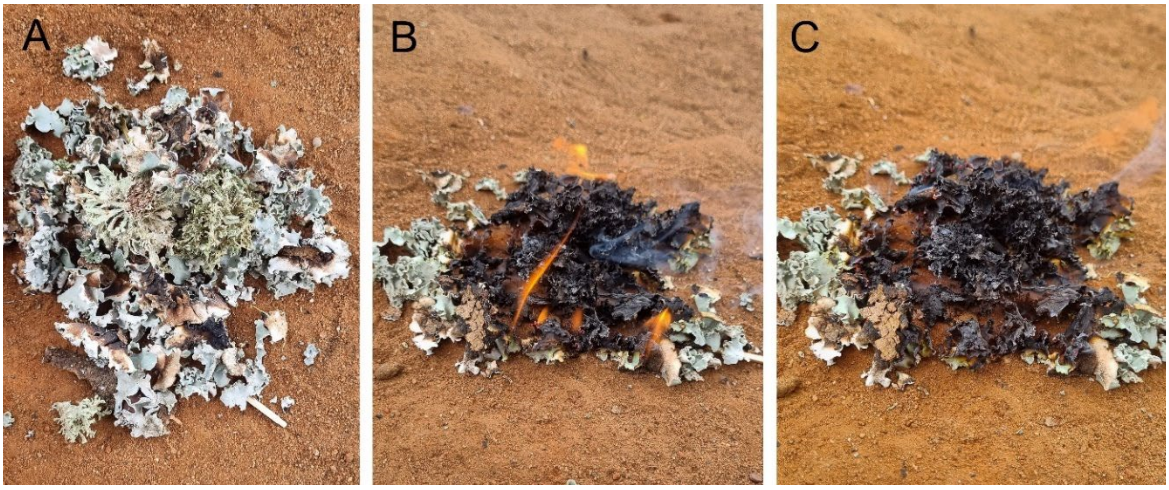

Figure 24. Lichens used to light fire, A, intact thalli of various lichen species, mostly *Parmotrema* species and *Ramalina africana* in the centre , B, an early moment with flames of the fire lit by dry thalli, C, burnt remnants of lichen thalli and smoke.

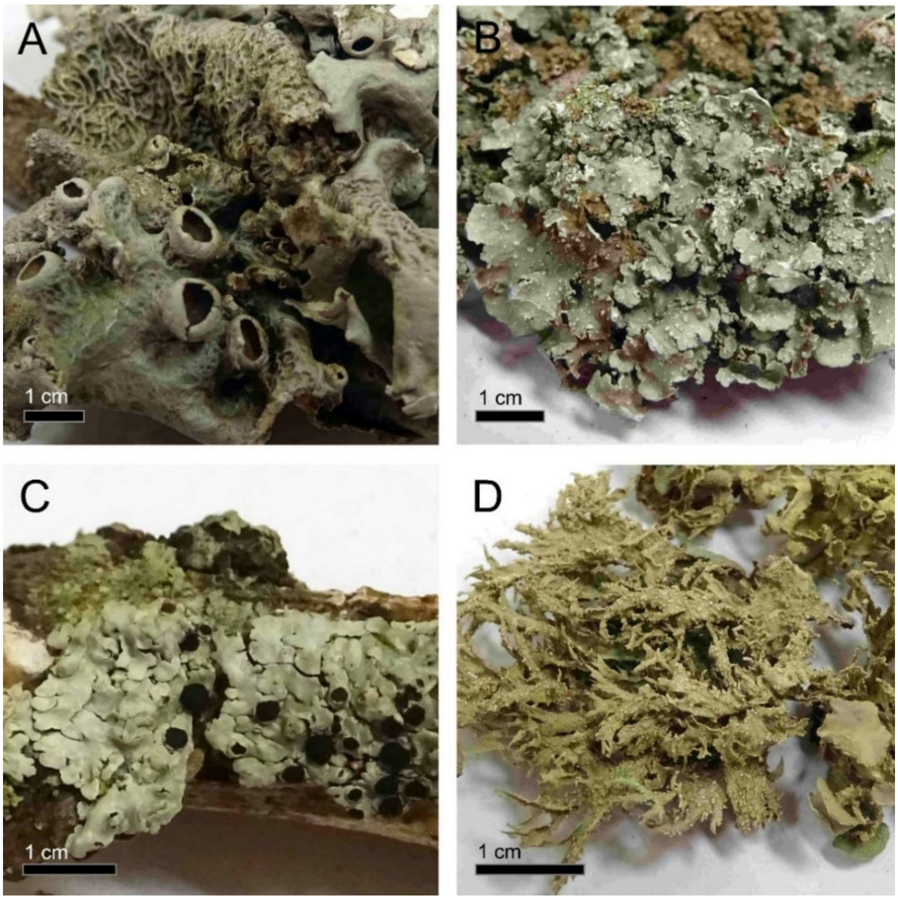

Figure 25. A few example of lichens used to light fire in Makueni study area*,* A*, Parmotrema eunetum*, B*, Punctelia stictica,* C, *Pyxine convexior*, D, *Ramalina africana*. Scales 1 cm.

Medicinal use of beard lichens (e.g., *Usnea bornmuelleri*, Fig. 26) was mentioned from Makueni county (Response 16, appendix 3) where the tradition still exists even in the past 2-3 decades. The thalli, collected from rock boulders, is ground into powder and mixed with tea or soup and the bitter liquid is taken against headaches. This effect of usnic acid, also present in the applied lichen, has been reported from *U. diffracta* (that contains also diffractaic acid) (NASH 2008, OKUYAMA et al. 1995) for analgesic effects).

The responses on the uses of lichens were recorded to investigate lichen uses in all age groups, while almost half of the respondensts were not aware of any roles. The results agree with opinions expressed by PEREIRA et al. (2020) and SUPYAN et al. (2021) who indicated a gap in awareness of nature by the young generations, however that (gap) can be filled by traditional knowledge (SUPYAN et al. 2021). The responses for the role of lichens in the four study areas revealed the great importance of the lichens, "the unsung giants" in nature that cut across from human use to natural biological indicators of pollution (Resp. 1 and 27, Appendix 4) (BERGAMINI et al. 2005, NASH 2008, SUTAR et al. 2021). Therefore conservation of lichens is justified by their multiple applications.

Figure 26. *Usnea bornmuelleri*, a lichen applied in tea against headache in Makueni study area, A, the habit of some thalli, B, a detail of a high performance thin layer chromatographic plate, used to identify lichen secondary metabolites from the thalli responsible for the alleviating effect. Scale 1 cm.

Conservation threats of lichens and their environment in the four study areas (Table 5, Column 8 in Appendix 5) were location-specific, driven by the geographical, climatic, consequently vegetational variation in Kenya and the varied communities in the areas. A threat to lichens might either affect their habitat or substrate, or their species (HOGUE and BREON 2022). The results (Table 5) show that the highest threats originate from human factors which were related to increase in population, agricultural activities, land grabbing and settling increase of Kenyan population

(NJUGUNA et al. 2016). Agricultural activities led the human factor category, since agriculture is the backbone of the Kenyan economy, agricultural activities cut across all the four counties. Climate change is coupled with events like floods, drought and unreliable weather patterns mentioned as the second highest threat to the four study areas (LAWRENCE et al. 2023). Although the climate change (ELLIS 2019) is hard to be controlled, protective measures can be introduced to reduce the future loss of lichens. Narok County led the challenge related to the lack of knowledge on threats of lichens. It can be explained by the following facts. Though the Maa communities have a good knowledge and awareness on their environment, the vast lands where they have their pastoral activities do not allow developing considerable knowledge on these cryptogamic organisms, rather on a few vascular ones, those they can use as herbs and dyes. Even more importantly, their focus might be on their cattle (which is the sole source of livelihood). Nairobi County's major threats came from human factors and industrialization. The increase in rural-urban migrations has increased the population in Nairobi county, thus more land is converted to built-up areas within the settlement at the expense of the habitats and conservation of species including the encroachment of Karura forest. From the research done, it was clear that the rise in industries, as the increasing influence of human factors, and climate change (Response 1, appendix 3) have a significant negative impact on lichen survival (NAEKU 2020, FRYDAY et al. 2022). Additionally, not knowing the threats of a species (e.g., lichen species) is a threat itself, since it can slow down conservation efforts by a community where conservation matters could be addressed when the species is almost extinct.

Table 5. The types of threats to lichens determined in different study areas by interviews of 60 respondents.

	Threats to lichens						
	A	B	C	D	E	F	
Kakamega	2	9	1	3	8	1	
Narok	5	2	0	2	1	0	
Nairobi	5	9	5	0	4	0	
Makueni	4	10	2	0	9	0	
Total	16	30	8	5	22	1	82
Percentage	20%	37%	10%	6%	27%	1%	

The number of mentions is given irrelevant to the number of respondents (n=82). Unaware of lichen threats (A), human factors (B) industrialization (C), unprioritized conservation efforts (D), environmental factors (E), invasive species (F)

Conservation is a way of protecting the treasures of a country including its living organisms. Responses collected represented effecting agents and the frequency of responses was expressed in the number of mentions regardless of the number of respondents (Fig. 19 and Column I, Threats to lichens in appendix 4). According to the results (Figure 27) setting laws that govern and penalties in case of breakage of any law, education on lichens, and conservation (NAEKU 2020) were proposed as leading factors to conservation gain. Two major bodies, Kenya Wildlife Services (KWS) and Kenya Forest Services (KFS), furthermore Forest Act 2016 having a role in conservation were mentioned by respondents (Resp. 6 and 28, Appendix 4). Habitat protection (Resp. 29, Appendix 3) where species thrive attracts attention from the government and the community surrounding any conservation facility (game reserves, national parks, protected forests and sanctuaries) in Kenya termed as friends of the specific facilities. The fact that a few people did not know about conservation, calls for attention to either the government of Kenya or ecologists to create a schedule for sensitizing its citizens and maybe include them in basic academic programs in schools (COCKERILL and HAGERMAN 2020). Kenya is a frequent target of tourism, and although much has been centralized on wildlife (mostly large mammals) conservation, especially in savannas and forests, in their habitats formed by higher plants further small living organisms and geological formations are highly protected for their survival.

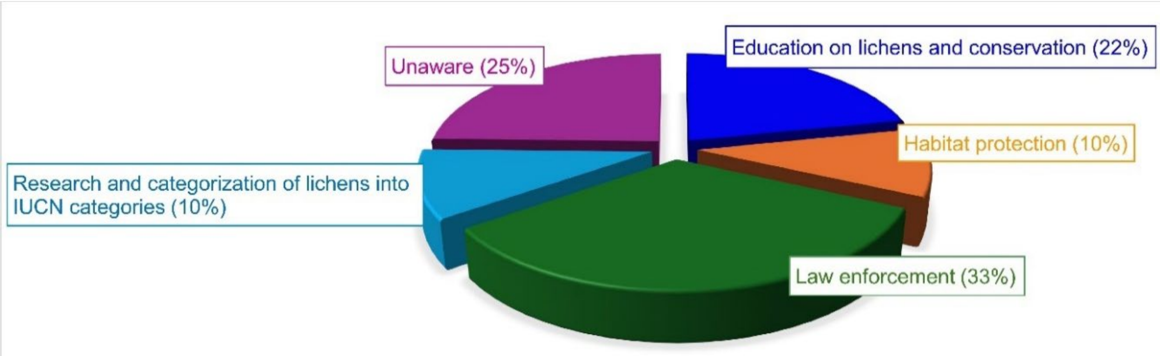

Figure 27. Knowledge on conservation-related matters of lichens.

5.5. Proposed Recovery Measures of Lichens from their Threats

According to the literature, Appendix_Tables 1–3, and results of bibliometric analysis, Figures 6 and 7, lichens are faced by threats that are mainly driven by climate change, air pollution, and human/anthropogenic impacts (KANYUNGULU and FARKAS 2026). In addition, Figures 2 and 5 show that there is uneven representation of research on lichen threats through a few authors and research concentrated in a few countries. The tentative recovery measures (Table 6) were therefore suggested as ways to sustain lichens globally in the environment. These are ther following:

1) Species and habitat protection by law, increase awareness, monitoring of protected and invasive species and important habitats, developing management practices.
2) Establishing the vulnerability of species by IUCN categories.
3) Revision of IUCN categories and improve the management practice accordingly.
4) Improvement of status assessment of species and its application.
5) Protection of endangered areas rich in epiphytes and terricolous species-rich lowland areas;

6) Placement-controlled industrialisation far from natural habitats and involvement of lichenologists in planning.

7) Translocation of populations and preservation of the quality of the adequate environment;

8) Implementing continuity-based substrate management to ensure the long-term availability of specific host trees.

Table 6. Threats, their influencing factors and proposed recovery measures that enhance lichen conservation.

Threats to lichen conservation	Factors influencing conservation challenges	Proposed recovery measures	References
Habitat destruction and shrinking	Forest and landuse management, policy and practices	Species and habitat protection by law, increase awareness, monitoring of protected and invasive species and important habitats, developing management practices	(NASCIMBENE et al. 2006, 2013, 2014a, LI et al. 2013, KUZEMKO et al.2016, GASPARYAN and SIPMAN 2016, MACEDA-VEIGA and GÓMEZ-BOLEA 2017, PAOLI et 2019, LÕHMUS et al 2019, CLUBBE et al. 2020, OLARIAGA et al 2020, MUELLER et al 2022, JÜRIADO et al 2022)
Industry	Decrease in population size due to urbanization	Establishing the vulnerability of species by IUCN categories	(HERRERA-CAMPOS et al. 2020)
	Economic growth and industrialization	Placement controlled industrialization far from natural habitats and involvement of lichenologists in planning	(WANG et al. 2019, WEI et al. 2020)
Erroneous conservation practice	Neglecting terricolous lichens and not including them in conservation policies	Improvement of status assessment of species and its application	(MCMULLIN 2019, GHEZA et al 2022, MCMULLIN and ALLEN 2022)
	Neglecting biodiversity hotspots and protected areas	Protection of endangered areas rich in epiphytes and terricolous species-rich lowland areas	MCMULLIN et al., 2014, GHEZA et al 2020
	Difficulties in establishing IUCN categories	Revision of IUCN categories and improve the management practice accordingly	(RAVERA et al 2016, GHEZA et al. 2018, LÜCKING et al 2020)
Global change, low population size	Vulnerability to ecosystem change caused by low population size	Translocation of populations and preservation of quality of the adequate environment	(SPARRIUS et al. 2017)
	Global environmental change	Applying global conservation activities / practices	(SCHEIDEGGER and GOWARD 2002, SCHEIDEGGER and WERTH 2009, SCHEIDEGGER and STOFER 2015, NARAYAN et al. 2023)

6. CONCLUSIONS AND RECOMMENDATIONS

Lichenological studies shows a gradual increase over the past three-four decades, as an answer to the global emphasis on biodiversity and climate change. Most of the studies are floristic works and taxonomic treatments, but research has also expanded to include lichens as bioindicators. The findings highlight potential areas of ecological interest and taxonomic complexity and may serve as a basis for biodiversity assessments, conservation planning, or further taxonomic revision. The diversity of genera like *Parmotrema* and *Hypotrachyna* warrants closer examination, while single-species genera present opportunities to explore rare or poorly known taxa. The category system – established here –can be extended to other geographical areas where a large amount of Data Deficient species are found. Further research is crucial in under-sampled regions and for understanding the impacts of environmental change. Collaboration among taxonomists, ecologists, and conservationists will be essential to advancing lichenological research and safeguarding Kenya's lichen heritage.

New records of Kenyan and Tanzanian species were identified and data of 57 species reported and evaluated, indicating that even the relatively well known East African region is far from fully explored. Seven species represent new distribution records for Tanzania. Additionally, *Hypogymnia subobscura* (Vainio) Poelt is a new distribution record for East Africa. Future field studies in countries of East Africa may result in a better knowledge of a wider distribution area of these and also other species.

Tentative recovery measures can be applied for the sustainable conservation of lichens. Effective responses highlighted for threats that cause lichen habitat loss through either pollution, climate change, or human impacts are the protection of critical habitats, maintenance of forest heterogeneity, reduction of anthropogenic disturbance, and systematic monitoring of invasive species (SCHEIDEGGER and GOWARD 2002, MUELLER et al. 2022). National and regional strategies, such as establishing protected areas and adapting land-use policy, remain central to safeguarding lichen diversity (KUZEMKO et al. 2016, NARAYAN et al. 2023).

Beyond habitat-related pressures, the lichen thallus is affected directly through air pollution, and heat and temperature stress from climate change effects, which can be solved through involvement of lichenologists in industrialisation planning and establishing industrial facilities away from nature reserves (WEI et al. 2020). Moreover, the bibliometric analysis outcome revealed two critical gaps. Firstly, collaboration remains limited, with only 23% of studies involving international co-authorship, suggesting that lichen research networks are still regionally centred (Appendix_Table 1 and Figure 3). Secondly, there is a geographical imbalance in contributions: most publications come from North America, Europe, and parts of East Asia, while presumed biodiversity-rich regions such as Africa, South America, and Southeast Asia are underrepresented (Figure 5). To address these gaps, recent literature calls for stronger integration of lichens into global biodiversity policy, refinement of IUCN assessments from all regions, and international collaboration that includes underrepresented regions. Even if we consider that conservation and redlisting (understanding that redlisting is not equal to protection by law) are local matters, since state governments create their own laws and redlisting must be the prior responsibility of local experts, the following international cooperation still can be introduced or increased: creating and incorporating general ideas, theories, contributing in identification of lichen taxa, selecting methods used in monitoring, restauration, applying instruments better available in more developed countries, adding that less developed areas should also do their best for increasing their knowledge and struggle for increasing governmental research budget for the necessary innovations. Such multidimensional and inclusive efforts are critical to ensuring the persistence of lichens in rapidly changing environments (LÜCKING et al. 2020).

The study of traditional knowledge shows a diverse pattern of knowledge by the various age groups, and literacy levels from urban and rural study areas and confirms evidence of unused local knowledge, traditions and applications among the Kenyan communities which are rapidly being eroded by modernisation and the development of academic knowledge. In order to prove the viability of a concept acquired in traditional knowledge, laboratory analysis should be involved as a recent possibility originating from modern education. Traditional knowledge must be documented, and its transmission to younger generations through oral or other means cannot be postponed. In addition to making the research and data collection process more effective, introducing a multi-disciplinary approach, the involvement of cultural anthropology (action anthropology) and its mediating role can also be of great help in this. However, to conserve lichen biodiversity in Kenyan hotspots, traditional and academic knowledge should be integrated. In addition, updating practical knowledge incorporated into the framework of formal education and coordinated with one's own environment can also be a forward-looking solution. The role of lichens should be better explained in regular education, and the awareness of the elderly needs to be increased and motivated. Furthermore, informing communities about alternative sources and energy can also be an effective solution, they should be sensitized on alternative sources of energy as most are over-collecting and destroying several tree species in the form of firewood, in extended rural areas, where forest trees represent substrate (bark and wood) for epiphytic lichens.

7. NEW SCIENTIFIC RESULTS: THESIS POINTS

The following new results were achieved:

1. An updated checklist of Kenya – consisting of 172 crustose and 553 foliose and fruticose taxa, altogether 725 taxa of lichen-forming and lichenicolous fungi – was compiled.

2. A conservation risk category system was established for Kenyan lichens and applied to 553 taxa (548 species and 5 varieties) of foliose and fruticose macrolichens.

3. New distribution records were established for 57 lichen species in East Africa. Seven species: *Flavoparmelia pachydactyla* (Hale) Hale, *Hypogymnia subobscura* (Vain.) Poelt, *Hypotrachyna microblasta* (Vainio) Hale, *Montanelia disjuncta* (Erichsen) Divakar, A. Crespo, Wedin and Essl., *Parmotrema pilosum* (Stizenb.) Krog and Swinscow, *Usnea aristata* Mot. and *Xanthoparmelia phaeophana* (Stirton) Hale are new for Tanzania. *Hypogymnia subobscura* (Vainio) Poelt is a new distribution record also for East Africa.

4. Evidence originating from Kenyan communities in Kakamega, Narok, Nairobi, and Makueni reveals a significant reservoir of unused local knowledge and traditions. While these applications remain culturally relevant, findings indicate they are undergoing rapid erosion due to the dual pressures of modernisation and the prioritisation of formal academic knowledge

5. The study established that nature conservation capacity is independent of formal literacy levels; instead, it is driven by a combination of traditional and educational knowledge. Data revealed that non- literate respondents possessed substantial conservation expertise required to be transferred to the younger generations.

8. SUMMARY

Kenya's diverse tropical ecosystems – from coastal mangroves and montane forests to alpine zones – support an extraordinary richness of lichens, yet these organisms receive little conservation concern and are thus increasingly threatened by accelerating environmental change. Lichen poikilohydric thalli absorb water and atmospheric substances directly, rendering them vulnerable to air pollution, shifts in humidity, changing precipitation regimes, and temperature extremes. In Kenya, expanding agriculture, forest degradation, land fragmentation, industrialisation, and changing climate patterns are already altering lichen habitats. Despite these escalating threats, lichens receive minimal attention in conservation policies, which traditionally prioritise larger plants and wildlife. At the same time, traditional ecological knowledge – once instrumental in guiding community understanding of ecosystems, including lichens – is rapidly eroding due to cultural transitions and modern education. To address the knowledge gaps in the field of conservation biology and conservation practice, the dissertation research aims were: 1). to analyse literature on lichen conservation for evaluating global research trends on threats to lichens, and for identifying drivers of threats to lichens and their shifts over time, various levels of threat, 2). to compile the updated lichen checklist of Kenya, 3). to establish a conservation risk category system for lichens in Kenya, 4). to identify lichens from East-African collections, 5). to explore traditional knowledge on lichens and its importance in the conservation of lichens in Kenya, 6). to find solutions and suggest proposals for conserving and/or recovering lichens under threat.

These aims were achieved applying various methods from bibliometric analysis (Biblioshiny R core package), light microscopic and chemical (high performance thin layer chromatography – HPTLC) analysis of lichen specimens to semistructured interviews of a combined biological and cultural anthropological study for revealing still existing traditional konwledge and attitudes necessary for successful conservation practice.

Based on the global bibliometric analysis, which analysed about four decades of scientific attention to lichen threats, the findings revealed a clear progression of concern from early air pollution studies to more recent focus on climate change, habitat degradation, nitrogen deposition, and anthropogenic pressures. Africa – despite its high biodiversity – remains underrepresented in the literature in lichenology and conservation biology. This geographic imbalance reflects limited research capacity.

To address the biodiversity of lichen species in Kenya, the study assembled an updated macrolichen checklist by synthesising historical records, especially from "*Macrolichens of East Africa*" by Swinscow and Krog (1988), recent literature, and herbarium collections. This effort resulted in an updated checklist of Kenya – consisting of 172 crustose and 553 foliose and fruticose

taxa, altogether 725 taxa of lichen-forming and lichenicolous fungi. Laboratory-based identification of Kenyan and East African specimens contributed with distribution records of 57 species from Kenya and Tanzania, including species newly reported from Tanzania and East Africa. These results confirm that the region's lichen flora remains significantly underexplored and highlight the importance of continued fieldwork to establish accurate taxonomic identifications.

A conservation risk assessment system was introduced for Data Deficienct species (in the sense of IUCN-category system) and applied on 548 macrolichens of Kenya. Given the absence of population monitoring data for most species, the system categorizes species according to rarity, geographic distribution, recency of collection, and habitat vulnerability. The assessment revealed that approximately seven percent of species are known only from historical type collections and may already be critically endangered. Roughly one-third were classified as significantly or moderately at risk, often restricted to narrow or endangered habitats. Only a small proportion were considered of negligible risk. This framework provides an urgently needed starting point for conservation planning and creates a reference for future Red List assessments. More broadly, it offers a model for evaluating data-deficient taxa in regions where fungal and lichen diversity remain poorly documented.

The study also explored the integration of socio-cultural dimensions through semi-structured interviews in four Kenyan counties. These interviews revealed that older community members retain notable familiarity with lichens – recognising their ecological roles, identifying habitats, or recalling medicinal uses such as applications of *Usnea* species. However, younger participants showed diminished knowledge, reflecting rapidly shifting cultural landscapes. The research found that conservation awareness does not depend solely on literacy; individuals with limited formal education often demonstrated strong ecological insight, contributed by daily interactions with their environment. Communities expressed concerns about environmental degradation and acknowledged that unsustainable firewood collection, agricultural expansion, and urbanisation indirectly threaten lichens by destroying substrates such as old-growth trees. Importantly, respondents emphasised the need for environmental education, alternative energy sources, and integration of local knowledge into conservation initiatives. This socio-cultural perspective reinforces the biological findings, demonstrating that both ecological and cultural losses threaten lichens and that conservation strategies must address both.

Thus, conservation of Kenyan lichens requires practical actions recommended by the research that include protecting lichen-rich habitats such as montane cloud forests, sacred groves, and old-growth woodlands, mitigating destructive land uses and involving lichenologists in environmental impact planning. The updated checklist, new distribution records, and risk assessment system provide foundational tools for monitoring and prioritising species. Continued collaboration between Kenyan and international researchers is essential for resolving remaining taxonomic uncertainties and expanding regional knowledge. The study also emphasizes the urgency of documenting traditional ecological knowledge before it disappears and incorporating it into modern conservation and education programs.

In conclusion, this dissertation represents a significant advancement for lichen conservation biology in Kenya. It offers an updated Kenyan lichen checklist of 725 taxa of lichen-forming and lichenicolous fungi, introduces a tailored conservation risk categorisation system, documents new distribution records, and demonstrates the crucial role of cultural knowledge in biodiversity conservation.

APPENDICES

Appendix 1: Bibliography

ABBAYES H. (1961): Lichens recoltes a Madagascar et a la Reunion (Mission H. des Abbayes, 1956). I. Introduction. II. Parmeliacees. In: *Mémoires de l'Institut Scientifique de Madagascar. Série B.,* 19 (2): 81–121.

ACTS (2016): The Forest Conservation and Management Act, 2016. No. 34 of 2016. *Kenya Gazette Supplement* 155 (Acts No. 34): 677–736. https://kenyalaw.org/kl/fileadmin/pdfdownloads/Acts/2016/No._34_of_2016.pdf

AGARWAL, K. (2025): Association of American Universities: Report Shows U.S. Still Leads the World in R&D – for Now (25 July 2025). Available online: https://www.aau.edu/newsroom/leading-research-universities-report/report-shows-us-still-leads-world-rd-now (accessed on 18 October 2025).

AGNELLO, G., MANNEVILLE, O. and ASTA, J. (2004): Mosses and lichens as bioindicators (s. l.) of wetlands state: Example of four protected areas in the Isère Department (France) [Mousses et lichens, bioindicateurs (s.l.) de l'état des zones humides: Exemples de quatre sites protégés du Département de l'Isère (France)]. In: *Revue d'Ecologie (La Terre et la Vie)*, 59: 147–162. https://doi.org/10.3406/revec.2004.6386

AHTI, T. and OKSANEN, J. (1990): Epigeic lichen communities of taiga and tundra regions. In: *Vegetation*, 86: 39–70. https://doi.org/10.1007/BF00045134

ALBUQUERQUE, U. P., LUDWIG, D., FEITOSA, I. S., DE MOURA, J. M. B., GONÇALVES, P. H. S., DA SILVA, R. H., DA SILVA, T. C., GONÇALVES-SOUZA, T. and JÚNIOR, W. S. F. (2021): Integrating traditional ecological knowledge into academic research at local and global scales. In*: Reg Environ Change,* 21 (2): 45. doi:10.1007/s10113-021-01774-2.

ALEIXANDRE-BENAVENT, R., ALEIXANDRE-TUDO, J. L., CASTELLÓ-COGOLLOS, L., and ALEIXANDRE, J. L. (2018): Trends in global research in deforestation. A bibliometric analysis. In: *Land Use Policy*, 72: 293–302. https://doi.org/10.1016/j.landusepol.2017.12.060

ALEIXANDRE-BENAVENT, R., ALEIXANDRE-TUDÓ, J. L., CASTELLÓ-COGOLLOS, L., and ALEIXANDRE, J. L. (2017): Trends in scientific research on climate change in agriculture and forestry subject areas (2005–2014). In: *Journal of Cleaner Production*, 147: 406–418. https://doi.org/10.1016/j.jclepro.2017.01.112

ALLEN, J. L., and LENDEMER, J. C. (2016): Climate change impacts on endemic, high-elevation lichens in a biodiversity hotspot. In: *Biodiversity Conservation*, 25: 555–568. https://doi.org/10.1007/s10531-016-1071-4

ALMBORN, O. (1966): Revision of some lichen genera in southern Africa I. In: *Botaniska Notiser,* 119: 70–112.

ALSTRUP, V. and APTROOT, A. (2005): Pyrenocarpous lichens from Tanzania and Kenya. In: *Cryptogamie, Mycologie,* 26 (3): 265–271. https://sciencepress.mnhn.fr/en/periodiques/mycologie/26/3/pyrenocarpous-lichens-tanzania-and-kenya

ALSTRUP, V. and CHRISTENSEN, S. N. (2006): New records of lichens with cyanobacteria from Tanzania and Kenya. In: *Cryptogamie, Mycologie*, 27 (1): 57–68. https://sciencepress.mnhn.fr/en/periodiques/mycologie/27/1/new-records-lichens-cyanobacteria-tanzania-and-kenya

ALSTRUP, V., APTROOT, A., DIVAKAR, P. K., LAGRECA, S. and TIBELL, L. (2010): Lichens from Tanzania and Kenya III. Macrolichens and calicioid lichens. In: *Cryptogamie, Mycologie,* 31 (3): 333–351. https://sciencepress.mnhn.fr/en/periodiques/mycologie/31/3/lichens-tanzania-and-kenya-iii-macrolichens-and-calicioid-lichens

ANDOLE, O. H., MATSUI, K. and ANTWI, A. O. (2020): Ther ole of women enterprises for the conservation of Kakamega forest, Kenya. In: *Journal of Advanced Research in Social Sciences and Humanities,* 5 (3): 52–56. doi:10.26500/JARSSH-05-2020-0301.

ANTÓN PARDO, M. (2019): The map of biodiversity: From local to global scales. In: *Metode Science Studies Journal*, 9: 83–89. https://doi.org/10.7203/metode.9.11333

APTROOT, A. and SCHUMM, F. (2010): Chimeras occur on the pantropical lichinomycete *Phyllopeltula corticola*. In: *The Lichenologist,* 42 (3): 307–310.

APTROOT, A., THOR, G., LÜCKING, R., ELIX, J. A. and CHAVES, J. L. (2009): The lichen genus *Herpothallon* reinstated. In: *Bibliotheca Lichenologica,* 99: 19–66.

APTROOT, A. (2009): Lichens as an indicator of climate and global change. In: TREVOR, M. L. (Ed.): *Climate change: observed impacts on planet Earth*, 1st ed, Netherlands: Elsevier, B.V. pp. 401–408. https://doi.org/10.1016/B978-0-444-53301-2.00023-3

APTROOT, A., STAPPER, N. J., KOŠUTHOVÁ, A. and CÁCERES, M. E. S. (2016): Lichens. In: TREVOR. M. L. (Ed.): *Climate change: observed impacts on planet Earth*, 2nd ed, Netherlands: Elsevier, B.V. pp. 295–307. https://doi.org/10.1016/B978-0-444-63524-2.00019-1

APTROOT, A., STAPPER, N. J., KOŠUTHOVÁ, A. and VAN HERK, K. C. M. (2021): Lichens as an indicator of climate and global change. In: TREVOR. M. L. (Ed.): *Climate change: observed impacts on planet Earth*, 3rd ed, The Netherlands: Elsevier, B.V. pp. 483–497. https://doi.org/10.1016/B978-0-12-821575-3.00023-2

APTROOT, A., and VAN HERK, C.M. (2007): Further evidence of the effects of global warming on lichens, particularly those with *Trentepohlia* phycobionts. In: *Environmental Pollution,* 146: 293–298. https://doi.org/10.1016/j.envpol.2006.03.018

ARCHER, A. W., ELIX, J. A., FISCHER, E., KILLMANN, D. and SÉRUSIAUX, E. (2009): The lichen genus *Pertusaria* (Ascomycota) in Central Africa (Congo/Kivu, Rwanda and Burundi) and western Kenya. In: *Nova Hedwigia,* 88 (3-4): 309–333. https://doi.org/10.1127/0029-5035/2009/0088-0309

ARDELEAN, I. V., KELLER, C. and SCHEIDEGGER, C. (2015): Effects of management on lichen species richness, ecological traits and community structure in the Rodnei Mountains National Park (Romania). In: *PLoS One*, 10 (12), e0145808. https://doi.org/10.1371/JOURNAL.PONE.0145808

ARIA, M. and CUCCURULLO, C. (2017): Bibliometrix: an R-tool for comprehensive science mapping analysis. In: *Journal of Informetrics,* 11: 959–975.

ARUP, U., EKMAN, S., LINDBLOM, L. and MATTSSON, J. E. (1993): High performance thin layer chromatography (HPTLC), an improved technique for screening lichen substances. In*:* *Lichenologist,* 25 (1): 61–71. doi:10.1006/lich.1993.1018.

AWASTHI, D. D. (1975): A monograph of the lichen genus *Dirinaria*. In: *Bibliotheca Lichenologica,* 2: 1– 108.

BABBIE, E.R. (2016): *The practice of social research.* 14th Edition, Belmont: Cengage Learning.

BAKER, H. K., KUMAR, S. and PATTNAIK, D.(2020): Research constituents, intellectual structure, and collaboration pattern in the Journal of Forecasting: A Bibliometric Analysis. In: *J. Forecast*, 40(4), 577–602.

BECK, H. E., ZIMMERMANN, N. E., MCVICAR, T. R., VERGOPOLAN, N., BERG, A. and WOOD, E. F. (2018): Data Descriptor: Present and future Köppen-Geiger climate classification maps at 1-km resolution. *Sci Data,* 5: 180214. doi:10.1038/sdata.2018.214.

BELLINO, M. J. (2018): Closing Information Gaps in Kakuma Refugee Camp: A Youth Participatory Action Research Study. In: *Am. J. Community Psychol.,* 62 (3–4): 492–507. doi:10.1002/ajcp.12277.

BENESPERI, R., LASTRUCCI, L. and NASCIMBENE, J. (2013): Human disturbance threats the red-listed macrolichen *Seirophora villosa* (Ach.) Frödén in coastal *Juniperus* habitats: Evidence from western peninsular Italy. In: *Environ. Manage,.* 52: 939–945. https://doi.org/10.1007/S00267-013-0081-1

BENHAMADA, O., BENHAMADA, N. and LEGHOUCHI, E. (2024): Review on the toxic effect of fluorine and lead on lichen metabolism. In: *International Journal of Secondary Metabolite,* 11: 765–794. https://doi.org/10.21448/ijsm.1401066

BENHAMADA, O., LAIB, E., BENHAMADA, N., CHAREF, S., CHENNAH, M., CHENNOUF, S., DERBAK, H. and LEGHOUCHI, E. (2023): Oxidative stress caused by lead in the lichen *Xanthoria parietina*. In: *Acta Sci. Biol. Sci.,* 45: e63221. https://doi.org/10.4025/actascibiolsci.v45i1.63221

BERGAMINI, A., SCHEIDEGGER. C., STOFER, S., CARVALHO, P., DAVEY, S., DIETRICH, M., DUBS, F., FARKAS, E., GRONER, U. and KÄRKKÄINEN, K. (2005): Performance of macro lichens and lichen genera as indicators of lichen species richness and composition. In*: Conservation Biology,* 19 (4): 1051–1062. doi:10.1111/j.1523-1739.2005.00192.x-i1.

BERNARDO, F., RODRIGUES, A., BRANQUINHO, C. and GARCIA, P. (2021): Elemental profile of native lichens displaying the impact by agricultural and artificial land uses in the Atlantic Island of São Miguel (Azores). In: *Chemosphere,* 267: 128887. https://doi.org/10.1016/J.CHEMOSPHERE.2020.128887

BJELLAND T., BENDIKSBY M. and FRISCH A. (2017): Geographically disjunct phylogenetic lineages in *Leptogium hibernicum* reveal *Leptogium krogiae* sp. nov. from East Africa. In: *The Lichenologist,* 49 (3): 239–251. https://doi.org/10.1017/S0024282916000645

BJERKE, J.W. (2011): Winter climate change: Ice encapsulation at mild subfreezing temperatures kills freeze-tolerant lichens. In: *Environ. Exp.* Bot., 72: 404–408. https://doi.org/10.1016/J.ENVEXPBOT.2010.05.014

BOGLÁR, L. (2001): *A kultúra arcai. Mozaikok a kulturális antropológia köréből.* [Faces of culture. Mosaics from the field of cultural anthropology.] Budapest: Napvilág kiadó.

BOWN, C.P, and CLAUSING, K. (2025): Together, China, the US, and the EU emit nearly half of the world's greenhouse gases (18 October 2023). Available online: https://www.piie.com/research/piie-charts/together-china-us-and-eu-emit-nearly-half-worlds-greenhouse-gases (accessed on 18 October 2025).

BRAKO, L. (1991): *Phyllopsora (Bacidiaceae)*. Flora Neotropica 55, New York Botanical Garden (for Organization for Flora Neotropica), Bronx, NY. 66 p.

BRANQUINHO, C., BROWN, D. H., MÁGUAS, C. and CATARINO, F. (1997): Lead (Pb) uptake and its effects on membrane integrity and chlorophyll fluorescence in different lichen species. In: *Environ. Exp. Bot.*, 37: 95–105. https://doi.org/10.1016/S0098-8472(96)01038-6

BREUSS, O. (1993): Studien über die Flechtengattung *Catapyrenium* (Verrucariaceae) V. Einige Arten aus dem südlichen Africa. In: *Linzer Biologische Beiträge,* 25: 339–346.

BU, C., WU, S., ZHANG, K., YANG, Y. and GAO G. (2015): Biological soil crusts: An eco-adaptive biological conservative mechanism and implications for ecological restoration. In: *Plant Biosystematics,* 149: 364–373. https://doi.org/10.1080/11263504.2013.819820

BÜDEL, B. (1987): Zur Biologie und Systematik der Flechtengattungen *Heppia* und *Peltula* im südlichen Afrika. In: *Bibliotheca Lichenologica,* 23: 1–105.

BULBOTHRIX GOEBELII (2025): Global Biodiversity Information Facility (GBIF). Available at https://www.gbif.org/species/2605131 (accessed on 03 Aug 2025)

BURGESS, R. (1984): In the field: An introduction to field research. London: Allen and Unwin.

BUSSMAN, R. W. (2006): Vegetation zonation and nomenclature of African mountains – an overview. In: *Lyonia,* 11: 41–66.

CALDWELL, I. R., HOBBS, J. P. A., BOWEN, B. W., COWMAN, P. F., DIBATTISTA, J. D., WHITNEY, J. L., AHTI, P. A., BELDEROK, R., CANFIELD, S., COLEMAN, R. R., IACCHEI, M., JOHNSTON, E. C., KNAPP, I., NALLEY, E. M., STAEUDLE, T. M. and LÁRUSON, Á. J. (2024): Global trends and biases in biodiversity conservation research. In: *Cell Reports Sustainability*, 1: 100082. https://doi.org/10.1016/j.crsus.2024.100082

CANOPARMELIA CONCRESCENS (2025): Consortium of lichen herbaria of the world. Available at https://lichenportal.org/portal/collections/list.php?usethes=1&taxa=139203 (accessed on 03 July 2025).

CARRERAS, H. A. and PIGNATA, M. L. (2007): Effects of the heavy metals Cu2+, Ni2+, Pb2+, and Zn2+ on some physiological parameters of the lichen *Usnea amblyoclada*. In: *Ecotoxicol. Environ. Saf.*, 67: 59–66. https://doi.org/10.1016/J.ECOENV.2006.05.005

CATAPYRENIUM SQUAMULOSUM (2025): Global Biodiversity Information Facility (GBIF). Available at https://www.gbif.org/species/2596450 (accessed on 03 July 2025)

CHOWANIEC, K., LATKOWSKA, E., and SKUBAŁA, K. (2023): Effect of thallus melanisation on the sensitivity of lichens to heat stress. In: *Scientific Reports*, 13: 5674. https://doi.org/10.1038/s41598-023-32215-1

CIESLINSKY, S., CZYZEWSKA, K. and FABISZEWSKI, J. (1986): Red list of threatened lichens in Poland. In: ZARZYCKI, K., WOJEWODA, W. (Eds): *List of threatened plants in Poland.* Warszawa, Poland: Panstwowe Wydawnictvo Naukowe, pp. 83–107.

CLADONIA PRAETERMISSA (2025): Consortium of lichen herbaria of the world. Available at https://lichenportal.org/portal/collections/list.php?usethes=1andtaxa=142222 (accessed on 04 July 2025).

CLERC, P. (2011): Notes on the genus *Usnea* Adanson (lichenized Ascomycota). III. In: *Bibliotheca Lichenologica,* 106: 41–51.

CLUBBE, C., AINSWORTH, A. M., BÁRRIOS, S., BENSUSAN, K., BRODIE, J., CANNON, P., CHAPMAN, T., COPELAND, A. I., CORCORAN, M., DANI, M., JOHN, S., TREVOR, C. D., LAUREN, D., HAMILTON, M. A., HELLER, T., HOLLINGSWORTH, P. M., HUTCHINSON, N., LLEWELYN, T. and STEPHANIE, J. M. (2020): Current knowledge, status, and future for plant and fungal diversity in Great Britain and the UK Overseas Territories. In: P*lants, People, Planet*, 2 (5): 557–579. https://doi.org/10.1002/ppp3.10142

ÇOBANOĞLU ÖZYIĞITOĞLU, G. (2020): Use of lichens in biological monitoring of air quality. In Environmental Concerns and Sustainable Development. Shukla, V, Kumar, N. Eds, Springer. Singapore. pp. 61–95. https://doi.org/10.1007/978-981-13-5889-0

COBO, M. J, LOPEZ-HERRERA, A. G, HERRERA-VIEDMA, E, and HERRERA, F. (2011): An approach for detecting, quantifying, and visualising the evolution of a research field: a practical application to the fuzzy sets theory field. In: Journal of Informetrics 5, 146–166

COCA L. F., LUMBSCH T. H., MERCADO-DÍAZ J. A., WIDHELM T. J., GOFFINET B., KIRIKA P. and LÜCKING R. (2025): Diversity, phylogeny, and historical biogeography of the genus *Coccocarpia* (Lichenized Ascomycota: Peltigerales) in the tropics. In: *Molecular Phylogenetics and Evolution,* 206: 108312. https://doi.org/10.1016/j.ympev.2025.108312

COCCOCARPIA FLAVICANS (2025): Consortium of lichen herbaria of the world. Available at https://lichenportal.org/portal/collections/list.php?usethes=1&taxa=142785 (accessed on 04 July 2025).

COCKERILL, K.A and HAGERMAN, S.M. (2020): Historical insights for understanding the emergence of community-based conservation in Kenya: International agendas, colonial legacies, and contested worldviews. In*: Ecology and Society,* 25(2): 1–19. doi:10.5751/ES-11409-250215.

COG (2022): Narok County Integrated Development Plan 2018–2022. Council of Governors (CoG). Available at https://www.devolutionhub.or.ke/resource/narok-county-integrated-development-plan-2018-2022. (accessed on 27 April 2024.

CONSORTIUM OF LICHEN HERBARIA (2025): Consortium of lichen herbaria of the world. Available at https://lichenportal.org/portal/ (accessed on 03 July 2025).

CONTI, M.E, and CECCHETTI, G. (2001): Biological monitoring: lichens as bioindicators of air pollution assessment: A review. In: *Environmental Pollution,* 114: 471–492. https://doi.org/10.1016/S0269-7491(00)00224-4

COZZOLINO, A., ADAMO, P., BONANOMI, G. and MOTTI, R. (2022): The role of lichens, mosses, and vascular plants in the biodeterioration of historic buildings: A review. In: *Plants,* 11 (24): 3429. https://doi.org/10.3390/plants11243429

CZECZUGA, B., MOBERG, R. and ALSTRUP V. (1992): Investigations on carotenoids in lichens. Carotenoids occurring in the thalli of lichens from Kenya. In: *Acta Societatis Botanicorum Poloniae,* 61 (2): 231–239. https://doi.org/10.5586/asbp.1992.021

DERMATOCARPON AEQUINOCTIALE (2025): Consortium of lichen herbaria of the world. Available at https://lichenportal.org/portal/collections/list.php?usethes=1&taxa=144329 (accessed on 04 July 2025).

DEVKOTA, S., CHAUDHARY, R.P., WERTH, S. and SCHEIDEGGER, C. (2017): Indigenous knowledge and use of lichens by the lichenophilic communities of the Nepal Himalaya. In: *Journal of Ethnobiol. Ethnomed.* 13(1): 15. doi:10.1186/s13002-017-0142-2.

DIEDERICH, P. and ETAYO, J. (2000): A synopsis of the genera *Skyttea*, *Llimoniella* and *Rhymbocarpus* (lichenicolous Ascomycota, Leotiales). In: *The Lichenologist* 32(5): 423–485. https://doi.org/10.1006/lich.2000.0290

DOBSON, A. (2005): Monitoring global rates of biodiversity change: Challenges that arise in meeting the Convention on Biological Diversity (CBD) 2010 goals. Philosophical Transactions of the Royal Society B: In: Biological Sciences 360(1454), 229–241. https://doi.org/10.1098/rstb.2004.1603

DODGE, C.W. (1959): Some lichens of tropical Africa. III. Parmeliaceae. In: *Annals of the Missouri Botanical Garden* 46: 39–193.

DTP in Environmental Research (2025): Lichen conservation. the demography of little things. Available online: https://www.environmental-research.ox.ac.uk/article/lichen-conservation-the-demography-of-little-things (accessed on 15 September 2025).

ECCF (2025): The European Council for the Conservation of Fungi. Available online www.eccf.eu (accessed on 13 August 2025)

ELIX, J. A. (2002): New species of *Xanthoparmelia* (lichenized Ascomycotina, Parmeliaceae) from Africa. In: *The Lichenologist* 34(4): 283–291. https://doi.org/10.1006/lich.2002.0383

ELIX , J. A. (2011): *Heterodermia*, Australian Physciaceae (lichenised Ascomycota). Available at http.//:www.anb.gov.au/abrs/lichnelist/Heterodermia.pdf (accessed on 04 July 2025).

ELLER, D.J. (2020): Cultural survival and revival in the twenty-first century. In: Nanda, S. and Warms, R.L. Cultural Anthropology. London and New York: Routledge. pp. 322–344. doi:10.4324/9780429197710-18.

ELLIS, C.J., ASPLUND, J., RENATO BENESPERI, R., BRANQUINHO, C., DI NUZZO, L., HURTADO, P., MARTÍNEZ, I., MATOS, P., NASCIMBENE, J., PINHO, P., PRIETO, M., ROCHA, B., RODRÍGUEZ-ARRIBAS, C., THÜS H. and GIORDANI P. (2021): Functional traits in lichen ecology: A review of challenge and opportunity. In: *Microorganisms* 9(4): 766. https://doi.org/10.3390/microorganisms9040766

ELLIS, C.J. (2019): Climate change, bioclimatic models and the risk to lichen diversity. In: *Diversity* 11(4): 54. doi:10.3390/d11040054.

ERIKSSON, O. E. (1992): *Psoroglaena cubensis* and *Flakea papillata* gen. et sp. nov., two corticolous lichens with a pantropical distribution. In: *Systema Ascomycetum* 11 (1): 11–27.

ESSLINGER, T. L. (1977): A chemosystematic revision of the brown Parmeliae. In: *Journal of the Hattori Botanical Laboratory,* 42, 1–211.

FALTYNOWICZ, W.(1998): Wykaz gatunków porostów chronionych w Polsce [List of lichens protected by law in Poland]. In: Chronmy Przyrode Ojczysta 54(1), 96–107.

FARKAS, E. and FLAKUS, A. (2015): Rare or overlooked? Two species of Lyromma (Lyrommataceae, lichenized Ascomycota) are new for Africa. In: *Herzogia* 28 (1): 204–211. https://doi.org/10.13158/heia.28.1.2015.204

FARKAS, E. (2003): Contributions to the lichen flora of East Africa *Pseudocyphellaria* and *Sticta*. *Acta Academiae Paedagogicae Agriensis, Sectio Biologiae* 24: 235-255.

FARKAS, E., KIRIKA, P.M., SZABÓ, K. and MUHORO A.M. (2024): Concentration data of (+)-usnic acid enantiomer from some European and African samples of *Flavoparmelia caperata* (L.) Hale (Parmeliaceae, lichenised Ascomycota) – results of a preliminary study. In: *Cryptogamie, Mycologie* 45(7): 71-82. https://doi.org/10.5252/cryptogamie-mycologie2024v45a7

FARKAS, E., KANYUNGULU, C.N. and VARGA, N. (2025). New records of lichens and lichenicolous fungi from Kenya and Tanzania (East Africa) 2. *Acta Biologica Plantarum Agriensis* **13**(1): 29–57. https://doi.org/10.21406/abpa.2025.13.1.29

FARKAS, E. (2003): Contributions to the lichen flora of East Africa. *Pseudocyphellaria* and *Sticta*. In: *Acta Academiae Paedagogicae Agriensis, Sectio Biologiae* 24: 235–255.

FARKAS, E. and MUHORO, A.M. (2022): Identification key to the lichen species of the parmelioid clade in Kenya. In*: Lichenologist* 54(5): 299–318. doi:10.1017/S0024282922000299.

FARKAS, E., LŐKÖS, L., MUHORO, A.M. and VARGA, N. (2023): New records of lichens and lichenicolous fungi from Kenya and Tanzania (East Africa). In*: Acta Biologica Plantarum Agriensis* 11(1): 107–128. doi:10.21406/abpa.2023.11.1.107.

FARKAS, E., XU, M., MUHORO, A.M., SZABÓ, K., LENGYEL, A., HEIÐMARSSON, S., VIKTORSSON, E. Ö. and OLAFSDOTTIR, E. S. (2024): The algal partnership is associated with quantitative variation of lichen specific metabolites in Cladonia foliacea from Central and Southern Europe. In: Symbiosis 92(3), 403–419. https://doi.org/10.1007/s13199-024-00982-8

FERNÁNDEZ-LLAMAZARES, Á., LEPOFSKY, D., LERTZMAN. K., ARMSTRONG, C.G., BRONDIZIO, E.S., GAVIN, M.C., LYVER, P.O.B., NICHOLAS, G.P., PASCUA, P., REO, N.J.REYES-GARCÍA, V., TURNER, N. J., YLETYINEN, J., ANDERSON, E. N., BALÉE, W., CARIÑO, J., DAVID-CHAVEZ, D. M., DUNN, C. P., GARNETT, S. C., GREENING, S., JACKSON, S., KUHNLEIN, H., MOLNÁR, Z., ODONNE G., RETTER, G., RIPPLE, W.J., SÁFIÁN, L., BAHRAMAN, A. S., TORRENTS-TICÓ, M. and VAUGHAN, M. B. (2021): Scientists' Warning to Humanity on Threats to Indigenous and Local Knowledge Systems. In*: Journal of Ethnobiology* 41(2): 144–69. doi:10.2993/0278-0771-41.2.144.

FERRARO, L. I. and LÜCKING, R. and SÉRUSIAUX, E. (2001): A world monograph of the lichen genus *Gyalectidium* (Gomphillaceae). In: *Botanical Journal of the Linnean Society* 137: 311–345.

FEUERER, T. (2012): Checklist of lichens and lichenicolous fungi of Kenya. http://www.biologie.uni-hamburg.de/checklists/africa/kenya_l.htm. 2011.Accessed February 9, 2012.

FRATI, L. and BRUNIALTI, G. (2023): Recent Trends and Future Challenges for Lichen Biomonitoring in Forests. In: *Forests* 14(3), 647. https://doi.org/10.3390/F14030647

FRISCH, A. and HERTEL, H. (1998): Flora of macrolichens in the alpine and subalpine zones of Mt. Kenya (Kenya) [Die Flora der Blatt- und Strauchflechten in der alpinen und subalpinen Stufe des Mount Kenya (Kenia)]. In: *Sauteria* 9: 363–370.

FRISCH, A. (1999): Afroalpine macrolichens of Mt. Kenya (Kenya). *Bayreuther Forum Ökologie* 64: 65–102.

FRISCH, A. (2006): The lichen family Thelotremataceae in Africa. A revision with special consideration of the taxa from Cameroon and Tanzania. In: *Bibliotheca Lichenologica,* 92: 3–370.

FRODIN, D. G. (2004): History and concepts of big plant genera. In: *Taxon* 53(3): 753–776. https://iks.ukzn.ac.za/sites/default/files/4135449.pdf

FRYDAY A. M., BECKETT R. P. and KIRIKA P. M. 2022. Lichenology in Africa. *The Lichenologist* 54(5): 227–230. https://doi.org/10.1017/S0024282922000329

FU, H. and WALTMAN, L. (2022): Mapping climate change research: A Bibliometric perspective. *Journal of Informetrics*, 16 (1): 101187.

GAKUYA, D. W., OKUMU, M. O., KIAMA, S. G., MBARIA, J. M., GATHUMBI, P. K., MATHIU, P. M. and NGUTA, J. M. (2020): Traditional medicine in Kenya: Past and current status, challenges, and the way forward. In*: Sci Afr.,* 8: e00360. doi:10.1016/j.sciaf.2020.e00360.

GALLOWAY, D. J. and THOMAS M. A. (2004): *Sticta*. In: NASH, T. H., RYAN, B. D., DIEDERICH, P., GRIES, C. and BUNGARTZ, F. (Eds): *Lichen flora of the Greater Sonoran Desert Region. 2.* Tempe, Arizona: Lichens Unlimited, Arizona State University, pp. 513–524.

GARRIDO-HUÉSCAR, E., GONZÁLEZ-BURGOS, E., KIRIKA, P. M., BOUSTIE, J., FERRON, S., GÓMEZ-SERRANILLOS, M. P., LUMBSCH, H. T. and DIVAKAR, P. K. (2022): A new cryptic lineage in Parmeliaceae (Ascomycota) with pharmacological properties. In: *Journal of Fung,i* 8 (8): 826. https://doi.org/10.3390/jof8080826

GASPARYAN, A., and SIPMAN, H. J. M. (2016): The epiphytic lichenized fungi in Armenia: Diversity and conservation. In: *Phytotaxa*, 281 (1): 1–68. https://doi.org/10.11646/phytotaxa.281.1.1

GBIF (2025): Global Biodiversity Information Facility. Available at https://www.gbif.org/ (accessed on 03 July 2025).

GFRLI (2025): Global Fungal Red List Initiative. Available online, https://redlist.info/en/iucn . Accessed on August 13, 2025

GHEZA, G., ASSINI, S., LELLI, C., MARINI, L., MAYRHOFER, H. and NASCIMBENE, J. (2020): Biodiversity and conservation of terricolous lichens and bryophytes in continental lowlands of northern Italy: the role of different dry habitat types. In: *Biodiversity and Conservation*, 29 (13): 3533–3550. https://doi.org/10.1007/s10531-020-02034-1

GHEZA, G., ASSINI, S, MARINI, L. and NASCIMBENE, J. (2018): Impact of an invasive herbivore and human trampling on lichen-rich dry grasslands: Soil-dependent response of multiple taxa. In: *Science of the Total Environment,* 639: 633–639. https://doi.org/10.1016/j.scitotenv.2018.05.191

GHEZA, G., DI NUZZO, L., NIMIS, P.L., BENESPERI, R., GIORDANI, P., VALLESE, C. and NASCIMBENE, J. (2022): Towards a Red List of the terricolous lichens of Italy. In: *Plant Biosystems,* 156 (3): 824–825. https://doi.org/10.1080/11263504.2022.2065379

GIORDANI, P., BENESPERI, R., BIANCHI, E., MALASPINA, P. and NASCIMBENE, J. (2020): Threats and conservation strategies for overlooked organisms: The case of epiphytic lichens, : In SHUKLA, V. and KUMAR, N. (Eds): *Environmental concerns and sustainable development*. Singapore: Springer, pp. 1–26. https://doi.org/10.1007/978-981-13-6358-0_1

GOFFINET, B. and HASTINGS, R. I. (1995): Two new sorediate taxa of *Peltigera*. In: *The Lichenologist* 27(1): 43–58.

GOGOI, R., DEVI, D., NAYAKA, S., and YASMIN, F. (2022): A checklist of lichens of Assam, India. In: *Asian Journal of Conservation Biology*. 11, 49–65. https://doi.org/10.53562/AJCB.73760

GÓMEZ-BAGGETHUN, E. (2022): Is there a future for indigenous and local knowledge? In*: Journal of Peasant Studies* 49(6): 1139–1157. doi:10.1080/03066150.2021.1926994.

GOWARD, T., SPRIBILLE, T., AHTI, T. AND HAMPTON-MILLER, C.J. (2012): Four new sorediate species in the *Hypogymnia austerodes* group (lichens) from northwestern North America, with notes on thallus morphology. In: *Bryologist* 115(1): 84–100.

GREEN, T.G.A., SANCHO, L.G., PINTADO, A. and SCHROETER, B. (2011): Functional and spatial pressures on terrestrial vegetation in Antarctica forced by global warming. In: *Polar Biology* 34(11), 1643–1656. https://doi.org/10.1007/s00300-011-1058-2

GUTIÉRREZ-LARRUGA, B., ESTÉBANEZ-PÉREZ, B. and OCHOA-HUESO, R. (2020): Effects of Nitrogen Deposition on the Abundance and Metabolism of Lichens: A Meta-analysis. In: Ecosystems 23, 783–797. https://doi.org/10.1007/s10021-019-00431-4

HABEL J. C., SCHULTZE-GEBHARDT K., MAGHENDA M., SHAURI H., KIOKO E., MWAGURA L. and TEUCHER, M. (2023): Harmonizing multi-stakeholder interests to improve forest conservation in Southern Kenya. In: *Biodiversity Conservation* 32: 1777–1785. https://doi.org/10.1007/s10531-023-02591-1

HAELEWATERS, D., QUANDT, C.A., BARTROP, L., CAZABONNE, J., CROCKATT, M.E., CUNHA, S.P., DE LANGE, R., DOMINICI, L., DOUGLAS, B., DRECHSLER-SANTOS, E.R., HEILMANN-CLAUSEN, J, IRGA, P.J., JAKOB, S, LOFGREN, L., MARTIN, T.E, MUCHANE, M.N., STALLMAN, J.K., VERBEKEN, A., WALKER, A.K., and GONÇALVES, S.C. (2024): The power of citizen science to advance fungal conservation. In: *Conservation Letters* 17, e13013. https://doi.org/10.1111/CONL.13013

HALE, M. E (1965): A monograph of *Parmelia* subgenus *Amphigymnia*. In: *Contributions from the United States National Herbarium* 36(5): 193–358.

HALE, M. E. (1972): Six new species of *Parmelia* from Africa. In: *Phytologia* 23: 343–349.

HALE, M. E. and KUROKAWA, S. (1964): Studies on *Parmelia* subgenus *Parmelia*. In: *Contributions from the United States National Herbarium* 36(4): 121–191.

HALE, M. E. (1988): New combinations in the lichen genus Xanthoparmelia (Ascomycotina: Parmeliaceae). *Mycotaxon*. 33:401–406. http://www.cybertruffle.org.uk/cyberliber/59575/0033/0401.htm

HALE, M. E. (1990): A synopsis of the lichen genus *Xanthoparmelia* (Vainio) Hale (Ascomycotina, Parmeliaceae). In: *Smithsonian Contributions to Botany* 74: 1–250.

HANSEN, E.S. and BRUCE MCCUNE, B. (2010): The lichen genus *Hypogymnia* in Greenland. In: *Folia Cryptogamie Estonica* 47: 13–20.

HARRIS, R.C. and LADD, D. (2008): The lichen genus *Chrysothrix* in the Ozark Ecoregion including a preliminary treatment for eastern and central North America. In: *Opuscula Philolichenum* 5: 29–42.

HAWKSWORTH, D. L. and GRUBE, M. (2020): Lichens redefined as complex ecosystems. In: *New Phytologist* 227: 1362–1375. https://doi.org/10.1111/nph.16630

HAWKSWORTH, D. L. and HILL, D. J. (1984): *The lichen-forming fungi.* Blackie, Glasgow and London, 158 p.

HAWKSWORTH, D. L. and LÜCKING, R. (2017): Fungal diversity revisited: 2.2 to 3.8 million species.In: *Microbiological Spectrum* 5: 4. https://doi.org/10.1128/microbiolspec.funk-0052-2016

HAWKSWORTH, D. L. and ITURRIAGA, T. and CRESPO, A. (2005): Lichens as rapid bioindicators of pollution and habit disturbance in the tropics [Líquenes como bioindicadores inmediatos de contaminación y cambios medio-ambientales en los trópicos]. In: *Revista Iberoamericana de Micología* 22: 71–82. https://doi.org/10.1016/s1130-1406(05)70013-9

HAWKSWORTH, D. L. (1971): Lichens as litmus for air pollution: a historical review. *International Journal of Environmental Studies*, 1, 281–296. https://doi.org/10.1080/00207237108709429

HAWKSWORTH, D.L., and GRUBE, M. Lichens redefined as complex ecosystems. New Phytologist 2020, 227(5):1281–1283. https://doi.org/10.1111/nph.16630

HAWKSWORTH, D.L. and MCMANUS, P.M. Lichen recolonization in London under conditions of rapidly falling sulphur dioxide levels, and the concept of zone skipping. Botanical Journal of the Linnean Society 1989, 100(2), 99–109.

HENSSEN A. (1986): *Thyrea polyglossa* and *Thyrea divergens* sp. nov. *Mycotaxon* 25: 493–503.

HERRERA-CAMPOS, M.A., PARRINELLO, C., and BUNGARTZ, F. (2020): Mobergia calculiformis. The IUCN Red List of Threatened Species 2020: e.T175709748A175710672. Available online.https://dx.doi.org/10.2305/IUCN.UK.2020-3.RLTS.T175709748A175710672.en (accessed on 20 August 2025).

HERTEL, H. (2007): Notes on and records of Southern Hemisphere lecideoid lichens. In: *Bibliotheca Lichenologica* 95: 267–296.

HOGUE, A. S. and BREON, K. (2022): The greatest threats to species. In: *Conservation Science and Practice* 4: e12670. https://doi.org/10.1111/csp2.12670

HUNTINGTON, H.P.(2018): Traditional knowledge and resource development. In: Southcott C, Abele F, Natcher D and Parlee B (eds), Resources and Sustainable Development in the Arctic. London: *Taylor and Francis* pp. 234–250. doi:10.4324/9781351019101.

HYPERPHYSCIA COCHLEARIS (2025): Consortium of lichen herbaria of the world. Available at https://lichenportal.org/portal//collections/list.php?usethes=1&taxa=149698 (accessed on 04 July 2025).

HYPERPHYSCIA ISIDIATA (2025): Consortium of lichen herbaria of the world. Available at https://www.lichenportal.org/portal/collections/list.php?usethes=1&taxa=149703 (accessed on 04 July 2025).

HYPERPHYSCIA PANDANI (2025): Consortium of lichen herbaria of the world. Available at https://lichenportal.org/portal/taxa/index.php?taxon=55079&clid=1278 (accessed on 04 July 2025).

HYPERPHYSCIA PRUINOSA (2025): Consortium of lichen herbaria of the world. Available at https://www.lichenportal.org/portal/collections/list.php?usethes=1&taxa=149706 (accessed on 04 July 2025).

HYPERPHYSCIA TUCKERMANII (2025): Consortium of lichen herbaria of the world. Available at https://lichenportal.org/portal/taxa/index.php?taxon=52093 (accessed on 04 July 2025).

HYPOTRACHYNA AFRICANA (2025): Consortium of lichen herbaria of the world. Available at https://lichenportal.org/portal/collections/list.php?usethes=1&taxa=257010 (accessed on 04 July 2025).

HYPOTRACHYNA SUBFATISCENS (2025): Consortium of lichen herbaria of the world. Available at https://lichenportal.org/portal/taxa/index.php?taxon=150044&clid=1278 (accessed on 04 July 2025).

IBRAHIM, M.S.N., ASSIM, M.I.S.A., JOHARI, S., MOHAMMAD, S.K.W., AFANDI, S.H.M. and HASSAN, S.(2022): Public awareness on biodiversity conservation and well-being: Case of Gunung Mulu National Park, Sarawak. In: *GeoJournal* 88(3): 3471–3496. doi:10.1007/s10708-022-10818-x.

IEA (2025): Total CO2 emissions. Available online: https://www.iea.org/regions/europe/emissions (accessed on 18 October 2025).

INATURALIST (2020): Why do some genera have so many species? December 2020. Available at https://forum.inaturalist.org/t/why-do-some-genera-have-so-many-species/18452/9 (accessed on 06 Aug 2025)

INDEX FUNGORUM (2025): Index Fungorum. Available at https://www.indexfungorum.org/names/.asp (accessed on 04 July 2025).

INSAROV G. E. (2010): Epiphytic montane lichens exposed to background air pollution and climate change: Monitoring and conservation aspects. In: *International Journal of Ecology and Environmental Sciences* 36: 29–35.

ISFC (2025): International Society for Fungal Conservation. Available online: www.fungal-conservation.org (accessed on 13 August 2025)

IUCN (1994): *IUCN Red List Categories.* IUCN Species Survival Commission. IUCN, Gland, Switzerland. 18 p.

IUCN (2024): Guidelines for Using the IUCN Red List Categories and Criteria, version 16 (March 2024). Available at https://www.iucnredlist.org/resources/redlistguidelines (accessed on 25 July 2025)

IUCN SSC Lichen Specialist Group (2025): Available online: https://iucn.org/our-union/commissions/group/iucn-ssc-lichen-specialist-group (accessed on 19 September 2025).

JOHANSSON, O., PALMQVIST, K. and OLOFSSON, J. (2012): Nitrogen deposition drives lichen community changes through differential species responses. In*: Glob. Chang. Biol. 18,* 2626–2635. https://doi.org/10.1111/J.1365

JØRGENSEN, P. M and KASHIWADANI, H. (2001): New or misunderstood species of Japanese *Pannaria* (Lichenes). In: *Journal of Japanese Botany* 76: 1–10.

JØRGENSEN, P. M. (1994): *Leptogium palustre*, a new lichen from East Africa. In: *The Lichenologis*t 26(2): 213–215. https://doi.org/10.1006/lich.1994.1034

JØRGENSEN P. M. (2002): *Kroswia*, a new genus in the Pannariaceae (lichenized ascomycetes). In: *Lichenologist* 34 (4): 297–303. https://doi.org/10.1006/lich.2002.0401

JØRGENSEN P. M. (2003): Notes on African Pannariaceae (lichenized ascomycetes). *The Lichenologist* 35(1): 11–20. https://doi.org/10.1006/lich.2002.0424.

JÜRIADO, I., DEGTJARENKO, P., OJA, E., and RANDLANE. T. (2022): A recent update in red-listing of Estonian lichens: threat status of 168 species was assessed for the first time. In: *Folia Cryptogamica Estonica* 59, 69–81. https://doi.org/10.12697/fce.2022.59.11

KAASALAINEN U., KIRIKA P. M., MOLLEL N. P., HEMP A. and RIKKINEN J. (2023a): The lichen genus *Sticta* (Lobariaceae, Peltigerales) in East African montane ecosystems. In: *Journal of Fungi,* 9 (2): 246. https://doi.org/10.3390/jof9020246

KAASALAINEN, U., KIRIKA, P. M., MOLLEL, N. P., HEMP, A. and RIKKINEN J. (2023b): Two new species of *Leptogium* (Collemataceae) with transversely septate ascospores from East Africa. In: *Folia Cryptogamica Estonica* 60: 57–64. https://doi.org/10.12697/fce.2023.60.08

KAASALAINEN U., TUOVINEN V., KIRIKA P. M., MOLLEL N. P., HEMP A. and RIKKINEN J. (2021b) Diversity of *Leptogium* (Collemataceae, Ascomycota) in East African montane ecosystems. In: *Microorganisms,* 9 (2):314. https://doi.org/10.3390/microorganisms9020314

KAASALAINEN U., TUOVINEN V., MWACHALA G., PELLIKKA P. and RIKKINEN, J. (2021a): Complex interaction networks among cyanolichens of a tropical biodiversity hotspot. In: *Frontiers in Microbiology* 12:672333. https://doi.org/10.3389/fmicb.2021.672333

KAASALAINEN, U., BIERMANN, L., MOLLEL, N.P., SCHMIDT, A.R. and HEMP, A. (2022): *Peltigera* (Lecanoromycetes) on Mt Kilimanjaro, East Africa. – *Lichenologist,* 54(5), 231–243. doi:10.1017/S0024282922000184.

KALB, K. and APTROOT, A. (2017): Lichenes Neotropici XVI. *Archive for Lichenology,* 12: 1–12.

KALB, K. and APTROOT, A. (2021): New lichens from Africa. *Archive for Lichenology,* 28: 1–12.

KALB, K. and VĚZDA, A. (1994): Neue Arten der Flechtengattung *Gyalideopsis* Vězda (Gomphillaceae). In: *Nova Hedwigia* 58(3-4). 511–528.

KALB, K. (1987): Brasilianische Flechten. I. Die Gattung Pyxine. In: *Bibliotheca lichenologica,* 24: 1–89.

KALB, K. (2004): New or otherwise interesting lichens II. In: *Bibliotheca Lichenologica,* 88: 301–329.

KALB, K. (2007): New or otherwise interesting lichens. III. In: *Bibliotheca Lichenologica,* 95: 297–316.

KALB K. (2008): New or otherwise interesting lichens. [IV. Neue oder anderweitig interessante Flechten. IV.] *Sauteria* 15: 239–248.

KALB K., BUARUANG K., PAPONG K. and BOONPRAGOB K. (2009): New or interesting lichens from the tropics, including the lichen genus *Ramboldia* in Thailand. In: *Mycotaxon,* 110, 109–123. https://doi.org/10.5248/110.109

KANTELINEN A., HYVÄRINEN M. T., KIRIKA P. M. and MYLLYS L. (2021): Four new *Micarea* species from the montane cloud forests of Taita Hills, Kenya. In: *The Lichenologist,* 53 (1): 81–94. https://doi.org/10.1017/S0024282920000511

KANTVILAS G. (1991): Records of East African lichens in cool temperate Australia. In: *Nordic Journal of Botany* 11: 369-373. https://doi.org/10.1111/j.1756-1051.1991.tb01416.x

KANYUNGULU, C.N. and FARKAS, E.É. (2025): Awareness of lichens and the necessity of their conservation among citizens in different regions of Kenya. In: *Acta Botanica Hungarica,* 67(4): https://doi.org/10.1556/034.2025.00573

KANYUNGULU, C.N. and FARKAS, E.É. (2026): Threats on lichens and their conservation – a review based on a bibliometric analysis. In: Diversity 18(1): 30. https://doi.org/10.3390/d18010030

KANYUNGULU, C.N., KIRIKA, P.M. and FARKAS, E.É. (2026): Introduction of categorisation in the annotated checklist of macrolichens in Kenya for describing a tentative estimation of extinction risk of Data Deficient species. In: *Cryptogamie, Mycologie,* manuscript accepted on 30.04.2026.

KENNEDY, G., WANG, Z., MAUNDU, P. and HUNTER, D. (2022): The role of traditional knowledge and food biodiversity to transform modern food systems. In*: Trends Food Sci. Technol.,* 1(130): 32–41. https://doi.org/10.1016/j.tifs.2022.09.011.

KHAN, K. S., KUNZ, R., KLEIJNEN, J. and ANTES, G. (2003): Five steps to conducting a systematic review. In: *Journal of the Royal Society of Medicine,* 96, 118–121. https://doi.org/10.1177/014107680309600304

KHANI, M.R., PIRASTEH, S., SHAHABPOOR, G. and DEHGHANI, S.A. (2011): Biomonitoring of air pollution sulfur dioxide (SO2) by lichen Lecanora muralis. In: *Res. J. Chem. Environ.*, 15, 933–938.

KHASANDI-TELEWA, V. (2016): Folklore and Environmental Conservation among the Swahili and Luhya of Kenya. In*: IJIRD,* 5(5): 146–154.

KINGE, T.R., JEFWA, J.M., HOUDANON, R.D., KAMALEBO, H.M., ABDEL-AZEEM, A.M., GRYZENHOUT, M., TRIEBEL, D., WEIBULAT, T. and RAMBOLD, G. (2023): Management and publication of scientific data on traditional mycological and lichenological knowledge in Africa. In*: Lichenologist,* 55(5) 169–179. doi:10.1017/S0024282923000294.

KIRIKA, P. M., DIVAKAR, P. K., BUARUANG, K., LEAVITT, S. D., CRESPO, A., GATHERI, G. W., MUGAMBI, G., BENATTI, M. N. and LUMBSCH, H. T. (2017a): Molecular phylogenetic studies unmask overlooked diversity in the tropical lichenized fungal genus *Bulbothrix* s.l. (Parmeliaceae, Ascomycota). In: *Botanical Journal of the Linnean Society,* 184(3): 387–399. https://doi.org/10.1093/botlinnean/box027.

KIRIKA P. M., DIVAKAR P. K., CRESPO A. and LUMBSCH H. T. (2019): Molecular and phenotypical studies on species diversity of *Hypotrachyna* (Parmeliaceae, Ascomycota) in Kenya, East Africa. *The Bryologist,* 122 (1): 140–150. https://doi.org/10.1639/0007-2745-122.1.140

KIRIKA P. M., DIVAKAR P. K., CRESPO A., GATHERI G. W., MUGAMBI G., LEAVITT S. D., MONCADA B. and LUMBSCH H. T. (2016a): Molecular data show that *Hypotrachyna sorocheila* (Parmeliaceae) is not monophyletic. In: *Bryologist,* 119: 172-180. https://doi.org/10.1639/0007-2745-119.2.172

KIRIKA P. M., DIVAKAR P. K., CRESPO A., LEAVITT S. D., MUGAMBI G., GATHERI G. W. and LUMBSCH H. T. (2016c): Polyphyly of the genus *Canoparmelia* – uncovering incongruences between phenotype-based classification and molecular phylogeny within lichenized Ascomycota (Parmeliaceae). In: *Phytotaxa,* 289 (1): 036–048. https://doi.org/10.11646/phytotaxa.289.1.2

KIRIKA P. M., DIVAKAR P. K., CRESPO A., MUGAMBI G., OROCK E. A., LEAVITT S. D., GATHERI G. W. and LUMBSCH H. T. (2016b): Phylogenetic studies uncover a predominantly African lineage in a widely distributed lichen-forming fungal species. In: *Mycokeys,* 14: 1–16. https://doi.org/10.3897/mycokeys.14.8971

KIRIKA, P. M., DIVAKAR, P. K., LEAVITT, S. D., BUARUANG, K., CRESPO, A., MUGAMBI, G., GATHERI, G. W. and LUMBSCH, H. T. (2017b): The genus *Relicinopsis* is nested within *Relicina* (Parmeliaceae, Ascomycota). In: *The Lichenologist,* 49(3): 189–197. https://doi.org/10.1017/S0024282916000748

KIRIKA P. M., LEAVITT S. D., DIVAKAR P. K., CRESPO A., GATHERI G. W., MUGAMBI G. and LUMBSCH H. T. (2015): The monotypic genus *Bulborrhizina* belongs to *Bulbothrix* sensu lato (Parmeliaceae, Ascomycota). In: *The Bryologist,* 118 (2):164–169. https://doi.org/10.1639/0007-2745-118.2.164

KIRIKA P. M., LUMBSCH H. T., HUÉSCAR E. G., QUEDENSLEY T. S. and DIVAKAR P. K. (2022): *Canoparmelia texana* (Parmeliaceae, Ascomycota) consists of two independent lineages. In: *The Lichenologist,* 54 (5): 245–251. https://doi.org/10.1017/S0024282922000135.

KIRIKA P. M., NDIRITU G. G., MUGAMBI G. K., NEWTON L. E. and LUMBSCH H. T. (2018): Diversity and altitudinal distribution of understorey corticolous lichens in a TROPICAL montane forest in Kenya (East Africa). In: *Cryptogam Biodiversity and Assessment Special Volume,* e-ISSN: 2456-0251, 47–70. https://doi.org/10.21756/cab.esp8

KIRIKA, P. M., PARNMEN, S. and LUMBSCH, H. T. (2012b): Two new species of *Lecanora* sensu stricto (Lecanoraceae, Ascomycota) from East Africa. In: *Mycokeys,* 3: 37–47. https://doi.org/10.3897/mycokeys.3.3201

KIRIKA P., MUGAMBI G., LÜCKING R. and LUMBSCH H. T. (2012a): New records of lichen-forming fungi from Kenya. In: *Journal of East African Natural History,* 101(1): 73–98. https://doi.org/10.2982/028.101.0105

KIRUI, K. (2024): Maa leaders call for preservation of Kenyan cultures. In: The Star, 28 April 2023. Available at https://www.the-star.co.ke/counties/rift-valley/2023-04-28-maa-leaders-call-for-preservation-of-kenyan-cultures/. (accessed 9 July 2024).

KISTENICH S., BENDIKSBY M., WEERAKOON G. and TIMDAL E. (2020): A revision of the genus *Aciculopsora* (Ramalinaceae), with the description of one new species and one new combination. In: *Plant and Fungal Systematics,* 65 (1): 200–209. https://doi.org/10.35535/pfsyst-2020-0015

KISTENICH, S., HALVORSEN, R., SCHRØDER-NIELSEN, A., THORBEK, L., TIMDAL, E., and BENDIKSBY, M. (2019): DNA sequencing historical lichen specimens. In: *Frontiers in Ecology and Evolution,* 7, 5. https://doi.org/10.3389/fevo.2019.00005

KNBS (2019*a*): 2019 Kenya Population and Housing Census Results. In: 2019 Census, KNBS News. Kenya National Bureau of Statistics (KNBS). Available at https://www.knbs.or.ke/2019-kenya-population-and-housing-census-reports/. (accessed 16 April 2024).

KNBS (2019*b*): 2019 Kenya population and housing census. Volume I: Population by County and sub-county. In: 2019 Census, KNBS News. Kenya National Bureau of Statistics (KNBS). Available at https://www.knbs.or.ke/?wpdmpro=2019-kenya-population-and-housing-census-volume-i-population-by-county-and-sub-county. (accessed 27 April 2024).

KOTTAK, C.P. (2021): Cultural Anthropology. 19th ed. New York: McGraw-Hill Education

KREMPELHUBER, A. VON (1876): Lichenes brasilienses collecti a D. A. Glaziou in provincia brasiliensi Rio Janeiro. In: *Flora (Regensburg)\Flora,* 59: (33–)56–63(–529).

KROG, H. and SWINSCOW, T. D. V. (1976): The genus *Ramalina* in East Africa. In: *Norwegian Journal of Botany*. 23: 153–175.

KROG, H. and SWINSCOW, T. D. V. (1981): *Parmelia* subgenus *Amphigymnia* (lichens) in East Africa. In: *Bulletin of the British Museum (Natural History) Botany* 9: 143–231.

KROG, H. and SWINSCOW, T. D. V. (1987): New species and new combinations in some parmelioid lichen genera, with special emphasis on East African taxa. In: *The Lichenologist,* 19(4):419–431

KULARATNE, K. I. A. and DE FREITAS, C. R. (2013): Epiphytic lichens as biomonitors of airborne heavy metal pollution. In: *Environmental and Experimental Botany*, 88: 24–32. https://doi.org/10.1016/j.envexpbot.2012.02.010

KUROKAWA, S. (1965): Revision of series *Relicinae* of the genus *Parmelia* in Japan and Taiwan. In: *Journal of Japanese Botany* 40(9): 264–269.

KUROKAWA, S. (1973): Supplementary notes on the genus *Anaptychia*. In: *Journal of the Hattori Botanical Laboratory,* 37: 563–607

KUROKAWA, S (1994): *Bulborrhizina africana*, a new genus and species of the Parmeliaceae. In: *Acta Botanica Fennica,* 150: 105–107.

KUZEMKO, A. A., STEINBAUER, M. J., BECKER, T., DIDUKH, Y. P., DOLNIK, C., JESCHKE, M., NAQINEZHAD, A., UĞURLU, E., VASSILEV, K. and DENGLER, J.(2016) Patterns and drivers of phytodiversity in steppe grasslands of Central Podolia (Ukraine). *Biodiversity and Conservation*, 25(12), 2233–2250. https://doi.org/10.1007/s10531-016-1060-7

LAWRENCE, T. J., VILBIG, J. M., KANGOGO, G., FÈVRE, E. M., DEEM, S. L., GLUECKS, I., SAGAN, V. and SHACHAM, E. (2023): Shifting climate zones and expanding tropical and arid climate regions across Kenya (1980–2020). In: *Regional Environmental Change,* 23, 59 https://doi.org/10.1007/s10113-023-02055-w

LEAVITT, S.D., and ST. CLAIR, L.L. (2015): Biomonitoring in Western North America: What Can Lichens Tell Us About Ecological Disturbances? In Recent Advances in Lichenology, Upreti, D., Divakar, P., Shukla, V., Bajpai, R. Eds, Springer: New Delhi, India, pp. 119–138. https://doi.org/10.1007/978-81-322-2181-4_5

LECIDEA THALERIZA (2025): Consortium of lichen herbaria of the world. Available at https://lichenportal.org/portal/collections/list.php?usethes=1andtaxa=264823 (accessed on 04 July 2025).

LEKSIN, I., SHELYAKIN, M., ZAKHOZHIY, I., KOZLOVA, O., BECKETT, R. and MINIBAYEVA, F. (2024): Ultraviolet-induced melanisation in lichens: physiological traits and transcriptome profile. Physiologia Plantarum 176(5), e14512. https://doi.org/10.1111/ppl.14512

LEPŠ, J. and LISNER, A. (2025): Resistance and resilience of species composition: thirty years of experimental mismanagement and subsequent restoration in a species rich meadow.In: *Ecology and Evolution* 15:e70923. https://doi.org/10.1002/ece3.70923

LEPTOGIUM SESSILE (2025): Global Biodiversity Information Facility (GBIF). Available at https://www.gbif.org/species/2601024 (accessed on 03 July 2025)

LI, S., LIU, W.Y. and LI, D.W. (2013): Epiphytic lichens in subtropical forest ecosystems in southwest China: Species diversity and implications for conservation. In: *Biological Conservation* 159, 88–95. https://doi.org/10.1016/j.biocon.2012.12.027

LIU, Y., REN, X., and LU, F.(2022): Research Status and Trends of Agrobiodiversity and Traditional Knowledge Based on Bibliometric Analysis (1992–Mid-2022). Diversity 14 (11), 950. https://doi.org/10.3390/d14110950

LOBARIA DISCOLOR (2025): Global Biodiversity Information Facility (GBIF). Available at https://www.gbif.org/species/7250235 (accessed on 03 July 2025)

LÕHMUS, P., MARMOR, L., JÜRIADO, I., SUIJA. A., OJA, E., DEGTJARENKO, P. and RANDLANE, T. (2019): Red list of Estonian lichens. *Folia Cryptogamica Estonica* 56, 63–76. https://doi.org/10.12697/fce.2019.56.07

LÜCKING, R. and KALB, K. (2002): New species and further additions to the foliicolous lichen flora of Kenya (East Africa), including the first lichenicolous *Aulaxina* (Ostropales: Gomphillaceae). In: *Botanical Journal of the Linnean Society* 139: 171–180. https://doi.org/10.1046/j.1095-8339.2002.00058.x

LÜCKING, R. and TIMDAL, E. (2016): New species of *Dictyonema* and *Cyphellostereum* (lichenized Basidiomycota: Hygrophoraceae) from tropical Africa and the Indian Ocean, dedicated to the late Hildur Krog. In: *Willdenowia* 46(1): 191–199. https://doi.org/10.3372/wi.46.46115

LÜCKING, R. and VĚZDA, A. (1998): Taxonomic studies in foliicolous species of the genus *Porina* (lichenized Ascomycotina: Trichotheliaceae) – II. The *Porina epiphylla* group. In: *Willdenowia* 28: 181–225. https://doi.org/10.3372/wi.28.2818

LÜCKING, R., RIVASPLATA, E., KALB, K., COMMON, R.S., BARCENAS-PEÑA, A. and DUYA, M. V. (2011): *Halegrapha* (Ascomycota: Graphidaceae), an enigmatic new genus of tropical lichenized fungi dedicated to Mason E. Hale Jr. In: *The Lichenologist* 43(4): 331–343. https://doi.org/10.1017/S0024282911000302

LÜCKING, R., KAMINSKY, L., PERLMUTTER, G.B., LAWREY, J.D., and FORNO, M.D. (2020): Cora timucua (Hygrophoraceae), a new and potentially extinct, previously misidentified basidiolichen of Florida inland scrub documented from historical collections. In: *Bryologist,* 123(4), 657–673. https://doi.org/10.1639/0007-2745-123.4.657

MACEDA-VEIGA, A. and GÓMEZ-BOLEA, A. (2017): Small, fragmented native oak forests have better preserved epiphytic lichen communities than tree plantations in a temperate sub-oceanic Mediterranean climate region. In: *Bryologist*, 120(2), 191–201. https://doi.org/10.1639/0007-2745-120.2.191

MARBACH, B. (2000): Corticole und lignicole Arten der Flechtengattung *Buellia* sensu lato in den Subtropen und Tropen. In: *Bibliotheca Lichenologica* 74: 1–384.

MAURYA, P., MISHRA, G. K. and UPRETI, D. K. (2024): A taxonomic revision of lichen genus *Phaeophyscia* Moberg (Physciaceae) with new records from India. In: *Journal of Asia-Pacific Biodiversity,* 17: 43–53. https://doi.org/10.1016/j.japb.2023.10.005

MCCARTHY, P. M. (2020): Checklist of the Lichens of Australia and its Island Territories. Australian Biological Resources Study, Canberra. Available at http://www.anbg.gov.au/abrs/lichenlist/introduction.html, [https://www.anbg.gov.au/abrs/lichenlist/PARMELIACEAE/Parmot_rimulos.html] (accessed on 03 July 2025)

MCCUNE, B., ROGERS, P., RUCHTY, A., and RYAN, B. (1998): Lichen communities for forest health monitoring in Colorado, USA: A report to the USDA Forest Service. Internal report to Interior West Region, USDA Forest Service: USA, pp. 1–30.

MCIDP (2018): Makueni County Integrated Development Plan 2018–2022. Makueni: County Government of Makueni. Available at https://repository.kippra.or.ke/xmlui/handle/123456789/646. (accessed on 27 April 2024).

MCMULLIN, R.T., and ALLEN, J.L. (2022): An assessment of data accuracy and best practice recommendations for observations of lichens and other taxonomically difficult taxa on iNaturalist. In: *Botany*, 100(6),491–497. https://doi.org/10.1139/cjb-2021-0160

MCMULLIN, R.T., MALOLES, J.R., EARLEY, C. and NEWMASTER, S.G. (2014): The arboretum at the University of Guelph, Ontario: An urban refuge for lichen biodiversity. North American Fungi 9(5), 1–16. https://doi.org/10.2509/naf2014.009.005

MCMULLIN, RT(2019): Lichens and allied fungi added to the list of rare species inhabiting the carden alvar natural area, Ontario. In: Natural Areas Journal 39(2), 212–225. https://doi.org/10.3375/043.039.0208

MELANELIXIA SUBARGENTIFERA (2025): Global Biodiversity Information Facility (GBIF). Available at https://www.gbif.org/species/3409184 (accessed on 03 July 2025)

MEYSUROVA, A.F., KHIZHNYAK, S.D. and PAKHOMOV, P.M.(2011): Toxic effect of nitrogen and sulfur dioxides on the chemical composition of Hypogymnia physodes (L.) Nyl.: IR spectroscopic analysis. Contemp. In: *Probl. Ecol.* 4, 186–194. https://doi.org/10.1134/S199542551102010X

MILLER, J.E.D., VILLELLA, J., CAREY, G., CARLBERG, T., ROOT, H.T.(2017): Canopy distribution and survey detectability of a rare old-growth forest lichen. In: *Forest Ecological Management*, 392, 195–201. https://doi.org/10.1016/J.FORECO.2017.03.007

MITTERMEIER R. A., ROBLES G. P., HOFFMANN M., PILGRIM J., BROOKS T., MITTERMEIER C. G., LAMOREUX J. and DA FONSECA G.A.B. (2004): *Hotspots revisited*: *Earth's Biologically Richest and Most Endangered Ecoregions.* CEMEX, Mexico City, 391 p.

MITTERMEIER, R.A., MITTERMEIER, C.G., BROOKS, T.M., PILGRIM, J.D., KONSTANT, W.R., DA FONSECA, G.A.B. and KORMOS, C. (2003): Wilderness and biodiversity conservation. *In: Proc. Natl. Acad. Sci. USA,* 100(18): 10309 –- 10313. https://doi.org/10.1073/pnas.1732458100.

MITTERMEIER, R.A., ROBLES-GIL, P., HOFFMANN, M., PILGRIM, J., BROOKS, T., MITTERMEIER, C.G., LAMOREUX, J. and DA FONSECA, G.A.B. (2004): *Hotspots revisited: earth's biologically wealthiest and most threatened ecosystems*. Arlington, Virginia, USA: Conservation International.

MITTERMEIER, R.A., TURNER, W.R., LARSEN, F.W., BROOKS. T.M. and GASCON, C (2011): Global Biodiversity Conservation: The Critical Role of Hotspots. In: Zachos FE and Habel

JC (eds), Biodiversity Hotspots. Berlin, Heidelberg: Springer-Verlag pp. 3–22. https://doi.org/10.1007/978-3-642-20992-5_1.

MOBERG, R. (1987): The genera *Hyperphyscia* and *Physconia* in East Africa. In: *Nordic Journal of Botany,* 7(6): 719–728.

MOBERG, R. (2012): Lichenes Selecti Exsiccati Upsalienses. Fasc. Nos. 51-75. *Thunbergia,* 7: 1–9.

MOLNÁR, K. and FARKAS, E. (2010): Current results on biological activities of lichen secondary metabolites: A review. In*: Z Naturforsch Sect C J Biosci.,* 65(3–4), 157–173. https://doi.org/10.1515/znc-2010-3-401.

MOLNÁR, K. and FARKAS, E. (2011): Depsides and depsidones in populations of the lichen *Hypogymnia physodes* and its genetic diversity. In*: Annales Botanici Fennici.,* 48(6), 473–482. https://doi.org/10.5735/085.048.0605.

MONGKOLSUK, P., MEESIM, S., POENGSUNGNOEN, V., BUARUANG, K., SCHUMM, F. and KALB, K. (2015): The lichen family Physciaceae in Thailand—II. Contributions to the genus *Heterodermia* sensu lato. In: *Phytotaxa,* 235 (1), 1–66. https://doi.org/10.11646/phytotaxa.235.1.1

MOTYKA, J. (1936): *Lichenum generis Usnea studium monographicum.* Pars systematica, volumen primum. \Leopoli. iv, 304 p.

MOTYKA, J. (1961): Usneae a R. A. Maas Geesteranus in Africa orientali et australi anno 1949 collectae. *Persoonia [Leiden],* 1(4), 415–431.

MOXHAM, T.H. (1986): The commercial exploitation of lichens for the perfume industry. In Progress in Essential Oil Research. Brunke, E.J. Ed, Walter de Gruyter: Berlin, Germany pp. 491–503.

MUELLER, G.M., CUNHA K.M., MAY, T.W., ALLEN, J.L., WESTRIP, J.R.S., CANTEIRO. C., COSTA-REZENDE D.H., DRECHSLER-SANTOS, E.R., VASCO-PALACIOS, A.M., AINSWORTH. A.M., YAHR, R., and DAHLBERG, A. (2022): What Do the First 597 Global Fungal Red List Assessments Tell Us about the Threat Status of Fungi? In: *Diversity*, 14(9), 736. https://doi.org/10.3390/d14090736

MÜLLER, J. (1885): Lichenologische Beiträge XXII. *Flora,* 68(28), 503–518.

MUTHEE, J.K., GAKUYA, D.W., MBARIA, J.M., KARERU, P.G., MULEI, C.M. and NJONGE, F.K. (2011): Ethnobotanical study of anthelmintic and other medicinal plants traditionally used in Loitoktok district of Kenya. In: *Journal of Ethnopharmacology,* 135(1), 15–21. doi:10.1016/j.jep.2011.02.005.

MYCOBANK (2025): Mycobank Database. Available at https://www.mycobank.org/ (accessed on 12 April 2025)

MYERS, N., MITTERMELER, R. A., MITTERMELER, C. G., DA FONSECA G. A. B. and KENT, J. (2000): Biodiversity hotspots for conservation priorities. In: *Nature* 403: 853–858. https://doi.org/10.1038/35002501

NAEKU, M. J. (2020): Climate change governance: An analysis of the climate change legal regime in Kenya. In: *Environmental Law Review* 22: 170–183. https://doi.org/10.1177/1461452920958398

NANKAYA, J., GICHUKI, N., LUKHOBA, C. and BALSLEV, H. (2020): Medicinal plants of the maasai of Kenya: A review. In*: Plants,* 9(1), 44. doi:10.3390/plants9010044.

NANKAYA, J., GICHUKI, N., LUKHOBA, C. and BALSLEV, H. (2021): Prioritization of Loita Maasai medicinal plants for conservation. In: *Biodivers. Conserv.,* 30, 761–780. https://doi.org/10.1007/s10531-021-02116-8

NARAYAN, T., SHERUB, S. and ROOT-BERNSTEIN, M. A. (2023): culturally appropriate redesign of the roles of protected areas and community conservation: understanding the features of the Wangchuck Centennial National Park, Bhutan. In: *Biodiversity and Conservation* 2023, *32(2)*, 609–634. https://doi.org/10.1007/s10531-022-02515-5

NASCIMBENE, J, MARTELLOS, S, and NIMIS, P. L. (2006): Epiphytic lichens of tree-line forests in the Central-Eastern Italian Alps and their importance for conservation. In: *Lichenologist*, 38(4), 373–382. https://doi.org/10.1017/S0024282906006220

NASCIMBENE, J., NIMIS, P.L., and DAINESE, M. (2014b): Epiphytic lichen conservation in the Italian Alps: The role of forest type. *Fungal Ecology*, 11, 164–172. https://doi.org/10.1016/j.funeco.2014.06.006

NASCIMBENE, J., NIMIS, P.L. and RAVERA, S. (2013): Evaluating the conservation status of epiphytic lichens of Italy: A red list. In: *Plant Biosystems*, 147(4), 898–904. https://doi.org/10.1080/11263504.2012.748101

NASCIMBENE, J., TRETIACH, M., CORANA, F., LO SCHIAVO, F., KODNIK, D., DAINESE, M. and MANNUCCI, B. (2014a) Patterns of traffic polycyclic aromatic hydrocarbon pollution in mountain areas can be revealed by lichen biomonitoring: A case study in the Dolomites (Eastern

Italiana Alps). In: *Science of the Total Environment*, 2014a, 475, 90–96. https://doi.org/10.1016/J.SCITOTENV.2013.12.090

NASH T. H. (2008): — *Lichen Biology.* 2nd ed. Cambridge University Press, Cambridge, UK. 486 p.

NASH, T.H. (2008): Lichen sensitivity to air pollution, in: Lichen Biology, 2nd ed, Nash, T.H. Ed, Cambridge University Press: New York, USA, pp. 299–314. https://doi.org/10.1017/CBO9780511790478.016

NASH, T.H. (1973): Sensitivity of Lichens to Sulfur Dioxide. Bryologist 76, 333. https://doi.org/10.2307/3241714

NAYAKA, S. and RAI, H. (2022): Antarctic Lichen Response to Climate Change: Evidence from Natural Gradients and Temperature Enchantment [sic] Experiments. In: Assessing the Antarctic Environment from a Climate Change Perspective. Khare, N. Ed, Springer, Cham. Switzerland, Earth. pp. 235–253. https://doi.org/10.1007/978-3-030-87078-2_

NEPHROMA ISIDIOSUM (2025): Consortium of lichen herbaria of the world. Available at https://lichenportal.org/portal/collections/list.php?usethes=1&taxa=55960 (accessed on 04 July 2025).

NJUGUNA, E., BROWNHILL, L., KIHORO E., MUHAMMAD, L. and HICKEY G. M. (2016): — Gendered technology adoption and household food security in semi-arid Eastern Kenya, *in* Njuki J., Parkins J. R. and Kaler A. (eds) *Transforming Gender and Food Security in the Global South.* Routledge, London and New York: 260–282. ISBN 9781315564111

NJUGUNA, E., BROWNHILL, L., KIHORO, E., MUHAMMAD, L. and HICKEY, G.M. (2016): Gendered technology adoption and household food security in semi-arid Eastern Kenya. In: Njuki J, Parkins JR and Kaler A (eds), Transforming Gender and Food Security in the Global South. London and New York: Routledge pp. 260–282. ISBN 9781315564111.

OKUYAMA, E., UMEYAMA, K., YAMAZAKI, M., KINOSHITA, Y. and YAMAMOTO,Y. (1995): Usnic acid and diffractaic acid as analgesic and antipyretic components of *Usnea diffracta*. – *Planta Med*. 61, 113–115. doi: 10.1055/s-2006-958027.

OLARIAGA, I., PAZ-BERMÚDEZ, G., CALVO, J, PRIETO, M., and PRIETO, M.(2020): Rediscovery of the endangered lichen Pseudocyphellaria aurata (Lobariaceae, Ascomycota) in mainland Spain. Anales Del Jardin Botanico de Madrid 2020, 77(2), 1–10. https://doi.org/10.3989/AJBM.2558

OLIVER, T. H., HEARD, M. S., ISAAC, N. J. B., ROY, D.B., DEBORAH PROCTER, D., EIGENBROD, F., FRECKLETON, R., HECTOR, A., C. DAVID, L. ORME L, OWEN, L. PETCHEY, K, PROENÇA, V., RAFFAELLI, D., SUTTLE, K. B., MACE G. M., MARTÍN-LÓPEZ, B., WOODCOCK, B. A. and BULLOCK, J. M. (2015): Biodiversity and Resilience of Ecosystem Functions. In: *Trends of Ecology and Evolution* 30(11): 673–684. https://doi.org/10.1016/j.ecolind.2016.05.004

PAGE, M.J., MCKENZIE, J.E., BOSSUYT, P.M., BOUTRON, I., HOFFMANN, T.C., MULROW, C.D,, SHAMSEER, L., TETZLAFF, J.M., AKL, E.A., BRENNAN, S.E., CHOU, R, GLANVILLE, J, GRIMSHAW, J.M, HRÓBJARTSSON, A, LALU, M.M, LI, T, LODER, E.W, MAYO-WILSON, E, MCDONALD, S, MCGUINNESS, L.A, STEWART, L.A, THOMAS, J, TRICCO, A.C, WELCH, V.A., WHITING, P. and MOHER, D. (2020):The PRISMA 2020 statement: an updated guideline for reporting systematic reviews.In: BMJ 372, n71. 2021. https://doi.org/10.1136/BMJ.N71

PANNARIA HOOKERI (2025): Consortium of lichen herbaria of the world. Available at https://lichenportal.org/portal/taxa/index.php?taxon=54270&clid=1163 (accessed on 04 July 2025).

PAOLI, L., BENESPERI, R., FAČKOVCOVÁ, Z., NASCIMBENE, J., RAVERA, S., MARCHETTI. M., ANSELMI, B., LANDI, M., LANDI. S., BIANCHI, E., LOPPI, S. and GUTTOVÁ, A. (2019): Impact of forest management on threatened epiphytic macrolichens: Evidence from a Mediterranean mixed oak forest (Italy). iForest – Biogeosciences and Forestry 12(4):383–388. https://doi.org/10.3832/ifor2951-012

PARMOTREMA COMMENSURATUM (2025): Global Biodiversity Information Facility (GBIF). Available at https://www.gbif.org/species/3407509 (accessed on 03 July 2025)

PARMOTREMA PSEUDOCRINITUM (2025): Consortium of lichen herbaria of the world. Available at https://lichenportal.org/portal/collections/list.php?usethes=1&taxa=170230 (accessed on 04 July 2025).

PARMOTREMA PSEUDOGRAYANUM (2025): Consortium of lichen herbaria of the world. Available at https://lichenportal.org/portal/collections/list.php?usethes=1&taxa=170231 (accessed on 04 July 2025).

PARMOTREMA STUHLMANNII (2025): Global Biodiversity Information Facility (GBIF). Available at https://www.gbif.org/pt/occurrence/search?taxon_key=2606253 (accessed on 03 July 2025)

PARMOTREMA TSAVOENSE (2025): Consortium of lichen herbaria of the world. Available at https://lichenportal.org/portal/collections/list.php?usethes=1&taxa=170303_(accessed on 04 July 2025).

PELTIGERA CICHORACEA (2025): Consortium of lichen herbaria of the world. Available at https://lichenportal.org/portal/collections/list.php?usethes=1&taxa=170496 (accessed on 04 July 2025).

PELTIGERA CONTINENTALIS (2025): Consortium of lichen herbaria of the world. Available at https://lichenportal.org/portal/collections/list.php?usethes=1&taxa=170499 (accessed on 04 July 2025).

PELTIGERA LAMBINONII (2025): Consortium of lichen herbaria of the world. Available at https://lichenportal.org/portal/collections/list.php?usethes=1&taxa=170566 (accessed on 04 July 2025).

PELTIGERA POLYDACTYLOIDES (2025): Consortium of lichen herbaria of the world. Available at https://lichenportal.org/portal/collections/list.php?usethes=1&taxa=170670 (accessed on 04 July 2025).

PELTULA SANTESSONII (2025): Consortium of lichen herbaria of the world. Available at https://lichenportal.org/portal/collections/list.php?usethes=1&taxa=170873 (accessed on 04 July 2025).

PEREIRA, E.C., DA SILVA. N.H., BURIL, M DE LL., MARTINS, M.C.B., SILVA, H.A.M.F., FALCÃO, E.P.S., DE OLIVEIRA, H.P., DA COSTA, M.M., LEGAZ, M.E., SANTIAGO, R. and VICENTE C. (2020): Bioactive compounds from Brazilian lichens and their biotechnological applications. In: Swamy MK (ed.), Plant-derived Bioactives: Production, Properties and Therapeutic Applications. Singapore: Springer Nature Singapore Pte Ltd., pp. 209–238. doi:10.1007/978-981-15-1761-7_9.

PÉREZ-ORTEGA, S., ORTIZ-ÁLVAREZ, R., ALLAN GREEN, T. and DE LOS RÍOS, A. (2012): Lichen myco- and photobiont diversity and their relationships at the edge of life (McMurdo Dry Valleys, Antarctica). *FEMS Microbiology Ecology*, 82(2), 429–448. https://doi.org/10.1111/j.1574-6941.2012.01422.x

PHYLLOPSORA KIIENSIS (2025): Consortium of lichen herbaria of the world. Available at https://lichenportal.org/portal/collections/list.php?usethes=1&taxa=173126 (accessed on 04 July 2025).

PHYSCIA ATROSTRIATA (2025): Global Biodiversity Information Facility (GBIF). Available at https://www.gbif.org/species/2608894 (accessed on 04 July 2025).

PHYSCIA ERUMPENS (2025a): Consortium of lichen herbaria of the world. Available at https://lichenportal.org/portal/taxa/index.php?tid=55144&taxauthid=1&clid=201 (accessed on 04 July 2025).

PHYSCIA ERUMPENS (2025b): Global Biodiversity Information Facility (GBIF). Available at https://www.gbif.org/species/22608927 (accessed on 04 July 2025).

PHYSCIA ERUMPENS (2025a): Consortium of lichen herbaria of the world. Available at https://lichenportal.org/portal/taxa/index.php?tid=55144&taxauthid=1&clid=201 (accessed on 04 July 2025).

PHYSCIA ERUMPENS (2025b): Global Biodiversity Information Facility (GBIF). Available at https://www.gbif.org/species/22608927 (accessed on 04 July 2025).

PHYSCIA INTEGRATA (2025): Global Biodiversity Information Facility (GBIF). Available at https://www.gbif.org/es/species/2608931 (accessed on 04 July 2025).

PHYSCIA PONCINSII (2025): Consortium of lichen herbaria of the world. Available at https://lichenportal.org/portal/taxa/index.php?tid=55130&taxauthid=1&clid=36840 (accessed on 04 July 2025).

PHYSCIA PONCINSII (2025): Consortium of lichen herbaria of the world. Available at https://lichenportal.org/portal/taxa/index.php?tid=55130&taxauthid=1&clid=36840 (accessed on 04 July 2025).

PHYSCIA UNDULATA (2025): Global Biodiversity Information Facility (GBIF). Available at https://www.gbif.org/species/2608902 (accessed on 04 July 2025).

PHYSCIA UNDULATA (2025): Global Biodiversity Information Facility (GBIF). Available at https://www.gbif.org/species/2608902 (accessed on 04 July 2025).

PICA, M.L., RENDINA, F., COCOZZA DI MONTANARA, A. and RUSSO, G.F. (2024): Bibliometric Analysis of the Status and Trends of Seamounts' Research and Their Conservation. Diversity 2024, 16(11), 670. https://doi.org/10.3390/D16110670

PINNA, D., GALEOTTI, M., PERITO, B., DALY, G. and SALVADORI, B. (2018): In situ long-term monitoring of recolonization by fungi and lichens after innovative and traditional conservative treatments of archaeological stones in Fiesole (Italy). *International Biodeterioration & Biodegradation* 132: 49–58. https://doi.org/10.1016/j.ibiod.2018.05.003

PIŠÚT, I. (1999): Chránené druhy machorastov a lisajníkov v Slovenskej republike [Bryophytes and lichens protected by law in the Slovak Republic]. *Bryonora*, 24, 27–28.

PLACOPSIS PARELLINA (2025): Consortium of lichen herbaria of the world. Available at https://lichenportal.org/portal/collections/list.php?taxa=126739&usethes=1&taxontype=2&comingFrom=newsearch&page=1 (accessed on 04 July 2025).

PÓCS T. and SZABÓ A. (1993): The epiphytic vegetation on the endemic giant groundsel (*Senecio barbatipes*) of Mt. Elgon, Kenya. *Opera Botanica,* 121, 189–194.

POELT, J. (1962): Bemerkungen über einie europaische Flechten. *Mitteil. der Bot. Staatssammlung München,* **4**: 297–299.

POLYBLASTIDIUM CASARETTIANUM (2025): Global Biodiversity Information Facility (GBIF). Available at https://www.gbif.org/species/3427574 (accessed on 03 July 2025)

POTT R. (2014): Biogeosystems and biodiversity-the network of biotic diversity on earth. In: *Phytocoenologia,* 44, 245–254. https://doi.org/10.1127/0340-269X/2014/0044-0575

PRADO, T., DEGRAVE, W. M. S., and DUARTE, G. F. (2025): Lichens and health—Trends and perspectives for the study of biodiversity in the Antarctic ecosystem. *Journal of Fungi,* 11(3), 198. https://doi.org/10.3390/jof11030198

PRETTY, J., and PILGRIM, S. (2008): Indigenous Intelligence: Diverse Solutions for the 21st Century. In: Nature and Culture. Resurgence. Web Exclusives 250. Sept/Oct 2008. Available at https://www.resurgence.org/magazine/article2629-nature-and-culture.html. (accessed 10 July 2024.

PSEUDOCYPHELLARIA DOZYANA (2025): Consortium of lichen herbaria of the world. Available at https://lichenportal.org/portal//taxa/index.php?tid=175982&taxauthid=1&clid=1283 (accessed on 04 October 2025).

PYXINE KIBWEZIENSIS (2025): Consortium of lichen herbaria of the world. Available at https://lichenportal.org/portal/collections/list.php?usethes=1&taxa=177723 (accessed on 04 July 2025).

PYXINE LILACINA (2025): Consortium of lichen herbaria of the world. Available at https://lichenportal.org/portal/collections/list.php?usethes=1&taxa=177725 (accessed on 04 July 2025).

PYXINE MACULATA (2025): Consortium of lichen herbaria of the world. Available at https://lichenportal.org/portal/collections/list.php?usethes=1&taxa=177729 (accessed on 04 July 2025).

PYXINE VERMIFORMIS (2025): Consortium of lichen herbaria of the world. Available at https://lichenportal.org/portal/collections/list.php?usethes=1&taxa=177794 (accessed on 04 July 2025).

R Core Team (2023): A Language and Environment for Statistical Computing. R Foundation for Statistical Computing, Vienna, Austria 2023, Available online: https://www.R-project.org/. (accessed on 7 August 2025).

RAMALINA CALCARATA (2025): Consortium of lichen herbaria of the world. Available at https://lichenportal.org/portal/collections/list.php?usethes=1&taxa=177890 (accessed on 04 July 2025).

RAMALINA HOEHNELIANA (2025): Consortium of lichen herbaria of the world. Available at https://lichenportal.org/portal//collections/list.php?usethes=1&taxa=178241 (accessed on 04 July 2025).

RAMALINA HOLSTII (2025): Consortium of lichen herbaria of the world. Available at https://lichenportal.org/portal/collections/list.php?usethes=1&taxa=178242 (accessed on 04 July 2025).

RAMALINA MARITIMA (2025): Consortium of lichen herbaria of the world. Available at https://lichenportal.org/portal/collections/list.php?usethes=1&taxa=178310 (accessed on 04 July 2025).

RAMALINA REDUCTA (2025a): Consortium of lichen herbaria of the world. Available at https://www.lichenportal.org/portal/collections/list.php?usethes=1&taxa=178436 (accessed on 03 July 2025).

RAMALINA REDUCTA (2025b): Global Biodiversity Information Facility (GBIF). Available at https://www.gbif.org/occurrence/3988118418 (accessed on 03 July 2025)

RAMBOLD G. (2015): The diversity of lichenised fungi: Ecosystem functions and ecosystem services, *in* Upreti D. K., Divakar P. K., Shukla V. & Bajpai R. (eds), *Recent Advances in Lichenology: Modern Methods and Approaches in Lichen Systematics and Culture Techniques, Volume 2,* Springer, New Delhi: 121–146.

RANA, A. (2020): Trends in climate change research: A Bibliometric review. In: *Environmental Science and Policy,* 114, 190–200.

RAVERA, S., ISOCRONO, D., NASCIMBENE, J., GIORDANI, P., BENESPERI, R., TRETIACH, M. and MONTAGNANI, C. (2016): Assessment of the conservation status of the mat-forming lichens *Cladonia* subgenus *Cladina* in Italy. *Plant Biosystems*, 2016, 150(5), 1010–1022. https://doi.org/10.1080/11263504.2014.1000422

REN, H., GUO, W., ZHANG, Z., KISOVI, L.M. and DAS, P. (2020): Population density and spatial patterns of informal settlements in Nairobi, Kenya. In*: Sustainability* 12(18): 7717. https://doi.org/10.3390/su12187717.

RIDDELL, J., PADGETT, P.E. and NASH, T.H. (2012): Physiological responses of lichens to factorial fumigations with nitric acid and ozone. *Environmental Pollution*, 170, 202–210. https://doi.org/10.1016/j.envpol.2012.06.014

RLL (2025): Recent literature on lichens. Available online: https://nhm2.uio.no/botanisk/lav/RLL/RLL.HTM. (accessed on 18 October 2025).

ROCCELLA BABINGTONII (2025): — Consortium of lichen herbaria of the world. Available at https://lichenportal.org/portal//collections/list.php?usethes=1&taxa=180054 (accessed on 04 July 2025).

ROCHA, B., PINHO, P., VIEIRA, J., BRANQUINHO, C. and MATOS, P. (2019): Testing the poleotolerance lichen response trait as an indicator of anthropic disturbance in an urban environment. *Diversity*, 11(4), 55. https://doi.org/10.3390/D11040055

RONO, P.K., RAHMAN, S.M., AMIN, M.D. and BADRUDDOZA, S. (2023): Unravelling the Channels of Food Security of the Households in Northern Kenya: Evidence from an Exclusive Dataset. – *Curr. Dev. Nutr.,* 7(2), 100005. doi:10.1016/j.cdnut.2022.100005.

SAMIR, H.A., HACHEMI, B., DJAMEL, M.M., MOHAMMED, A.H. and OUSSAMA, H. (2019) Species diversity, chorology and conservation of the lichen flora in Tessala Mountains forest (North-West Algeria). In: *Flora Mediterranea*, 29, 75–91.

SCHEI, F. H., BLOM, H. H., GJERDE, I., GRYTNES, J. A., HEEGAARD, E. and SÆTERSDAL M. (2013): Conservation of epiphytes: Single large or several small host trees? In: *Biological Conservation* 168: 144–151. https://doi.org/10.1016/j.biocon.2013.10.001

SCHEIDEGGER, C and GOWARD, T. (2002): Monitoring lichens for conservation: red lists and conservation action plans, *in* Nimis, P. L., Scheidegger, C. and Wolseley, P. A. (eds) *Monitoring* *with Lichens — Monitoring Lichens. Springer,* Dordrecht 163–181. https://doi.org/10.1007/978-94-010-0423-7_12

SCHEIDEGGER, C. and WERTH, S. (2009): Conservation strategies for lichens: insights from population biology. In: *Fungal Biology Review,* 23(3): 55–66. https://doi.org/10.1016/j.fbr.2009.10.003

SCHEIDEGGER, C. (1998): Erioderma pedicellatum: a critically endangered lichen species. Species: Newsletter of the Species Survival Commission IUCN June, 68–69.

SCHEIDEGGER, C. and GOWARD, T. (2002): Monitoring Lichens for Conservation: Red Lists and Conservation Action Plans. In Monitoring with Lichens – Monitoring Lichens. Nimis, P.L., SCHEIDEGGER, C., WOLSELEY, P.A. Eds., Springer: Dordrecht, The Nertherlands pp. 163–181. https://doi.org/10.1007/978-94-010-0423-7_12

SCHEIDEGGER, C. and STOFER, S. (2015): The importance of old-growth forests for lichens: Keystone structures, connectivity, ecological continuity. Schweizerische Zeitschrift fur Forstwesen 166, 75–82. https://doi.org/10.3188/szf.2015.0075

SCHEIDEGGER, C. and WERTH, S. (2009): Conservation strategies for lichens: insights from population biology. In: *Fungal Biology Reviews*, 23(3), 55–66. https://doi.org/10.1016/j.fbr.2009.10.003

SCHRÖDER, B. (1927): Zellpflanzen Ostafrikas, gesammelt auf der Akademischen Studienfahrt 1910. *Hedwigia* 67: 141-149.

SCUTARI, N. C. (1997): Three new species of *Hyperphyscia* (Physciaceae, lichenized Ascomycotina), with a revision of *Hyperphyscia adglutinata*. *Mycotaxon,* 61, 87–102.

SCYTINIUM GELATINOSUM (2025): Consortium of lichen herbaria of the world. Available at https://lichenportal.org/portal/taxa/index.php?taxauthid=1&taxon=53565&clid=1046 (accessed on 04 July 2025).

SCYTINIUM INTERMEDIUM (2025): Consortium of lichen herbaria of the world. Available at https://lichenportal.org/portal/collections/list.php?usethes=1&taxa=25738 (accessed on 04 July 2025).

SCYTINIUM LICHENOIDES (2025): Consortium of lichen herbaria of the world. Available at https://lichenportal.org/portal/taxa/index.php?taxauthid=1&taxon=53573&clid=1103 (accessed on 04 July 2025).

SCYTINIUM SUBFRAGRANS (2025): Atlas of living Australia. Available at https://bie.ala.org.au/species/NZOR-6-92632 (accessed on 03 July 2025)

SEAWARD, M.R.D. (1993): Lichens and sulphur dioxide air pollution: Field studies. In: *Environ. Rev.,* 1, 73–91. https://doi.org/10.1139/A93-007

SENN-IRLET, B. (2005): The role of the ECCF in studies and conservation of fungi in Europe. In: *Mycologia Balcanica,* 2(3), 185–192. https://doi.org/10.5281/zenodo.2547027

SHARMA, R. and KAUR, R. (2019): Fluoride toxicity triggered oxidative stress and the activation of antioxidative defence responses in Spirodela polyrhiza L. Schleiden. In: *J. Plant Interact.,* 14, 440–452. https://doi.org/10.1080/17429145.2019.1646826

SINGH G., APTROOT A., RICO V. J., OTTE J., DIVAKAR P. K., CRESPO A., LUMBSCH H. T., SCHMITT I. and CÁCERES M. E. S. (2018): *Neoprotoparmelia* gen. nov. and *Maronina* (Lecanorales, Protoparmelioideae): species description and generic delimitation using DNA barcodes and phenotypical characters. In: *MycoKeys,* 44: 19–50. https://doi.org/10.3897/mycokeys.44.29904

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, 1046 p.

SOLHAUG, K.A., GAUSLAA, Y., NYBAKKEN, L., BILGER, W.(2003): UV-induction of sun-screening pigments in lichens. In: *New Phytologist*, 158, 91–100. https://doi.org/10.1046/J.1469-8137.2003.00708.X

SPARRIUS, L.B., APTROOT, A., SIPMAN, H.J.M., PÉREZ-VARGAS, I., MATOS, P., GERLACH, A., VERVOORT, M (2017): Estimating the population size of the endemic lichens *Anzia centrifuga* (Parmeliaceae) and *Ramalina* species (Ramalinaceae) on Porto Santo (Madeira archipelago). In: Bryologist 120(3), 293–301. https://doi.org/10.1639/0007-2745-120.3.293

STAIGER, B. and KALB, K. (1995): *Haematomma*-studien. I. Die Flechtengattung *Haematomma*. In: *Bibliotheca Lichenologica,* 59, 1–198.

STAIGER, B. (2002): Die Flechtenfamilie Graphidaceae. Studien in Richtung einer natürlicheren Gliederung. In: *Bibliotheca Lichenologica,* 85, 1–526.

STAM, A., HE, X., KAASALAINEN, U., TOIVONEN, M., ENROTH, J., RÄSÄNEN, M. and RIKKINEN, J. (2020): Epiphyte colonisation of fog nets in montane forests of the Taita Hills, Kenya. *Annales Botanici Fennici,* 57(4-6), 227–238. https://doi.org/10.5735/085.057.0406

STEINER, J. (1897): Flechten aus Britisch-Ostafrika. *Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften. Mathematisch-Naturwissenschaftliche Classe.* 106(1), 207-234

STEREOCAULON CLAVICEPS (2025): Consortium of lichen herbaria of the world. Available at https://lichenportal.org/portal/collections/list.php?usethes=1&taxa=184426 (accessed on 03 July 2025).

STEREOCAULON CORTICATULUM (2025): New Zealand Plant Conservation Network. Available at https://www.nzpcn.org.nz/flora/species/stereocaulon-corticatulum/ (accessed on 03 July 2025).

STICTA VARIABILIS (2025): Global Biodiversity Information Facility (GBIF). Available at https://www.gbif.org/species/5260677 (accessed on 03 July 2025)

STORK, H. and ASTRIN, J.J. (2014): Trends in Biodiversity Research. A Bibliometric Assessment. In: Open J. Ecol. 4, 354–370. https://doi.org/10.4236/OJE.2014.47033

SUIJA, A., DE LOS RÍOS A. and PÉREZ-ORTEGA S. (2015): A molecular reappraisal of *Abrothallus* species growing on lichens of the order Peltigerales. *Phytotaxa,* 195(3), 201–226. https://doi.org/10.11646/phytotaxa.195.3.1

SUIJA, A., KAASALAINEN, U., KIRIKA, P. M. and RIKKINEN, J. (2018): *Taitaia*, a novel lichenicolous fungus in tropical montane forests in Kenya (East Africa). In: *The Lichenologist,* 50(2): 173–184. https://doi.org/10.1017/S0024282918000026

SUJETOVIENĖ, G., SALIŠIŪTĖ, J., DAGILIŪTĖ, R. and ŽALTAUSKAITĖ, J. (2020): Physiological response of the bioindicator Ramalina farinacea in relation to atmospheric deposition in an urban environment. *Environmental Science and Pollution Research,* 27, 26058–26065. https://doi.org/10.1007/s11356-020-08767-4

SUPYAN, S., SUSANTO, A.N., SAMADAN, G.M. and SULISTIONO, S. (2021): Traditional wisdom as a starting point for conservation: A review. In*: IOP Conf. Ser. Earth Environ. Sci.,* 890(1): 012064. doi:10.1088/1755-1315/890/1/012064.

SUSANTO, D. and NUMATA, S. (2023): Traditional Ecological Knowledge of the Tengger Tribe and its Influencing Factors in Bromo Tengger Semeru National Park. In: *Jurnal Manajemen Hutan Tropika,* 29(3), 254–264. doi:10.7226/jtfm.29.3.254.

SUTAR, R. R., GAIKWAD, S. B., MAPARI, S. V. and BEHERA, B. C. (2021): Lichens: traditional use and biological activities. *Botanica Pacifica,* 10, 69–82. https://doi.org/10.17581/bp.2021.10202

SWINSCOW, T. D. V. and KROG, H. (1979): The lichen genera *Heppia* and *Peltula* in East Africa. In: *Norwegian Journal of Botany,* 26, 213–224.

SWINSCOW, T. D. V. and KROG, H. (1988): *Macrolichens of East Africa.* British Museum (Natural History), London, 390 p.

SWINSCOW, T.D.V. and KROG, H. (1975): The genus *Pyxine* in East Africa. In: *Norwegian Journal of Botany*, 22, 43-68

TAN, YL., YIEW, T.H., HABIBULLAH, M.S., CHEN, J.E., KAMAL, S.M. and SAUD, N.A. (2023): Research trends in biodiversity loss: a Bibliometric analysis. In: *Environ. Sci. Pollut. Res.*, 30, 2754–2770. https://doi.org/10.1007/s11356-022-22211-9

TEHLER, A., IRESTEDT, M., WEDIN, M. and ERTZ, D. (2010): The old world *Roccella* species outside Europe and Macaronesia: taxonomy, evolution and phylogeny. In*: Systematics and Biodiversity,* 8(2), 223–246.

TEMU, S. G. and TIBUHWA, D. D. (2024): Advancing the understanding of Tanzania's lichen flora: a comprehensive review. In: *Plant and Fungal Systematics* 6 (2): 218–251. https://doi.org/10.35535/pfsyst-2024-0020

THIERS, B. (2025): Index Herbariorum: A Global Directory of Public Herbaria and Associated Staff. New York Botanical Garden's Virtual Herbarium. Available at http://sweetgum.nybg.org/science/ih/ (accessed on 27 May 2025).

THIERS, B. (Continuously Updated) Index Herbariorum: A Global Directory of Public Herbaria and Associated Staff. New York Botanical Garden's Virtual Herbarium. Available online: http://sweetgum.nybg.org/science/ih/. (accessed on 12 May 2024).

TIBELL, L. and FRISCH, A. (2010): New data on crustose mazaediate lichens from tropical Africa. *Bibliotheca Lichenologica,* 104, 323–332.

TIMDAL, E. and KROG, H. (2001): Further studies on African species of the lichen genus *Phyllopsora* (Lecanorales). In: *Mycotaxon* 77: 57–89.

TOMORY, I. (2019): The Cultural Context Of Adaptation Western Education In East-Africa: Paradoxons And Missing Links. *In: WEJSS,* 8, 133–145. doi:10.36739/wejss.2019.v8.i2.23.

TOMORY, I. (2024): Challenges of technical training and technical teacher training in Africa. In: Tovar-Caro, E., Vendrell-Vidal, E., Cukierman, U.R. and Auer, M.E. (eds), Towards a hybrid, flexible and socially engaged higher education: Proceedings of the 26th International Conference on Interactive Collaborative Learning (ICL2023), Volume 2. Cham: Springer Nature Switzerland. pp. 250–261. doi: 10.1007/978-3-031-52667-1_25.

TOMORY, I. (2018): The role of foreign aid in education and development: field experiences, examples from East Africa. In: AUER, M. E., GURALNICK, D. and SIMONICS, I. (Eds): Teaching and learning in a digital world: proceedings of the 20th International Conference on Interactive Collaborative Learning: Volume 1. Dordrecht: Springer Netherlands, pp. 936–942. doi: 10.1007/978-3-319-73210-7_106.

TONG, Y.-J., YANG, H.-D., JENKINS SHAW, J., YANG X.-K. and BAI M. (2021): The relationship between genus/species richness and morphological diversity among subfamilies of jewel beetles. In: *Insects,* 12, 24. https://doi.org/10.3390/insects12010024

TRASS, H. and RANDLANE, T. (1987): Extinct macrolichens of Estonia. In: *Folia Cryptogamica Estonica*, 25: 1–7.

TRIEBEL, D., RAMBOLD, G. and ELIX, J. A. (1995): A conspectus of the genus *Phacopsis* (Lecanorales).In: *The Bryologist,* 98 (1), 71–83. https://doi.org/10.2307/3243643

TRUONG, C., RODRIGUEZ, J. M., and CLERC, P. (2013): Pendulous *Usnea* (Parmeliaceae, lichenized Ascomycota) species from tropical South America and the Galapagos. In: *The Lichenologist*, 45 (4), 505–543

TURNER, W. R., BRANDON, K., BROOKS, T. M., COSTANZA, R., DA FONSECA, G. A. B. and PORTELA, R. (2007): Global conservation of biodiversity and ecosystem services. In: *BioScience,* 57 (10), 868–873. https://doi.org/10.1641/B571009

U.S. FOREST SERVICE. (2025): Forest Inventory and Analysis. U.S. Department of Agriculture, Forest Service, Research and Development. Available online: https://research.fs.usda.gov/programs/fia (accessed on 19 September 2025).

UMBILICARIA HAUMANIANA (2025): Consortium of lichen herbaria of the world. Available at https://lichenportal.org/portal/collections/list.php?usethes=1&taxa=188701 (accessed on 04 July 2025).

UMBILICARIA VELLEA (2025): Consortium of lichen herbaria of the world. Available at https://lichenportal.org/portal/taxa/index.php?taxon=69738 (accessed on 04 July 2025).

UNECE (2025a): United Nations Economic Commission for Europe. Forests. Available online: https://unece.org/environmental-policy/air/forests (accessed on 19 September 2025).

UNECE (2025b): United Nations Economic Commission for Europe. Convention and Its Achievements. Available online: https://unece.org/environmental-policy/air/convention-and-its-achievements (accessed on 20 September 2025).

UNFCCC 2025a. United Nations Framework Convention on Climate Change. The Kyoto Protocol. Available online: https://unfccc.int/process-and-meetings/the-kyoto-protocol. (accessed on 18 September 2025).

UNFCCC 2025b. United Nations Framework Convention on Climate Change. The Paris Agreement. Available online: https://unfccc.int/process-and-meetings/the-paris-agreement (accessed on 18 September 2025).

UPRETI, D. K., DIVAKAR, P. K. and NAYAKA, S. (2005): Commercial and ethnic use of lichens in India. In: *Econ. Bot.*, 59, 269–273. https://doi.org/10.1663/0013-0001(2005)059[0269:CAEUOL]2.0.CO,2

USNEA ANGULATA (2025): Global Biodiversity Information Facility (GBIF). Available at https://www.gbif.org/species/2606124 (accessed on 03 July 2025)

USNEA ELATA (2025): Consortium of lichen herbaria of the world. Available at https://www.lichenportal.org/portal/collections/list.php?usethes=1&taxa=189461 (accessed on 04 July 2025).

USNEA PERHISPIDELLA (2025): Consortium of lichen herbaria of the world. Available at https://lichenportal.org/portal/collections/list.php?usethes=1&taxa=189866 (accessed on 03 July 2025)

USNEA PERPLEXANS (2025): Global Biodiversity Information Facility (GBIF). Available at https://www.gbif.org/species/2605985 (accessed on 03 July 2025)

USNEA SUBFLORIDA (2025): — Consortium of lichen herbaria of the world. Available at https://lichenportal.org/portal/collections/list.php?usethes=1&taxa=190068 (accessed on 04 July 2025).

USNEA SUBMOLLIS (2025): Global Biodiversity Information Facility (GBIF). Available at https://www.gbif.org/species/3410372 (accessed on 03 July 2025)

USNEA TORULOSA (2025): New Zealand (Australia). Available at https://www.nzpcn.org.nz/flora/species/usnea-torulosa/ (accessed on 03 July 2025)

VAN BREUGEL, P., KINDT, R., LILLESØ, J-PB and VAN BREUGEL, M. (2015): Environmental gap analysis to prioritize conservation efforts in Eastern Africa. In*: PLoS One* 10(4), e0121444. doi:10.1371/journal.pone.0121444.

VINAYAKA, K. S. and KEKUDA, T. R. P. (2023): Ethnic knowledge on medicinal and nutritional attributes of lichens with emphasis on the Western Ghats. In: ÖSTÜRK,M, SRIDHAR, K. R., SARWAT, M., ALTAY, V. and HUERTA-MARTÍNEZ, F. M. (Eds): *Ethnic knowledge and perspectives of medicinal plants: Volume 2: Nutritional and dietary benefits*. New York: Apple Academic Press, pp. 57–69.

WALKER, M. D., WAHREN, C. H., HOLLISTER, R. D., HENRY, G. H. R., AHLQUIST, L. E., ALATALO, J. M., BRET-HARTE, M. S., CALEF, M. P., CALLAGHAN, T. V., CARROLL, A. B., EPSTEIN, H. E., JÓNSDÓTTIR, I. S., KLEIN, J. A., MAGNÚSSON, B., MOLAU, U., OBERBAUER, S. F., REWA, S. P., ROBINSON, C. H., SHAVER, G. R., SUDING, K. N., THOMPSON, C. C., TOLVANEN, A., TOTLAND, Ø., TURNER, P. L., TWEEDIE, C. E., WEBBER, P. J. and WOOKEY, P. A. (2006): Plant community responses to experimental warming across the tundra biome. Proc. Natl. Acad. Sci. USA 103, 1342–1346. https://doi.org/10.1073/PNAS.0503198103

WANG, C-H., MUNZI, S., WANG, M., JIA, Y-Z. and TAO, W. (2019): Increasing nitrogen depositions can reduce lichen viability and limit winter food for an endangered Chinese monkey. *Basic and Applied Ecology*, 34, 55–63. https://doi.org/10.1016/j.baae.2018.10.006

WANG, Z., ZHAO, Y. and WANG, B. (2018): A Bibliometric analysis of climate change adaptation based on massive research literature data. In: *J. Clearner Prod.*, 199: 1072–1082. https://doi.org/10.1016/j.jclepro.2018.06.183

WEDIN, M. (1994): New and noteworthy lichenicolous fungi from southernmost South America. In: *The Lichenologist,* 26 (3), 301–310. https://doi.org/10.1017/S002428299400037X

WEI, X., DENG, H. and WEI, J. (2020): Threatened categories assessment of lichens in China. In: *Biodiversity Science,* 28 (1), 54–65. https://doi.org/10.17520/biods.2019154

WIRTH, V. (1976): Rote Liste der Flechten (Lichenes). 1. Fassung (vorlaufige Artenauswahl), Stand Ende . In Rote Liste der gefahrdeten Tiere und Pfanzen in der Bundesrepublik Deutschland. Naturschutz aktuell 1, Blab J. et al. Eds., Kildaverlag: Greven, Germany, 1977, pp. 60-64.

WIRTH, V. (1984): Rote Liste der Flechten (Lichenieserte Ascoyzeten). In Rote Liste der gefährdeten Tiere und Pflanzen in der BRD, Blab, J., Nowak, E., Trautmann, W., Sukopp, H., Eds, Kildaverlag: Greven, Germany pp. 152–162.

XANTHOPARMELIA CONGENSIS (2025): Global Biodiversity Information Facility (GBIF). Available at https://www.gbif.org/species/2604256 (accessed on 03 July 2025)

XANTHOPARMELIA HYPOLEIA (2025): Consortium of lichen herbaria of the world. Available at https://lichenportal.org/portal/collections/list.php?usethes=1&taxa=192688 (accessed on 04 July 2025).

XANTHOPARMELIA KENYANA (2025): Consortium of lichen herbaria of the world. Available at https://lichenportal.org/portal/collections/list.php?usethes=1&taxa=192729 (accessed on 04 July 2025).

XANTHOPARMELIA KROGIAE (2025): Consortium of lichen herbaria of the world. Available at https://www.lichenportal.org/portal/collections/list.php?usethes=1&taxa=192741 (accessed on 04 July 2025).

XANTHOPARMELIA SUBRAMIGERA (2025): Global Biodiversity Information Facility (GBIF). Available at https://www.gbif.org/species/2603995 (accessed on 03 July 2025)

XANTHOPARMELIA SUBTORTULA (2025): Consortium of lichen herbaria of the world. Available at https://lichenportal.org/portal/collections/list.php?usethes=1&taxa=193057 (accessed on 04 July 2025).

XIA, C., ZHAO, W., WANG, J., SUN, J., CUI, G. and ZHANG, L. (2023): Progress on geographical distribution, driving factors and ecological functions of Nepalese alder. In: *Diversity*, 15 (1), 59. https://doi.org/10.3390/d15010059

XU, M., DE BOER, H., OLAFSDOTTIR, E. S., OMARSDOTTIR, S. and HEIDMARSSON, S. (2020): Phylogenetic diversity of the lichenized algal genus Trebouxia (Trebouxiophyceae, Chlorophyta): A new lineage and novel insights from fungal-algal association patterns of Icelandic cetrarioid lichens (Parmeliaceae, Ascomycota). In: *Botanical Journal of the Linnean Society*, 194 (4), 460–468. https://doi.org/10.1093/botlinnean/boaa050

YAHR R., ALLEN J. L., ATIENZA V., BURGARTZ F., CHRISMAS N., DAL FORNO M., DEGTJARENKO P., OHMURA Y., PÉREZ-ORTEGA S., RANDLANE T., NÆSBORG R.R., SIMIJACA-SALCEDO, D., VON HIRSCHHEYDT, G., ANDERSON, F., APTROOT, A., BALDERAS E., BORUKHIYAH N., CHANDLER A. M., MARRO M. C., DIVAKAR P. K., GARCÍA R. A., HERRERA-CAMPOS M. Á., HOWE, N., JOSEPH S., LARSEN E. M., LENDEMER J. C., MCMULLIN R. T., MICHLIG A., MONCADA B./ PAULSEN J., ROA-GARCÍA F., ROSENTRETER R., SCHEIDEGGER C., SPARRIUS L. B. and STONE D. F.

(2024): Red Listing lichenized fungi: Best practices and future prospects. In: *The Lichenologist,* 56(6), 345–362.

YANG, M-X., DEVKOTA, S., WANG, L-S. and SCHEIDEGGER, S.(2021): Ethnolichenology – The use of lichens in the Himalayas and Southwestern parts of China. In: *Diversity,* 13 (7), 330.

YANG, Y. N., SAFAROVA, R. B., PARK, S. Y., SAKURABA, Y., OH, M. H., ZULFUGAROV, I.S., LEE, C. B., TANAKA, A., PAEK, N. C., and LEE, C. H. (2019): Chlorophyll degradation and light-harvesting complex ii aggregate formation during dark-induced leaf senescence in *Arabidopsis* pheophytinase mutants. In: *Journal of Plant Biology*, 62, 27–38. https://doi.org/10.1007/S12374-018-0242-0/METRICS

YESHITELA, K. (2008): [Dissertation:] *Effects of anthropogenic disturbance on the diversity of foliicolous lichens in tropical rainforests of East Africa: Godere (Ethiopia), Budongo (Uganda) and Kakamega (Kenya).* Cuvillier Verlag, Göttingen, 265 p.

YESHITELA, K., FISCHER, E., KILLMANN, D. and SÉRUSIAUX E. (2009a): *Aspidothelium hirsutum* (Thelenellaceae) and *Caprettia goderei* (Monoblastiaceae), two new species of foliicolous lichens from Ethiopia and Kenya. In: *The Bryologist,* 112 (4), 850–855.

YESHITELA, K., FISCHER, E., KILLMANN, D. and SÉRUSIAUX, E. (2009b): Two new foliicolous species of *Enterographa* (Roccellaceae) from Kenya. In: *The Lichenologist,* 41 (1), 17–23. https://doi.org/10.1017/S0024282909008299

ZAHLBRUCKNER, A. (1926): Afrikanische Flechten (Lichenes). In: *Englers Botanische Jahrbücher,* 60, 468–552.

ZARABSKA-BOŻEJEWICZ, D. (2020): The impact of nitrogen pollution in the agricultural landscape on lichens: A review of their responses at the community, species, biont and physiological levels. In: *Agronomy*, 10 (12), 1852. https://doi.org/10.3390/agronomy10121852

ZEDDA L. (2015): The diversity of lichenised fungi: Ecosystem functions and ecosystem services, *in* Upreti D. K., Divakar P. K., Shukla V. and Bajpai R. (eds), *Recent Advances in Lichenology: Modern Methods and Approaches in Lichen Systematics and Culture Techniques, Volume 2,* Springer, New Delhi: 121–145. https://doi.org/10.1007/978-81-322-2235-4_7

ZHAO, L. and TAGHIZADEH-HESARY, F. (2022): Role of R&D investments and air quality in green governance efficiency. In: *Economic Research-Ekonomska Istraživanja*, 35(1), 5895–5906. https://doi.org/10.1080/1331677X.2022.2039877

ZHURBENKO, M. P. (2021): Studies on lichenicolous fungi in the Uppsala (UPS) collection curated by the late Rolf Santesson. In: *Herzogia,* 34(2), 493–507. https://doi.org/10.13158/heia.34.2.2021.493

Appendix 2: Tables

Appendix_Table 1. Pollution-based threats to lichens.

Type of pollutant	Source of pollutant	Effects on lichens	References
Fluoride-containing pollutants	Industrial	Chlorophyll degradation death to the lichen, hence to population loss, inhibiting spore germination, destruction of lichen substances	(BENHAMADA et al 2020, SHARMA and KAUR 2019, YANG et al. 2019)
Lead	Gasoline combustion and industry	Reduction of photosystem II (PSII) photochemical reactions, and consequently the reduction of integrity and chlorophyll content	(CARRERAS and PIGNATA 2007, BENHAMADA et al. 2023, BRANQUINHO et al. 1997)
Nitrogen-containing pollutants	Agricultural fertilizers, industrial origin	Excess N deposition reduces lichen abundance and increases the metabolism of sensitive species	(GUTIÉRREZ-LARRUGA et al.2020, JOHANSSON et al. .2012, RIDDELL et al. 2012, SUJETOVIENĖ et al. 2020, ZARABSKA-BOŻEJEWICZ 2020)
Sulphur compounds, mostly sulphur dioxide	Industrial	Reduction of chlorophyll	(NASH 1973,2008, KHANI et al. 2011, MEYSUROVA et al. 2011, SEAWARD 1993)

Appendix_Table 2. Land-use change and other threats caused by physical impacts of human activites to lichens.

Category	Potential effects/impacts	Mechanism of the impact	References
Agricultural / artificial land use	Bioaccumulation in lichens, physiological changes in thalli	Increase of heavy metal tolerant and nitrophilous species, decrease of sensitive species	(BERNARDO et al 2021)
Urbanization / infrastructure development	Reduce lichen habitats	Reduction of lichen biodiversity	(NASCIMBENE et al. 2014a, ROCHA et al. 2019)
Physical habitat disturbance	Alter the microclimate and substrate availability	Reduces species richness and biodiversity	(MOXHAM 1986, ARDELEAN et al. 2015, BENESPERI et al. 2013, LEAVITT and ST. CLAIR 2015)
Overcollection	Reduction of lichen population	Decline in species diversity	(GOGOI et al . 2022)

Appendix_Table 3. Climate change-related threats.

Category	Potential effects/impacts	Mechanism of the impact	References
Climate driven biodiversity change	Shrinkage of lichen habitat	Endemic lichen species are predicted to be lost	(ALLEN and LENDEMER 2016, APTROOT 2009, APTROOT et al. 2016, 2021, GREEN et al. 2011, MILLER et al 2017, NAYAKA and RAI 2022, WALKER et al. 2006)
	Shift in species distribution	Favouring certain algal partner species (particularly those with *Trentepohlia* algae)	(APTROOT and VAN HERK 2007)
	Loss of freeze-tolerant lichens	Damage to algal partner through carbon depletion and toxic metabolite accumulation	(BJERKE 2011)
Physiological responses	Heat stress	Reduction in photosynthetic efficiency and UV radiation damage	(CHOWANIEC et al. 2023)
	Ozone layer depletion	Exposure to UV-B radiation leads to increased melanisation and secondary metabolite synthesis that limits metabolism	(LEKSIN et al. 2024, SOLHAUG et al. 2023)

Appendix 3: Collection localities of East African samples

Kenya

Makueni 2000

Kenya: Makueni County, Kiou Hill at Makueni, S and above Kiou Primary School, saxicolous at 1,650 m a.s.l., 1°56’57.65”S; 37°19’23.51”E, 2000.

Makueni

Kenya: Makueni County, Sultan Hamud, towards NW on Mombasa Road A109 near Africa Inland Church Bethel at Pendo Kindergarten, in arid savannah vegetation, on bark and twigs of *Acacia* sp. at 1,270 m a.s.l., 1°58’29.08”S; 37°20’15.84”E, C.N. Kanyungulu, 17.08.2023.

Ngong

Kenya: Kajioado County, Ngong Hill Forest Recreational Park, between KenGen Ngong Wind Power Station and Ziplinning Ngong Hills on volcanic rock/tuff and in arid–semi-arid mixed wood vegetation, saxicolous and corticolous at c. 2,300 m a.s.l., 1°23'03.41"S; 36°38'18.39"E, C.N. Kanyungulu, 12.09.2023.

Tanzania

1989

89002– Arusha Region, Ngorongoro District, Ngorongoro Conservation Area, subalpine *Stoebe kilimanjarica* bush, saxicolous at 2,800–3,100 m a.s.l., T. Pócs, 02.01.1989.

89004 – Ngorongoro Conservation Area, the rocky main summit of Oldonyo Oldeani, subalpine dwarf bush of *Crotalaria agatiflora* ssp. *engleri*, *Psoralea foliosa*, *Myrsine africana*, *Kotschya recurvifolia*, saxicolous at 3,200–3,215 m a.s.l., T. Pócs, 02.01.1989.

89005 – Arusha Region, Ngorongoro District, Ngorongoro Conservation Area, E side of the mean Oldeani summit, high altitude *Hagenia* forest at the timberline with *Agauria salicifolia* and *Pittosporum viridiflora*, corticolous at 3,200 m a.s.l., T. Pócs, 02.01.1989.

89011 – Ngorongoro Conservation Area, NE rim, inner slope NW of Oljoro Nyuki, mature, mist effected but heavily grazed *Acacia lahai* stand, very rich in epiphytes, ramicolous at 2,220 m a.s.l., T. Pócs, A. Kijazi & P. Murphy, 09.01.1989.

89027 – Arusha Region, Ngorongoro District, Ngorongoro Conservation Area, SE outer slopes of Ngorongoro Crater, in the valley leading to S from Rotian Glade, evergreen riverine forest with *Ilex mitis* and *Hagenia*, *Podocarpus milanjianus*, *Prunus africanus*, saxicolous at 2,000–2,100 m a.s.l., T. Pócs & S. Chuwa, 18.01.1989.

89031 – Arusha Region, Ngorongoro District, Ngorongoro Conservation Area, Marera Forest NE of Karatu village, at the E slope of Ayandu Hill, S edge of the forest reserve, dry semideciduous forest with many old *Olea africana,* ramicolous at 1,500–1,600 m a.s.l., T. Pócs & S. Chuwa, 19.01.1989.

89053 – Morogoro District, Nguru Mts, on the ridge above the Spirit Lake at the N source of Chazi River, just above the huge Chazi Falls, elfin forest, ramicolous at 2,000–2,100 m a.s.l., T. Pócs & E. Knox, 04.02.1989.

89145 – Kilimanjaro Region, Moshi Rural District, Kilimanjaro Mts, Marangu Route, subalpine *Erica arborea* forest around Mandara Hut at 2,600–2,850 m a.s.l., T. Pócs & S. Orbán, 19.,22.05.1989.

89147 – Kilimanjaro Region, Moshi Rural District, Kilimanjaro Mts, Marangu Route, mosaic of scattered subalpine *Erica arborea* stands and secondary grassland at 2,900–3,000 m a.s.l., T. Pócs & S. Orbán, 20.05.1989.

89149 – Kilimanjaro Region, Moshi Rural District, Kilimanjaro Mts, Marangu Route, gorge with *Senecios* below Horombo Hut at 3,750–3,800 m a.s.l., T. Pócs & S. Orbán, 20.05.1989.

89151 – Kilimanjaro Mts, Marangu Route, spring bog at the "Last Water" at 3,900 m a.s.l., T. Pócs & S. Orbán, 21.05.1989.

89157 – Arusha Region, Hanang District, Pienaar Heights, Bereku Forest Reserve, along the road on the ridge of Babati, mist effected miombo woodland, saxicolous at 1,800 m a.s.l., T. Pócs & S. Orbán, 26.05.1989.

89158 – Dodoma Region, Kondoa District, Salenga Forest Reserve on the ridge along the road between Bereku and Kondoa, mist effected miombo woodland, at 1,900 m a.s.l., T. Pócs & S. Orbán, 26.05.1989.

89160 – Morogoro District, Nguru Mts, S branch of Divue River Valley NW of Mlaguzi village, submontane rainforest, saxicolous at 960–1,080 m a.s.l., T. Pócs & S. Orbán, 30.05.1989.

89165 – Nguru Mts, W from Spirit Lake, above Chazi Falls, elfin forest, ramicolous at 2,140 m a.s.l., T. Pócs & S. Orbán, 01.06.1989.

89180 – Morogoro Region, Morogoro District, Kitulanghalo Forest Reserve 35 km ENE of Morogoro, miombo woodland on the ridge at 560–700 m a.s.l., T. Pócs, 07.06.1989.

89186 – Arusha Region, Meru District, Mt Meru, W slope, *Erica arborea* stand with *Senecio kilimanjari* and *Lobelia deckenii* in the N branch of Engare Narok valley at 3,150–3,250 m a.s.l., T. Pócs, 16.06.1989.

89192 – Arusha Region, Longido (Maasai) District, Longido Hill above Longido village, dry evergreen forest on the S ridge, saxicolous at 1,900–2,000 m a.s.l., T. Pócs & V. R. Nsolomo, 16.06.1989.

89194 – Arusha Region, Meru District, Mt Meru, SW slope, subalpine *Erica arborea* giant heath with many *Senecio kilimanjari*, *Myrsine, Rapanea*, *Dirsa stairsii* and *Swertia kilimanjarica* on the SW ridge of the main peak, corticolous at 2,700–3,100 m a.s.l., T. Pócs, Mnyonga & V. R. Nsolomo, 21.06.1989.

89217 – Morogoro Region, Kilosa District, Mamboya Hills, round granitic rock outcrop near Magubike along the Morogoro–Dodoma highway, *Xerophyta scabrida* (Velloziaceae) bush on the rock summit at 880 m a.s.l., T. Pócs & H. Krog, 25.08.1989.

89224 – Morogoro Region, Morogoro District, Nguru Mts, S branch of Divue Valley 1 km W of Mlaguzi village, submontane rainforest, saxicolous at 1,000–1,300 m a.s.l., T. Pócs & D. Emmrich, 23-24.09.1989.

1990

90008 – Kilimanjaro Region, Siha District, Kilimanjaro Mts, NW slopes, at Larangwa, dry semievergreen forest dominated by *Teclea simplicifolia*, *Calodendrum capense*, *Olea Africana*, corticolous at 1,700 m a.s.l., T. Pócs with Katigula, 19.01.1990.

90021 – Kilimanjaro Region, Rombo District, Kilimanjaro Mts, NE slope of Mawenzi, WSW of Tarakea village, N side of Nesikiria river, mossy montane evergreen forest dominated by *Hagenia abyssinica*, corticolous at 2,560 m a.s.l., T. Pócs with Mjatta & J. Linden, 01.02.1990.

90022 – Kilimanjaro Region, Rombo District, Kilimanjaro Mts, NE slope of Mawenzi, WSW of Tarakea village, N side of Nesikiria river, 4–6 m tall *Erica arborea* giant heath at 2,580–2,600 m a.s.l., T. Pócs with Mjhatta & J. Linden, 01.02.1990.

90030 – Kilimanjaro Region, Siha District, Kilimanjaro Mts, Shira Plateau, near the campsite above Engare Nairobi gorge, alpine semidesert tussock and *Philippia* bush, saxicolous at 3,550 m a.s.l., T. Pócs with K. Pócs & J. Linden, 17.02.1990.

90031 – Kilimanjaro Region, Siha District, Kilimanjaro Mts, Shira Plateau, at the campsite above S-Engare Nairobi gorge, many cliffs, lava caves and a small stand of *Senecio cottonii* (10–20 trees), saxicolous at 3,580 m a.s.l., T. Pócs & J. Linden, 17–18.02.1990.

90096 – Manyara Region, Mbulu District, Mbulu Highlands, Guay Hill at the N end of Nou Forest Reserve, dry, semideciduous forest, saxicolous at 2,000–2,050 m a.s.l., T. Pócs & J. Linden, 01.06.1990.

90097 – Manyara Region, Mbulu District, Mbulu Highlands, Guam Hills 4 km E of Mbulu town. Datlaa Hill, steep granite outcrop with huge cliffs and boulders, covered by secondary bush at 1,950–2,100 m a.s.l., T. Pócs & J. Linden, 01.06.1990.

Appendix 4: Details (demographics, questions, responses) of semi-structured interviews in different regions of Kenya (Kanyungulu and Farkas 2025, Appendix 1)

DEMOGRAPHICS

1. Location (rural/urban)
2. Gender
3. Age (18–25, 26–35, 36–45, 46–)
4. Level of education

QUESTIONS

Section A: General knowledge on lichens

1. What do you know about lichens and how they look?
2. How would you describe the lichens growing where you live?
3. From what you know, what kinds of conservation places are there in Kenya?
4. Where do you think lichens grow best? Are these places protected in any way?
5. What do you think lichens do for the environment?

Section B: Threats to lichens

1. What changes, if any, have you observed in the population or diversity of lichens over time in your region?
2. What activities do you believe could pose threats to lichen species in your area?

Section C: Strategies for conservation

1. What laws or regulations, if any, are you aware of that protect lichens in Kenya?
2. In your experience or knowledge, how is the protection of lichens currently being implemented in the country?
3. What strategies do you think could be effective in improving lichen conservation efforts?
4. What kinds of lichens do you think should be protected by law in Kenya?

RESPONSES

Makueni County and immediate environments (15–27 July 2023)

Resp. 1. Rural, female, 26–35, postgraduate. – Has high knowledge about lichens. Conservation of species in Kenya is done in protected regions, but lichens are indirectly protected by protecting their substrates (tree barks, soils, and rocks), though lichens grow in protected and non-protected areas. Lichens are useful for ecosystem monitoring in terms of pollution. Climate change has been a great threat to the ecosystem though forest encroachments and agricultural activities have catalysed a decline of diversity in the rural setups. Thus, using strict rules can protect species, especially in Kenya.

Resp. 2. Urban, female, 18–25, bachelor. – Has medium knowledge and can identify some. Species are conserved in Kenya, but more energy is given to animals (big five) and higher plants. Bryophytes just thrive passively in parks, sacred grooves, in both protected and non-protected areas. Climate change and forest encroachments have enabled the decline of species thus government of Kenya ought to pass strict laws of conservation, especially lichens.

Resp. 3. Urban, male, 26–35, bachelor. – Has very limited knowledge of lichens though can show foliose on soils. A few lichens can be spotted in urban areas. Much conservation of species is done on protected areas though unaware if lichens are included in the conservation. Their roles in the ecosystem might be to balance food chains/web thus more work is yet to be done to make people aware of their importance.

Resp. 4. Rural, male, 26–35, postgraduate (ecologist). – High knowledge about lichens and cryptogams. There is a high diversity of lichens in rural setups. Conservation of species is highly a priority in the protected areas in Kenya especially for higher plants and animals though lichens grow in all environments regardless of protection. Lichens are collected accidentally with firewood as sources of energy which might be a threat to conservation. In protected areas forest encroachment and climate change have been a threat to existence over time while in rural areas agricultural activities, an increase in population, and climate have affected lichens' existence over time. Currently no idea if there is a protection law about lichens other than Forest ACT 2016 which is too general on all forest species. Documenting Kenyan lichens might be the solution, especially in identifying and knowing their diversity.

Resp. 5. Urban, male, 18–25, bachelor. – Not aware of the existence of lichens and their protection in the Kenyan context although conservation of species in Kenya is done in forests and protected areas.

Resp. 6. Urban, male, 26–35, bachelor. – Moderate knowledge of lichens from school. Lichens are scattered in different areas having diverse habitats. Species conservation for both animals and plants is done in protected zones and national parks and reserves in Kenya by 2 major bodies KWS (Kenya Wildlife Services) and KFS (Kenya Forest Services)) although not sure if there are lichen considerations. Not sure about their roles in the ecosystem but they have shown a gradual reduction in the area due to industrialization (clearing their habitats).

Resp. 7. Urban, male, 26–35, bachelor. – Low knowledge about lichens but can point to a few samples. Not sure of their conservation status in Kenya although the country conserves species in national parks and reserves, forests, and sacred areas (passive conservation). There is a gradual decrease of land species over due to climate change, an increase of settlement and population increase, and agricultural practices. Sensitization of citizens on what lichens are, and their role in the ecosystem maybe through documentaries and social media can improve their conservation.

Resp. 8. Rural, male, 26–35, bachelor. – Greatly aware of the existence of lichens in the region and growing in diverse habitats. They can also be found in protected areas though not sure of their priorities on protection criteria. In Kenya species of animals and plants are protected in national parks and reserves, and protected forests. There is a great role of lichens in the ecosystem to humans, animals, and plants. Some are mixed for concoction making of herbs and nests for insects. Their existence has declined due to changes in weather, it had been too dry recently, agricultural activities, and forest encroachments due to an increase in population. Forest management by the government can be tighter to stop species decline and maybe sensitize citizens to reasons for the conservation of species. Not sure of any species documented in Kenyan laws for conservation.

Resp. 9. Rural, male, 46 and above, none. – Aware of them but the name was new, locally referred to as tree parasites, and usually scrapped to prevent tree death. Not sure of their importance in the ecosystem but their existence has declined over time due to tree loggings, agricultural practices, and an increase in population that clears land for settlement. No knowledge of their conservation in Kenyan national parks and reserves and protected forests. Sensitization of lichen importance can change people's perception on their roles and maybe the conservation might be improved.

Resp. 10. Rural, male, 26–35, certificate. – They exist in the region. The foliose are shelters for insects and can be used to start and maintain fire in the area. Not sure of their protection regulations in Kenya though passively protected in sacred grooves. There has been a gradual decline of lichen species due to weather changes, agricultural practices, and increased settlements in the region. The conservationists should sensitize people on lichens and their role in improving their protection.

Resp. 11. Rural, female, 18–25, bachelor. – Lichens are frequently spotted in the region, especially on rocks and barks of trees. Conservation is biased toward higher plants and wild animals because of tourism attractions and is mostly done in parks reserves and protected forests. Lichens are passively conserved in these areas because of the presence of substrates (barks of trees, leaves, and rocks). There has been a gradual decline of species including lichens due to forest encroachments, weather changes, and clearing land for settlement. I am not sure of any database of lichen conservation in Kenya or species under conservation. The government can regulate the settlement of people and restrict forest management to conserve species.

Resp. 12. Urban, male, 26–35, postgraduate. – Slightly aware of lichens which are rarely spotted in the area. Conservation of species in Kenya is done on protected forests, national parks, and reserves and passively conserved on sacred grooves. Lichens in these areas are conserved though not documented on the species present in the conservation areas. The only threat to lichen conservation in the forest is illegal firewood collection and tree logging. Forest encroachment for agricultural activities and settlement has reduced species conserved. Government and specialists should sensitize citizens on the conservation of species and their importance.

Resp. 13. Rural, male, 26–35, bachelor. – Lichens are highly referred to as fungi and termed as saprophytes thus scrapped off from items, they attached citing they cause decomposition, especially timber. They have no use in the area though traditionally used as sources of energy. There is a high conservation of species in forests though not sure if lichens have a priority. It is upon being told their use and importance in nature that people can change their perception. Conservation lessons on nature can be introduced in school to create awareness from tender ages.

Resp. 14. Rural, male, 26–35, bachelor. – Moderate knowledge from high school; lichens are frequently spotted in the area and are often found on tree twigs and accidentally collected with firewood as sources of energy. Mostly in Kenya, the conservation of species is done in protected areas and passively in sacred groves though not sure if lichens are given priority in conservation. They are important to the ecosystem as they act as shelters for some insects and their collection with firewood though recent is a gradual reduction of their evenness due to excessive tree logging and agricultural practices. There is a call for stakeholders to enlighten the citizens on the conservation of species to stop depletion of Moreso lichens where most do not know their roles.
Resp. 15. Urban, female, 26–35, certificate. – Aware of the existence but known as fungi. Rarely spotted in the area, mostly on undisturbed environments and stones. Highly seen in protected areas like forests and sacred groves. Not aware of their role in the environment. There is a need for more knowledge on lichens and their role in the environment to be spread to the citizens.
Resp. 16. Rural, female, 46 and above, none. – Slightly aware and use them with firewood to start and maintain a fire. The thin filamentous ones (locally called roots of stones) are used for medicinal purposes. Usually ground to fine powder and mixed with warm solvent and taken to cure headaches. There are several lichens found in the forest both protected and unprotected, and parks (on sand, rocks, and barks of trees). Due to environmental changes, some species have been wiped away inclusive of the filamentous ones. Therefore, more conservation of the remaining needs to be increased.
Kakamega County and immediate environment (29th July – 10th August 2023)
Resp. 17. Urban, female, 26–35, postgraduate. – Slightly aware of lichens' existence though mostly spotted in conserved environments in the barks of trees. Not sure of their role in the environments. There is a decline of species in the ecosystem though not keen on lichens, which could be caused by climate change, clearing lands for agricultural purposes, forest encroachments, and tree illegal logging for timber. Strict measures to protect forests could be tightened to prevent illegal practices.
Resp. 18. Rural, male, 26–35, bachelor. – Lichens are called tree parasites (fungi) mostly scrapped off so as not to cause tree decay. The leafy ones are used to start and maintain fire and are collected with firewood as a source of energy. They are also found in protected areas and sacred groves in high quantities though their protection is achieved through their substrate conservation (trees). There is a gradual change in their abundance over time due to climate change, forest encouragements, and an increase in agricultural practices. Issuing permits for tree logging and restricting people from protected areas can reduce the misuse of species.

Resp. 19. Urban, female, 36–45, postgraduate. – Slightly aware of lichen but rarely seen in the area. In Kenya, national parks and reserves, protected and sacred grooves act as conservation areas for species although higher plants and animals have high importance due to their economic value; the diversity of species in these areas is rich inclusive of lichens. Lichens might have importance in the ecosystem though not aware of specifics maybe the conservationists should sensitize their importance for people to be aware. Currently, not aware of any lichens that are conserved or protected due to threats, though generally there has been a gradual decrease in biota due to climatic conditions.

Resp. 20. Rural, male, 26–35, postgraduate. – Generally confused with fungi and highly spotted in the area and protected areas in the country. Though not sure of their priority in conservation, they are densely growing in forests, especially the aged trees. Not sure of any protected species in Kenya though the government doesn't allow the collection of species from conserved areas without permits. Adverse climate conditions, forest encroachments, and settlement are diminishing the conservation efforts.

Resp. 21. Urban, female, 36–45, none. – Limited knowledge of lichens and a few grow in the areas. Their role in the ecosystem is not well defined and often ignored in the region thereby not considered to have any importance for conservation purposes. There has been a decline of all species due to climate change, increased agricultural activities, and settlement areas for the increased population.

Resp. 22. Urban, male, 18–25, certificate. – Not aware of lichens and their roles. Aware that conservation is done in Kenyan forest, game parks, and reserves.

Resp. 23. Rural, female, 36–45, bachelor. – lichens but might be connected to fungi and generally termed as decomposing agents. They are found on tree bark where they get shelter and maybe nutrients. They have no specific roles though termed as protectants of barks from physical damage. Not sure of a priority in their conservation in the protected areas in Kenya though higher plant and animal species have been documented in those areas. Conservation of species has been faced with unrealistic climate changes, encroachments, and tree logging in both protected and unprotected zones. Sensitization needs to be done on the use and management of forests and strict management of conserved areas can be accompanied with penalties upon once guilty.

Resp. 24. Rural, female, 36–45, postgraduate. – Highly conversant with lichens and cryptogams which make part of the ecosystem in the area and protected areas though passively conserved due to their substrates. The leafy lichens are highly collected as sources of energy in remote areas, reducing threat to their diversity in the region. Although the lichens thrive in diverse areas and harsh environments increased pollution, especially near towns, climatic conditions and agricultural activities have reduced their quantities which calls for conservation experts to educate people on their role and the need to conserve them and other species in nature for future use.

Resp. 25. Urban, male, 26–35, certificate. – Less familiar to lichens and less spotted in the region though often grow in conserved areas and protected forests. There has been a decline of forests and conservation areas because of encroachments, settlements, and invasive species that suppress indigenous ecosystems. Much needs to be done on the management of forests, the introduction of exotic species, and regulating settlement areas.

Resp. 26. Urban, female, 18-26, bachelor. – Limited knowledge of lichens though highly spotted in the area and conservation areas (unprotected and protected areas). Also, lichens are found in undisturbed areas in sacred grooves. Conservation is highly concentrated in protected areas though much is done to higher plants and animals compared to lower plants and fungi. Thus, documentation on the species number of lower plants might not be available. This calls for scientists to sensitize the connected government docket to update all species in the conserved areas.

Resp. 27. Urban, male, 36–45, postgraduate (ecology lecturer). – Excellent knowledge of lichens especially the foliose lichens. Conservation of species is both ex-situ and in-situ (seedbanks, gene banks, in forests and museums). Lichens can be found in the forests they are passively conserved because of their habitats and those found in museums are for research purposes. Lichens are highly sensitive organisms that detect the health of an ecosystem thus used as bioindicators. In Kenya, there is no data on documented species of the country on protected species categories of lichens. There has been a gradual depletion of species because of climate change, the introduction of invasive species in the forests, industrialization, the increase of agricultural activities, and clearing forests for settlements. The government, ecologists, and conservationists have a role in sensitizing on species importance, strict rules on collection and destruction of forests, and having proper settling zones away from forests.

Resp. 28. Rural, male, 36–45, bachelor (forest warden). – Conservation officer at Kakamega Forest (covers two counties) which is managed by both KWS and KFS. Has both animal and plant conservation. Lichens are densely populated in the forests inclusive of the foliicolous lichens. The management highly conserves species according to the Forest Act 2016 where all species are crucial, and no collection is done without a permit. The nearest community (friends of Kakamega Forest) usually has the mandate of reporting cases of tree logging and promoting the protection knowledge to other communities. There is minimal data on the number of species of lichen species in the forest thus no documents of any protected species in the forest.

Resp. 29. Rural, female, 36–45, bachelor (forest officer). – Kakamega covers Kakamega and Nandi counties having almost 80% indigenous trees some over 50 years including Elgon oak. It's protected by the Kenya Wildlife Service (KWS) in collaboration with the Kenya Forest Service (KFS). These old trees are used as habitats for species – birds, lichens, mosses, and other microorganisms. No tree logging is allowed. The forest has seen a gradual decline of species due to climate change, forest encroachments, illegal tree logging, and the introduction of some exotic trees which have allelopathic effects on the soil. Lichens have been conserved in the area, but the systematics of their diversity is not well known. Currently, no species have been classified under any threat in Kenya though much needs to be done on systematics and analysis of their diversity and conservation priorities.

Resp. 30. Urban, male, 36–45, postgraduate. – Minimal knowledge of lichens though they are often growing on soil. Traditionally they were used to light fire in the local areas which have been replaced with gas and electricity. Their conservation in the region is only on protected and sacred groves. The increase in industries and pollution have reduced the number of species growing in the area.

Resp. 31. Rural, female, 46 and above, none. – Not sure of their name though were used to quickly light fire in the old days and accidentally collected with firewood as sources of energy (thread-like ones). There is no need for their protection as they grow in high amounts everywhere in the area maybe the government-protected areas.

Resp. 32. Rural, male, 36–45, postgraduate. – Medium knowledge of lichens. They grow on bark, stones, and on soils and mostly in wet environments. Lichens also grow in quantities in forests, protected lands, and sacred grooves. Although their species might not be documented fully, their diversity in nature can be seen. Not sure if Kenya has a list of species of lichens in the country and if any are in declining situation.

Narok County (10–22 August 2023)

Resp. 33. Rural, male, 26–35, certificate. – I am not aware of the name but aware of lichens, locally called 'narara' which are assumed to be part of the bark. The leafy ones are used to start fires in remote areas and are accidentally collected with firewood as sources of energy. They are declining because of high and dry temperatures in the region.

Resp. 34. Rural, female, 26–35, none. – Not aware of the name but they had a traditional role as dyes. They were mixed with other herbs and used as hair dye during cultural events. They are often found on trees and shrubs. High amounts are found in protected areas- forests, national parks, and reserves.

Resp. 35. Rural, male, 36–45, bachelor. – Medium knowledge of lichens. They are spotted in the area in leafy forms and used in the villages as sources of energy. They are conserved with other species in protected areas and passively in sacred groves. Not aware of their priority in conservation but their habitats are highly conserved (trees) thus sustaining their growth.

Resp. 36. Rural, female, 18–25, bachelor. – Usually confused with algae or mosses as most are green and classified as lower plants. Mostly they do not have a specified role in the ecosystem. Their conservation in the protected areas is passively by conserving their substrate. Most protected areas have documented tree species, not lower plants. Conservationists and related stakeholders need to update all species and sensitize the people on the roles of distinct species in the ecosystem.

Resp. 37. Rural, male, 18–25, bachelor. – Basic knowledge of lichens from biological classes. They are a symbiotic relationship between algae and fungi. Their symbiotic nature is of significant importance in nature as they produce their food. Their conservation is not well known but lichens are hardy and grow in diverse environments which makes them survive. I'm not sure of species lists, but they are well-known for their forms. There need to do more on conservation and biological systematics to update the lists of species.

Resp. 38. Rural, male, 36–45, basic education. – The name is not known but the lichens are well known in the region especially their use as dye in traditional setups. They grow freely on surfaces and undisturbed soils. Their protection depends on their use in the area, especially the leafy ones are highly used as sources of energy. Though their collection has contributed to their decline and increased population the area which turns bare lands into settlements.

Resp. 39. Rural, male, 46 and above, none. – Locally termed as extensions of the bark. Mixed with concoctions and used as herbs for diverse ailments including fever and head-aches. Not sure of their protection though they have reduced with time because of tree logging and charcoal burning, clearing lands for settlements.

Resp. 40. Rural, female, 46 and above, none. – The name is not known though the organisms grow randomly in the environment and on the barks of trees which are used to start and maintain fire. They were also used in the olden days as sources of dyes. Not sure of the need for their protection because they are in high amounts in the environment.

Resp. 41. Urban, male, 18–25, bachelor. – Not sure of the name but the lichens are spotted in the areas, especially on walls of old buildings but confused with mosses and algae because of the green nature during the rainy season.

Resp. 42. Urban, male, 36–45, certificate. – They are found in damp areas and green but not sure if they are plants or dead organisms. Mostly scrapped from planted trees as they are thought to cause diseases and cause plant decay. Mostly burnt after collection to prevent regrowth. No knowledge of their conservation though they are also found in protected areas. People should be sensitized about their use and role in nature to prevent further misuse.

Nairobi country at its environment (25th August 2023 – 12th September 2023)

Ngong Forest

Resp. 43. Urban, female, 36–45, bachelor (forest officer). – Ngong Hills/Forest is a conservation centre that accommodates plants and a few wild animals. Highly managed by KFS and friends of the forest. It allows the friends of the forest to access part of the forest through grazing as they are pastoralists. The forest is situated in an arid and semi-arid region with both exotic and indigenous varieties of trees. Some significant volcanic soils and stones harbour significant amounts of lichen. Conservation has highly been challenged by industrialization, pollution, and nearby communities (Maa people) who are pastoralists and graze in the forest, which causes disturbance in their growth.

Resp. 44. Rural, male, 26–35, bachelor (forest warden). – Lichens are passively conserved in the forest due to the presence of their substrates, especially shrubs and rocky environments. The forest has seen a decline of species over time and also lost land to a nearby increasing community. The decline has been due to harsh weather conditions and to its nature of tourist attractions thus construction ongoing. Forest encroachment for grazing lands has left part of it shrubby and losing some species of lichens where their habitats have been disturbed. Conservation sensitization to the pastoralists should be done to reduce forest disturbances and destocking of their cattle.

Resp. 45. Rural, male, 26–35, bachelor. – Conservation is highly key where all species are protected including a few wild animal species. Lichens often grow in the forests on the calcareous rocks, soils, and barks of the trees. A few can be spotted on rocks. The main challenge of conservation is the unpredictable weather conditions, pastoralist communities that graze near the forest, forest encroachments, and pollution due to its location near the capital centre. Recommendations are for the government to enlighten the community on the conservation of the forest, strict management of the forest, and setting grazing zones and demarcations of the forest.

Resp. 46. Rural, male, 18–25, certificate. – The forest contains diverse species which are protected by KFS. The knowledge of lichens is minimal though they are often spotted in the forest, especially the leafy/ branched ones. Their role in the ecosystem is not known and their protection might be of less important to the forest. The increase in population, pollution, and forest encroachments has led to the decline of species and grabbing of forest land.

Resp. 47. Rural, male, 18–25, certificate. – Lichens are not well known but they often grow in the area and in the Ngong Forest. Details on their conservation are not well known. Due to pastoralists found in this area and the arid and semi-arid climatic conditions, most land is bare, and a few shrubs can be found. Campaigns led by the government, the community, and conservationists for tree planting reclaim the land. Not sure if there are protected lichens.

Resp. 48. Rural, male, 18–25, certificate. – As a pastoralist, and a friend of the Ngong Forest; conservation of the forest is paramount due to its microclimate. Lichens are accidentally conserved because of their habitats, i.e. trees and stones found in the forests. There is a need to educate the pastoralists on the destocking of their flocks as they cause overgrazing in the area and immerse on other profitable agriculture. Overgrazing has led to a decline of species, biodiversity, and bare lands exposing them to runoffs.
Resp. 49. Rural, female, 36–45, certificate. – The rural area is very dry a clear characteristic of arid and semi-arid areas. Although the name is not common, the organisms are often found in the area. Mostly sticking on rocks and loosely attached to the bark of trees. Not sure of their conservation in the forest although they are spotted amidst other species.
Karura Forest
Resp. 50. Urban, male, 26–35, bachelor. – Karura Forest lies within the capital city of Nairobi County and is majorly under Kenya Forest Services (KWS) management and friends of Karura Forest which is the immediate community. Lichens are conserved in this conservation area passively as majorly higher plants of high priority. Not yet documented the species diversity of lichens in the forest. The old logs harbour high amounts of species of lichens and even other animals' bird nests. There has gradual loss of the forests due to industrialization and pollution which harms biodiversity and the density of species. The management can be strict on rules and allocation of industries' land.
Resp. 51. Urban, female, 26–35, bachelor (forest scout). – Lichens are classified under lower plants in the forest and part of the species conserved in the forest. The challenge is firewood collections that are legalized in the forest as most are attached to the branches. Pollution and climate change have also led to the gradual decline of species in the forest. The nearby should change to other sources of energy and firewood collection banned. This can restore some lichens.
Resp. 52. Urban, female, 36–45, bachelor (forest scout). – All species in the forests are protected from destruction inclusive of lichens and no collection is allowed without permit. The indigenous trees are highly protected as they harbour most epiphytes like lichens and logging results in a penalty. The friends of Karura protect the forest encroachment and report on matters of illegal logging.
Resp. 53. Urban, male, 26–35, postgraduate (forest officer). – Though they are not the main agenda of conservation, lichens are in large amounts in the forest. The forest is demarcated into hiking, leisure, and protected zones. Incorporation of the immediate community in conservation has improved the forest status although pollution is negatively affecting the diversity of species. Much

of the forest land is lost to industrialization. This calls for the government to reallocate other lands for industrialization.

Nairobi Centre (Central Business District and nearby accommodation areas)

Resp. 54. Urban, female, 46 and above, postgraduate (biology teacher). – The ecosystem in the city centre can only accommodate a few plant and animal species due to industrialization, pollution, and the settlements of people. Lichens because of their nature to survive in harsh environments are few, spotted in undisturbed places like rocks and buildings. In Kenya conservation and protection of species is done in forests, game reserves, game parks, and sacred groves.

Resp. 55. Urban, female, 18–25, bachelor. – Very low knowledge of lichens. Few are spotted in the centre, especially on walls of old buildings but highly seen in forests and protected areas. Conservation is only done in forests, game park reserves, and sacred groves. Not sure of their role or their conservation status in the country.

Resp. 56. Urban, male, 36–45, basic education. – Limited knowledge of their existence in the area but they are often found in forests. Their role is not known in the region, but they grow and attach themselves to substrates majorly because of their lack of roots.

Resp. 57. Urban, male, 26–35, bachelor. – Medium knowledge of lichens from biology classes in school. They are symbiotic and thus produce their food. Very minimal in the area but highly found in the outskirts of the city and the nearby forest and conservation areas like Nairobi reserve and Karura Forest.

Resp. 58. Urban, female, 18–25, bachelor. – Low basic knowledge of lichens which are classified under cryptogams/epiphytes. Just attach on substrates for support as they are autotrophs.

Resp. 59. Urban, male, 18–25, basic education. – Very low knowledge of lichens though conservation for species is often done in the forests and protected areas in the country. Not sure about their priority of conservation in Kenyan protection although they grow in diverse environments.

Resp. 60. Urban, female, 18–25, certificate. – No knowledge on the existence of lichens. Although in Kenya, conservation of species is majorly done in forests, game parks and game reserves. Threats to conservation have been pollution especially near towns and industrialization.

Appendix 5: Characterization of responses from the semi-structured interviews (Kanyungulu and Farkas 2025, Table 1)

Table 1

Characterization of respondents (Rp; see Appendix) and data gained from their responses through the semi-structured interviews in different regions of Kenya. G = gender (F = female; M = male), LOC = location, KLL = knowledge level of lichens, ROL = role of lichens.

Rp	G	Age	LOC	Education	KLL	ROL	Threats to lichens	Conservation strategies
Makueni								
1	F	26–35	rural	postgraduate	intensive knowledge	monitoring of pollution	forest encroachment (B), pollution (C), climate change (E)	strict rules of forest conservation (L)
2	F	18–25	urban	bachelors	medium	not aware	forest encroachment (B), climate change (E)	strict rules of use of forests and management (L)
3	M	26–36	urban	bachelors	low	not sure	not sure (A)	need for more knowledge to people on what are lichens (E)
4	M	26–35	rural	postgraduate	intensive knowledge	lighting and maintaining fire	overcollection, forest encroachment, settlement increase, and agricultural activities (B)climate change (E)	strengthening forest Act 2016 (L), taxonomy and documenting the lichen diversity (R)
5	M	18–25	urban	bachelors	none	not aware	not aware of any knowledge of conservation (A)	general forest protection (L)
6	M	26–35	urban	bachelors	medium	not aware	industrialization (C)	no response (A)
7	M	26–35	urban	bachelors	low	not aware	settlement increase, agricultural practices (B), climate change (E)	sensitize people on conservation (E)
8	M	26–35	rural	bachelors	intensive knowledge	nests for insects	forest encroachment and agricultural practices (B), climate change (E)	sensitizing on conservation (E), penalties for destruction of forests (L)
9	M	46–	rural	none	medium	not sure	settlement increase and agricultural practices (B), climate change (E)	teaching citizens on conservation (E)
10	M	26–35	rural	certificate	medium	lighting and maintaining fire	settlement increase and agricultural practices (B), climate change (E)	sensitize on the importance of lichens (E)
11	F	18–25	rural	bachelors	medium knowledge	none	settlement increase and forest encroachment (B), climate change (E)	government to regulate settlement areas (L)

Table 1 (continued)

Rp	G	Age	LOC	Education	KLL	ROL	Threats to lichens	Conservation strategies
Makueni								
12	M	26–35	urban	postgraduate	medium knowledge	not sure	illegal firewood collection and illegal tree logging (B)	importance of conservation should be sensitized (E)
13	M	26–36	rural	bachelors	low	plant parasites	not aware of any knowledge of conservation (A)	introduce conservation lessons in schools (E)
14	M	26–35	rural	bachelors	medium	lighting and maintaining fire	tree logging and agricultural practices (B)	enlighten citizens on lichen importance and its role of conservation (E)
15	F	46–	rural	none	medium	medicinal use, lighting and maintaining fire	environmental changes (E)	increase conservation strategies (L)
16	F	26–35	urban	certificate	low	not aware	not sure (A)	enlighten citizens on role of lichens (E)
Kakamega								
17	F	26–35	urban	postgraduate	low	not sure	forest encroachment and illegal tree loggings (B), climate change (E)	strict measures to protect lichens (L)
18	M	26–35	rural	bachelors	high	plant parasites, cause tree decay, lighting and maintaining fire	forest encroachment and increased agricultural practices (B), climate change (E)	restricting people from forested areas (L)
19	F	35–45	urban	postgraduate	medium	not aware	climate change (E)	conservationists sensitize on the importance of protecting species (E)
20	M	26–35	rural	postgraduate	medium	not sure	settlement and forest encroachment (B), climate change (C)	restricting people from forested areas (L)

Table 1 (continued)

Rp	G	Age	LOC	Education	KLL	ROL	Threats to lichens	Conservation strategies
Kakamega								
21	F	36–45	urban	none	low	not sure	climate change (E)	no response (A)
22	M	18–25	urban	certificate	none	not sure	no response (A)	no response (A)
23	F	36–45	rural	bachelors	medium	protect tree barks	tree logging, agricultural practices and encroachments (B), climate change (E)	conservation sensitization (E), strict management of forests (L)
24	F	36–45	rural	postgraduate	high	lighting and maintaining fire	agricultural activities, climate change (B, E)	conservation education be impacted to citizens (E)
25	M	26–35	urban	none	low	not sure	forest encroachments and increased settlements (B), exotic invasive species (F)	improve forest management and regulate introduction of species (L)
26	F	18–25	urban	bachelors	medium	not sure	more focus on conservation of higher plants (D)	inclusive conservation strategies (L)
27	M	36–45	urban	postgraduate	high	research use, bioindicators	industrialization (C), climate change (E), invasive species (F)	ecologists sensitize people on conservation (E), strict rules on forest management and proper settling zones (L)
28	M	36–45	rural	bachelors	high	part of the forest diversity	illegal tree logging (B), documents on species (D)	work on species documentation (R)
29	F	36–45	rural	bachelors	high	habitats for insects	forest encroachments, exotic trees and illegal tree logging (B), climate change (E)	update diversity and species of lichens (R)
30	M	36–45	urban	postgraduate	minimal	lighting and maintaining fire	industrialization and pollution (C)	conservation of species (R)
31	F	46–	rural	none	minimal	lighting and maintaining fire	no response (A)	no response (A)
32	M	36–45	rural	postgraduate	low	not sure	no documents on species diversity (D)	update classification of lichen species (R)

Table 1 (continued)

Rp	G	Age	LOC	Education	KLL	ROL	Threats to lichens	Conservation strategies
Narok								
33	M	26–35	rural	certificate	minimal	lighting and maintaining fire	climate change (E)	no response (A)
34	F	26–35	rural	none	low	dyes	no response (A)	no response (A)
35	M	36–45	rural	bachelors	medium	lighting and maintaining fire	no response (A)	no response (A)
36	F	18–25	rural	bachelors	medium	not sure	bias on conservation (D)	update all species and prioritise all in conservation (R)
37	M	18–25	rural	bachelors	low	symbiotic nature	lack of a list of threatened lichen (D)	systematics on diversity and update all lists of lichens (R)
38	M	36–45	rural	certificate	medium	dyes	overcollection and overpopulation (B)	have an alternative for dyes (H), have specific settlement schemes (L)
39	M	46–	rural	none	low	protect tree barks	illegal tree logging and clearing lands for settlements (B)	issue permits for before forest logging (L)
40	F	46–	rural	none	low	lighting and maintaining fire, dyes	no response (A)	no response (A)
41	M	18–25	urban	bachelors	low	no response	no response (A)	no response (A)
42	M	26–35	urban	certificate	low	plant parasites	collection to burn (B)	sensitize people what lichens are, their role and conservation (E)
Nairobi								
43	F	36–45	urban	bachelors	high	food for animals	overgrazing (B), industrialization and pollution (C)	restricting people from forested areas (L)
44	M	26–35	rural	bachelors	high	ecosystem balance	overgrazing (B), climate change (E)	destocking (H)

Rp	G	Age	LOC	Education	KLL	ROL	Threats to lichens	Conservation strategies
Nairobi								
45	M	26–35	rural	bachelors	high	ecosystem balance	overstocking and forest encroachments (B), climate change (E)	enlighten people on conservation (E), strict forest management (L)
46	M	18–25	rural	certificate	minimal	not sure	forest encroachment and increase in human population (B)	law enforcements (L)
47	M	18–25	rural	certificate	minimal	not sure	overstocking (B), arid land (E)	destocking and afforestation (H)
48	M	18–25	rural	certificate	minimal	not sure	overgrazing and overstocking (B)	destocking (H)
49	F	36–45	rural	certificate	low	not sure	unfavourable climatic conditions (E)	afforestation (H
50	M	26–35	urban	bachelors	high	diversity in the forest	pollution and industrialization (C)	government to allocate industry land away from industries (L)
51	F	26–35	urban	bachelors	minimal	maintain diversity	firewood collection (B)	alternative lighting and maintaining fire (H)
52	F	36–45	urban	bachelors	minimal	forest in the forest	forest encroachment (B)	restrict tree logging (L)
53	M	26–35	urban	postgraduate	high	diversity in the forest	industrialization and pollution (C)	enlighten people on conservation (E), strict forest management (L),
54	F	46–	urban	postgraduate	high	diversity in the forest	increased settlement (B), pollution and industrialization (C)	enlighten people on conservation (E), strict forest management (L)
55	F	18–25	urban	bachelors	low	not sure	not sure (A)	not sure (A)
56	M	36–45	urban	certificate	low	not sure	not sure (A)	not sure (A)
57	M	26–35	urban	bachelors	medium	diversity in the forest	not sure (A)	not sure (A)
58	F	18–25	urban	bachelors	very low	not sure	not sure (A)	not sure (A)
59	M	18–25	urban	certificates	very low	not sure	not sure (A)	not sure (A)
60	F	18–25	urban	certificate	none	not sure	industrialization, pollution (C)	not sure (A)

Abbreviations: "Threats to lichens": A = unaware of lichen threats; B = human factors; C = industrialization; D = unprioritized conservation efforts; E = environmental factors; F = invasive species; for column "Conservation strategies": A = unaware; E = education-based; H = habitat-related; L = law-related; R = research-based

Appendix 6: Checklist of fruticose and foliose lichen-forming fungi of Kenya (1988-2024)

Anzia afromontana R. Sant.
Bryoria bicolor (Hoffm.) Brodo and D. Hawksw.
Bryoria fuscescens (Gyeln.) Brodo and D. Hawksw.
Bryoria motykae (D. Hawksw.) Brodo & D. Hawksw.
Bryoria nadvornikiana (Gyeln.) Brodo and D. Hawksw.
Bulborrhizina africana Kurok.
Bulbothrix decurtata (Kurok.) Hale
Bulbothrix goebelii (Zenker) Hale
Bulbothrix hypocraea (Vain.) Hale
Bulbothrix isidiza (Nyl.) Hale
Bulbothrix kenyana Kirika, Divakar & Lumbsch
Bulbothrix meizospora (Nyl.) Hale
Bulbothrix sensibilis (J. Steiner and Zahlbr.) Hale
Bulbothrix sublaevigatoides (Dodge) Kirika, Divakar and Lumbsch, syn.: *B. tabacina sensu* early authors not (Mont. and Bosch) Hale [East-African specimens]
Bulbothrix suffixa (Stirt.) Hale
Bulbothrix ventricosa (Hale & Kurok.) Hale
Bunodophoron melanocarpum (Sw.) Wedin
Candelaria concolor (Dicks.) Stein
Candelaria fibrosa (Fr.) Müll. Arg.
Canoparmelia albaniensis (C.W. Dodge) Divakar and Kirika
Canoparmelia caroliniana (Nyl.) Elix and Hale
Canoparmelia concrescens (Vain.) Elix and Hale
Canoparmelia ecaperata (Müll. Arg.) Elix and Hale
Canoparmelia eruptens (Kurok.) Elix and Hale
Canoparmelia kakamegaensis Garrido-Huéscar, Divakar & Kirika
Canoparmelia nairobiensis (J. Steiner and Zahlbr.) Elix and Hale
Canoparmelia pustulescens (Kurok.) Elix
Canoparmelia rodriguesiana (Hue) Elix
Canoparmelia somaliensis (Müll. Arg.) Elix and Hale
Canoparmelia texana (Tuck.) Elix and Hale
Catapyrenium squamulosum (Ach.) Breuss, syn.: *Dermatocarpella squamulosa* (Ach.) H. Harada
Cetraria aculeata (Schreb.) Fr.
Cetrelia braunsiana (Müll. Arg.) W.L. Culb. & C.F. Culb.
Cladonia andesita Vain.
Cladonia bacillaris Nyl.
Cladonia cenotea (Ach.) Schaer.
Cladonia chlorophaea (Flörke ex Sommerf.) Spreng.
Cladonia crispata (Ach.) Flot.
Cladonia digitata (L.) Hoffm.
Cladonia diplotypa Nyl.
Cladonia dubia Abbayes
Cladonia hedbergii Ahti
Cladonia intermediella Vain.
Cladonia krempelhuberi (Vain.) Zahlbr.
Cladonia leucophylla Ahti & Krog
Cladonia macilenta Hoffm.
Cladonia ochrochlora Flörke
Cladonia pachyclados (Vainio) Ahti
Cladonia pocillum (Ach.) O.J. Rich.
Cladonia poeciloclada Abbayes
Cladonia praetermissa A.W. Archer; syn.: *Cladonia praetermissa* var. *modesta* (Ahti & Krog) Kantvilas & A.W. Archer
Cladonia pyxidata (L.) Hoffm.

Cladonia ramulosa (With.) J.R. Laundon
Cladonia rei Schaer.
Cladonia squamosa Hoffm.
Cladonia subradiata (Vain.) Sandst.
Cladonia subsquamosa Kremp.
Coccocarpia adnata Arv.
Coccocarpia dissecta Swinscow and Krog
Coccocarpia erythroxyli (Spreng.) Swinscow & Krog
Coccocarpia flavicans Arv.
Coccocarpia palmicola (Spreng.) Arv. and D.J. Galloway
Coccocarpia pellita (Ach.) Müll. Arg.
Coccocarpia stellata Tuck.
Collema coilocarpum (Müll. Arg.) Zahlbr.
Collema furfuraceum (Arnold) Du Rietz
    Collema furfuraceum (Arnold) Du Rietz var. *luzonense* (Räsänen) Degel.
Collema leptaleum Tuck.
    Collema leptaleum Tuck. var. *biliosum* (Mont.) Degel.
    Collema pulcellum Ach. var. *subnigrescens* (Müll. Arg.) Degel.
Collema rugosum Kremp.
Collema subflaccidum Degel.
Crespoa crozalsiana (B. de Lesd. ex Harm.) Lendemer and B.P. Hodk.
Crespoa inhaminensis (C.W. Dodge) Lendemr & B.P. Hodk.
Dermatocarpon aequinoctiale (Hochst. ex Flot.) Müll. Arg.
Dibaeis baeomyces (L. f.) Rambold and Hertel
Dictyonema krogiae Lücking & Timdal
Dictyonema thelephora (Spreng.) Zahlbr.
Digitothyrea divergens (Henssen) P.P. Moreno & Egea, syn.: *Thyrea divergens* Henssen
Dirinaria aegialita (Afzel. ex Ach.) B.J. Moore
Dirinaria applanata (Fée) D.D. Awasthi
Dirinaria coccinea (Müll. Arg.) D.D. Awasthi
Dirinaria complicata D.D. Awasthi
Dirinaria confluens (Fr.) D.D. Awasthi
Dirinaria leopoldii (Stein) D.D. Awasthi
Dirinaria picta (Sw.) Clem. and Shear
Dolichousnea trichodeoides (Vain. ex Motyka) Articus
Dufourea africana (Almb.) Frödén, Arup & Søchting
Emmanuelia patinifera (Taylor) Lücking, M. Cáceres and Ant. Simon, syn.: *Lobaria patinifera* (Taylor) Hue
Enchylium conglomeratum (Hoffm.) Otálora, P.M. Jørg. & Wedin, syn.: *Collema conglomeratum* Hoffm. var. *crassiusculum* (Malme) Degel.
Enchylium polycarpon (Hoffm.) Otálora, P.M. Jørg. and Wedin, syn.: *Collema polycarpon* Hoffm.
Enchylium tenax (Sw.) Gray, syn.: *Collema tenax* (Sw.) Ach.
Endocarpon albidulum (Müll. Arg.) Zahlbr.
Endocarpon johnstonii (Müll. Arg.) Stizenb.
Erioderma meiocarpum Nyl.
Erioderma mollissimum (Samp.) Du Rietz
Eschatogonia prolifera (Mont.) R. Sant.
Eschatogonia triptophyllina (Nyl.) Kalb]
Eumitria baileyi Stirt.
    Eumitria baileyi Stirt. var. *pinnatifida* Swinscow & Krog
Flavoparmelia caperata (L.) Hale
Flavoparmelia pachydactyla (Hale) Hale
Flavoparmelia rutidota (Hook. f. & Taylor) Hale
Flavoparmelia soredians (Nyl.) Hale
Flavopunctelia flaventior (Stirt.) Hale]
Flavopunctelia praesignis (Nyl.) Hale
Fuscopannaria ignobilis (Anzi) P.M. Jørg.
Fuscopannaria praetermissa (Nyl.) P.M. Jørg.
Gabura fascicularis (L.) P.M. Jørg., syn.: *Collema fasciculare* (L.) Wigg. var. *fasciculare*; *C. fasciculare* (L.) Wigg. var. *microcarpum* (Müll. Arg.) Degel.
Heterodermia allardii (Kurok.) Trass

Heterodermia borphyllidiata (Kalb and Meesim) M.F. Souza and Aptroot, syn.: *Leucodermia borphyllidiata* Kalb and Meesim
Heterodermia comosa (Eschw.) Follmann and Redón
Heterodermia diademata (Taylor) D.D. Awasthi
Heterodermia isidiophora (Nyl.) D.D. Awasthi
Heterodermia lepidota Swinscow and Krog
Heterodermia loriformis (Kurok.) Swinscow & Krog
Heterodermia podocarpa (Bél.) D.D. Awasthi
Heterodermia pseudospeciosa (Kurok.) W.L. Culb.
Heterodermia speciosa (Wulfen) Trevis.
Hyperphyscia adglutinata (Flörke) H. Mayrhofer and Poelt
Hyperphyscia cochlearis Scutari
Hyperphyscia granulata (Poelt) Moberg
Hyperphyscia isidiata Moberg
Hyperphyscia pandani (H. Magn.) Moberg
Hyperphyscia pruinosa Moberg
Hyperphyscia syncolla (Tuck. ex Nyl.) Kalb
Hyperphyscia tuckermanii Lynge ex Moberg
Hypogymnia bitteri (Lynge) Ahti
Hypogymnia physodes (L.) Nyl.
Hypogymnia tubulosa (Schaer.) Hav.
Hypotrachyna africana (Hale ex W.L. Culb. & C.F. Culb.) Divakar, A. Crespo, Sipman, Elix & Lumbsch
Hypotrachyna afrorevoluta (Krog and Swinscow) Krog and Swinscow
Hypotrachyna brevirhiza (Kurok.) Hale
Hypotrachyna catawbiensis (Degel.) Divakar, A. Crespo, Sipman, Elix and Lumbsch
Hypotrachyna costaricensis (Nyl.) Hale
Hypotrachyna croceopustulata (Kurok.) Hale
Hypotrachyna damaziana (Zahlbr.) Krog & Swinscow
Hypotrachyna densirhizinata (Kurok.) Hale
Hypotrachyna ducalis (Jatta) Hale
Hypotrachyna endochlora (Leighton) Hale
Hypotrachyna fissicarpa (Kurok.) Hale
Hypotrachyna formosana (Zahlbr.) Hale
Hypotrachyna gondylophora (Hale) Hale
Hypotrachyna horrescens (Taylor) Krog & Swinscow
Hypotrachyna immaculata (Kurok.) Hale
Hypotrachyna kenyana Kirika, Divakar & Lumbsch
Hypotrachyna laevigata (Sm.) Hale
Hypotrachyna leiophylla (Kurok.) Hale]
Hypotrachyna meridionalis Kirika, Divakar & Lumbsch
Hypotrachyna meyeri (Zahlbr.) Streimann
Hypotrachyna microblasta (Vainio) Hale
Hypotrachyna minarum (Vainio) Krog and Swinscow
Hypotrachyna neodissecta (Hale) Hale
Hypotrachyna nyandaruaensis Kirika, Divakar & Lumbsch
Hypotrachyna orientalis (Hale) Hale
Hypotrachyna polydactyla (Krog & Swinscow) Nash
Hypotrachyna producta Hale
Hypotrachyna revoluta (Flörke) Hale
Hypotrachyna rockii (Zahlbr.) Hale
Hypotrachyna scytophylla (Kurok.) Hale
Hypotrachyna sinuosa (Sm.) Hale
Hypotrachyna sorocheila (Vain.) Divakar, A. Crespo, Sipman, Elix and Lumbsch
Hypotrachyna spathulata (Kurok.) Krog & Swinscow
Hypotrachyna spumosa (Asah.) Krog & Swinscow
Hypotrachyna subfatiscens (Kurok.) Krog and Swinscow
Hypotrachyna sublaevigata (Nyl.) Hale.
Hypotrachyna swinscowi (Hale) Krog and Swinscow
Hypotrachyna vexans (Zahlbr. ex W.L. Culb. and C.F. Culb.) Divakar, A. Crespo, Sipman, Elix and Lumbsch
Imshaugia aleurites (Ach.) S.L.F. Mey., syn.: *Parmeliopsis aleurites* (Ach.) Nyl.
Klauskalbia flabellata (Fée) S.Y. Kondr., Lőkös, Farkas & Hur, syn.: *Heterodermia flabellata* (Fée) Awasthi

Klauskalbia obscurata (Nyl.) S.Y. Kondr., Lőkös, E. Farkas and Hur, syn.: *Heterodermia obscurata* (Nyl.) Trevis
Kroswia crystallifera P.M. Jørg.
Lasallia papulosa (Ach.) Llano
Lasallia pustulata (L.) Mérat
Lecidea thaleriza Stirt., syn.: *Phyllopsora thaleriza* (Stirton) G. Schneider
Lepidocollema marianum (Fr.) P.M. Jørg., syn.: *Pannaria mariana* (Fr.) Müll. Arg.
Leprocaulon coriense (Hue) Lendemer and B.P. Hodk.
Leptogium adpressum Nyl.
Leptogium asiaticum P.M. Jørg.
Leptogium austroamericanum (Malme) C.W. Dodge
Leptogium azureum (Sw.) Mont.
Leptogium brebissonii Mont.
Leptogium burgessii (L.) Mont.
Leptogium burnetiae C.W. Dodge.
Leptogium caespitosum (Taylor) Swinscow and Krog
Leptogium cochleatum (Dicks.) P.M. Jørg. and P. James
Leptogium coralloideum (Meyen and Flot.) Vain.
Leptogium cyanescens (Ach.) Körb.
Leptogium digitatum (A. Massal.) Zahlbr.
Leptogium furfuraceum (Harm.) Sierk
Leptogium hibernicum M.E. Mitch. ex P.M. Jørg.
Leptogium javanicum Mont.
Leptogium juressianum Tav.
Leptogium krogiae Bjelland, Frisch and Bendiksby
Leptogium laceroides B. de Lesd.
Leptogium marginellum (Sw.) Gray.
Leptogium phyllocarpum (Pers.) Mont.
Leptogium resupinans Nyl.
Leptogium sessile Vain.
Leptogium tiinae Kaasal. and Rikkinen
Leptogium vesiculosum (Sw.) Malme
Leucodermia boryi (Fée) Kalb
Leucodermia leucomelos (L.) Kalb
Leucodermia lutescens (Kurok.) Kalb
Leucodermia vulgaris (Vain.) Kalb, syn.: *Heterodermia vulgaris* (Vainio) Follmann and Redón
Lobaria discolor (Bory ex Delise) Hue
Lobaria pulmonaria (L.) Hoffm.
Lobaria retigera (Bory) Trevis.
Lobarina scrobiculata (Scop.) Nyl. ex Cromb.
Melanelixia subargentifera (Nyl.) O. Blanco, A. Crespo, Divakar, Essl., D. Hawksw. & Lumbsch.
Melanelixia subaurifera (Nyl.) O. Blanco, A. Crespo, Divakar, Essl., D. Hawksw. and Lumbsch
Melanohalea elegantula (Zahlbr.) O. Blanco, A. Crespo, Divakar, Essl., D. Hawksw. and Lumbsch, syn.: *Melanelia elegantula* (Zahlbr.) Essl.
Montanelia disjuncta (Erichsen) Divakar, A. Crespo, Wedin and Essl.
Myelochroa aurulenta (Tuck.) Elix & Hale, syn.: *Hypotrachyna aurulenta* (Tuck.) Krog & Swinscow
Nephroma isidiosum (Nyl.) Gyeln.
Nephroma tropicum (Müll. Arg.) Zahlbr.
Niorma chrysophthalma (L.) S.Y. Kondr., Kärnefelt, Elix, A. Thell, M.H. Jeong and Hur
Niorma hypoglauca (Nyl.) S.Y. Kondr., Kärnefelt, Elix, A. Thell, M.H. Jeong & Hur, syn.: *Teloschistes hypoglaucus* (Nyl.) Zahlbr.
Normandina pulchella (Borrer) Nyl.
Opeltiella fruticans (Poelt and Oberw.) S.Y. Kondr.
Oxneria fallax (Hepp) S.Y. Kondr. and Kärnefelt
Pannaria conoplea (Ach.) Bory
Pannaria globulifera Hue (as *P. fulvescens* (Mont.) Nyl.)
Pannaria hookeri (Borrer) Nyl.
Pannaria lurida (Mont.) Nyl.
Pannaria pannosa (Sw.) Nyl., syn.: *Parmeliella pannosa* (Sw.) Müll. Arg.
Pannaria planiuscula P.M. Jørg.
Pannaria rubiginosa (Ach.) Delise
Paracollema italicum (B. de Lesd.) Otálora, P.M. Jørg. & Wedin, syn.: *Collema italicum* B. de Lesd.

Parmelia saxatilis (L.) Ach.
Parmelia sulcata Taylor
Parmeliella nigrocincta (Mont.) Müll. Arg.
Parmeliella triptophylloides P.M. Jørg.
Parmelinella amazonica (Nyl.) A.S. Rodrigues, A.P. Lorenz & Canêz, syn.: *Canoparmelia amazonica* (Nyl.) Elix and Hale, *Pseudoparmelia amazonica* (Nyl.) Hale
Parmelinella schimperiana Kirika and Divakar [part of *Parmelinella wallichiana* (Taylor) Elix and Hale (syn: *Pseudoparmelia wallichiana* (Taylor) Krog and Swinscow), identified earlier from Kenya].
Parmotrema abessinicum (Krempelh.) Hale
Parmotrema aldabrense (C.W. Dodge) Hale
Parmotrema andinum (Müll. Arg.) Hale
Parmotrema apricum (Krog & Swinscow) Krog & Swinscow
Parmotrema araucariarum (Zahlbr.) Hale
Parmotrema arnoldii (Du Rietz) Hale
Parmotrema austrosinense (Zahlbr.) Hale
Parmotrema bangii (Vainio) Hale
Parmotrema cetratum (Ach.) Hale
Parmotrema commensuratum (Hale) Hale
Parmotrema cooperi (Steiner and Zahlbr.) Sérus.
Parmotrema crinitum (Ach.) M. Choisy
Parmotrema cristiferum (Taylor) Hale
Parmotrema cryptoxanthum (des Abb.) Hale
Parmotrema defectum (Hale) Hale
Parmotrema dilatatum (Vainio) Hale
Parmotrema direagens (Hale) Hale
Parmotrema durumae (Krog & Swinscow) Krog & Swinscow
Parmotrema epileucum (Hale) Kirika, Divakar and Lumbsch
Parmotrema erubescens (Stirton) Krog & Swinscow
Parmotrema eunetum (Stirton) Hale
Parmotrema gardneri (Dodge) Sérus.
Parmotrema hababianum (Gyelnik) Hale
Parmotrema hololobum (Hale) Hale
Parmotrema indicum Hale
Parmotrema jacarandicola (Krog & Swinscow) Krog & Swinscow
Parmotrema kwalense (Krog & Swinscow) Krog & Swinscow
Parmotrema leonis (Krog and Swinscow) Krog and Swinscow
Parmotrema lobulascens (J. Steiner) Hale
Parmotrema lophogenum (des Abb.) Hale
Parmotrema louisianae (Hale) Hale
Parmotrema maclayanum (Müll. Arg.) Hale
Parmotrema mellissii (Dodge) Hale
Parmotrema nilgherrense (Nyl.) Hale
Parmotrema nyasense (C. W. Dodge) R.S. Egan, syn.: *Parmotrema xanthinum* (Müll. Arg.) Hale
Parmotrema parahypotropum (W. Culb.) Hale
Parmotrema pardi (Krog & Swinscow) Krog & Swinscow
Parmotrema perlatum (Huds.) M. Choisy]
Parmotrema permutatum (Stirton) Hale
Parmotrema pigmentiferum (Krog & Swinscow) Krog & Swinscow
Parmotrema pilosum (Stizenb.) Krog and Swinscow
Parmotrema poolii (C.W. Dodge) Krog & Swinscow
Parmotrema praesorediosum (Nyl.) Hale
Parmotrema pseudocrinitum (Abbayes) Hale
Parmotrema pseudograyanum (Hale) Sérus.
Parmotrema ravum (Krog & Swinscow) Sérus.
Parmotrema reticulatum (Taylor) M. Choisy, syn.: *Rimelia reticulata* (Taylor) Hale and A. Fletcher
Parmotrema rimulosum (Dodge) Hale
Parmotrema sancti-angelii (Lynge) Hale
Parmotrema soyauxii (Müll. Arg.) Hale
Parmotrema stuhlmannii (C.W. Dodge) Krog & Swinscow
Parmotrema subcoloratum (Hale) Hale
Parmotrema subisidiosum (Müll. Arg.) Hale

Parmotrema subschimperi (Hale) Hale
Parmotrema subsumptum (Nyl.) Hale
Parmotrema subtinctorium (Zahlbr.) Hale
Parmotrema sulphuratum (Nees and Flotow) Hale
Parmotrema taitae (Krog & Swinscow) Krog & Swinscow
Parmotrema tinctorum (Nyl.) Hale
Parmotrema tsavoense (Krog and Swinscow) Krog and Swinscow
Parmotrema uberrimum (Hue) Hale
Parmotrema umbrosum (Krog & Swinscow) Krog & Swinscow
Parmotrema zimbabwense (Hale) Kirika, Divakar and Lumbsch
Parmotrema zollingeri (Hepp) Hale
Peltigera cichoracea Delise ex Jatta
Peltigera continentalis Vitik.
Peltigera didactyla (With.) J.R. Laundon
Peltigera dolichorhiza (Nyl.) Nyl.
Peltigera lambinonii Goffinet
Peltigera polydactyloides Nyl.
Peltigera polydactylon (Neck.) Hoffm.
Peltigera praetextata (Flörke ex Sommerf.) Zopf.
Peltigera rufescens (Weiss) Humb.
Peltigera rufescentiformis (Gyeln.) C.W. Dodge
Peltigera ulcerata Müll. Arg.
Peltula africana (Jatta) Swinscow & Krog.
Peltula euploca (Ach.) Poelt ex Ozenda & Clauzade.
Peltula impressa (Vain.) Swinscow & Krog, syn.: *Peltula lingulata* (Vainio) Swinscow & Krog
Peltula patellata (Bagl.) Swinscow and Krog.
Peltula santessonii Swinscow & Krog
Peltula umbilicata (Vain.) Swinscow and Krog.
Phaeophyscia adiastola (Essl.) Essl.
Phaeophyscia confusa Moberg
Phaeophyscia endococcinodes (Poelt) Essl.
Phaeophyscia fumosa Moberg
Phaeophyscia hirsuta (Mereschk.) Essl.
Phaeophyscia hispidula (Ach.) Essl.
Phyllopeltula corticola (Büdel & R. Sant.) Kalb, syn.: *Peltula corticola* Büdel & R. Sant.
Phyllopsora albicans Müll. Arg.
Phyllopsora buettneri (Müll. Arg.) Zahlbr.
  Phyllopsora buettneri var. *glauca* (B. de Lesd.) Brako
Phyllopsora chlorophaea (Müll. Arg.) Zahlbr.
Phyllopsora confusa Swinscow and Krog
Phyllopsora furfuracea (Pers.) Zahlbr.
Phyllopsora haemophaea (Nyl.) Müll. Arg.
Phyllopsora kiiensis (Vain.) Gotth. Schneid.
Phyllopsora mediocris Swinscow and Krog
Phyllopsora santensis (Tuck.) Swinscow and Krog
Physcia adscendens H. Olivier
Physcia aipolia (Ehrh. ex Humb.) Fürnr.
Physcia albata (F. Wilson) Hale
Physcia alboplumbea (Taylor) Nyl.
Physcia atrostriata Moberg
Physcia biziana (A. Massal.) Zahlbr.
Physcia caesia (Hoffm.) Fürnr.
Physcia crispa Nyl.
Physcia dilatata Nyl.
Physcia dimidiata (Arnold) Nyl. (var. *ornata* (Nadv.) Moberg)
Physcia dubia (Hoffm.) Lettau
Physcia erumpens Moberg
Physcia flava Müll. Arg., syn.: *Dirinaria flava* (Müll. Arg.) C.W. Dodge
Physcia fragilescens Zahlbr.
Physcia integrata (Nyl.) Arnold
Physcia krogiae Moberg

Physcia poncinsii Hue
Physcia stellaris (L.) Nyl.
Physcia tribacia (Ach.) Nyl.
Physcia tribacioides Nyl.
Physcia undulata Moberg
Physcia verrucosa Moberg
Physciella chloantha (Ach.) Essl.
Physconia distorta (With.) J.R. Laundon
Physconia muscigena (Ach.) Poelt
Physconia perisidiosa (Erichsen) Moberg
Physma byrsaeum (Afzel. ex Ach.) Tuck.
Placopsis gelida (L.) Linds.
Placopsis parellina (Nyl.) I.M. Lamb
Platismatia glauca (L.) W.L. Culb. and C.F. Culb.
Polyblastidium albicans (Pers.) S.Y. Kondr., Lőkös and Hur, syn.: *Heterodermia albicans* (Pers.) Swinscow and Krog
Polyblastidium casarettianum (A. Massal.) Kalb
Polyblastidium chilense (Kurok.) Kalb, syn.: *Heterodermia chilensis* (Kurok.) Swinscow & Krog
Polyblastidium hypoleucum (Ach.) Kalb, syn.: *Heterodermia hypoleuca* (Ach.) Trevis.
Polyblastidium japonicum (M. Satô) Kalb
Polyblastidium magellanicum (Zahlbr.) Kalb, syn.: *Heterodermia magellanica* (Zahlbr.) Swinscow and Krog
Polyblastidium microphyllum (Kurok.) Kalb, syn.: *Heterodermia microphylla* (Kurok.) Skorepa
Polyblastidium propaguliferum (Vain.) Kalb, syn.: *Heterodermia reagens* (Kurok.) Elix
Polycauliona candelaria (L.) Frödén, Arup and Søchting, syn.: *Xanthoria candelaria* (L.) Th. Fr.
Protoparmeliopsis peltata (Lam. and DC.) Arup, Zhao Xin and Lumbsch, syn.: *Rhizoplaca peltata* (DC) Leuckert and Poelt
Pseudevernia furfuracea (L.) Zopf
Pseudocyphellaria argyracea (Delise) Vain.
Pseudocyphellaria aurata (Ach.) Vain.
Pseudocyphellaria clathrata (De Not.) Malme
Pseudocyphellaria crocata (L.) Vain.
Pseudocyphellaria intricata (Delise) Vain.
Pseudoparmelia singularis Krog & Swinscow
Pseudoparmelia usambarensis (J. Steiner and Zahlbr.) Krog and Swinscow
Punctelia borreri (Sm.) Krog
Punctelia constantimontium Sérus.
Punctelia neutralis (Hale) Krog
Punctelia punctilla (Hale) Krog
Punctelia reddenda (Stirton) Krog
Punctelia rudecta (Ach.) Krog
Punctelia semansiana (W. Culb. and C. Culb.) Krog
Punctelia stictica (Duby) Krog
Punctelia subpraesignis (Nyl.) Krog
Punctelia subrudecta (Nyl.) Krog
Punctelia toxodes (Stirt.) Kalb & M. Götz.
Pyxine berteroana (Fée) Imshaug [as '*berteriana*'], syn. *Pyxine meissnerina* Nyl.
Pyxine cocoes (Sw.) Nyl.
Pyxine consocians Vain., syn.: *P. physciaeformis* (Malme) Imsh.
Pyxine convexior (Müll. Arg.) Swinscow and Krog
Pyxine copelandii Vain.
Pyxine coralligera Malme
Pyxine katendei Swinscow and Krog
Pyxine kibweziensis Swinscow and Krog
Pyxine lilacina Swinscow and Krog
Pyxine lyei Swinscow and Krog
Pyxine maculata Swinscow & Krog
Pyxine nubila Moberg
Pyxine petricola Nyl.
    Pyxine petricola Nyl. var. *pallida* Swinscow and Krog
Pyxine reticulata (Vain.) Vain.
Pyxine sorediata (Ach.) Mont.
Pyxine subcinerea Stirt.

Pyxine vermiformis Swinscow and Krog
Ramalina africana (Stein) C.W. Dodge
Ramalina aspera Räsänen (Ach.) Mont.
Ramalina asperula Kremp.
Ramalina calcarata Krog and Swinscow
Ramalina celastri (Spreng.) A. Massal.
Ramalina consanguinea Müll. Arg.
Ramalina dendriscoides Nyl.
Ramalina disparata Krog and Swinscow
Ramalina ecklonii (Spreng.) Meyen and Flot., syn.: *R. sprengelii* Krog and Swinscow
Ramalina exiguella Stirt.
Ramalina fecunda Krog and Swinscow
Ramalina fimbriata Krog and Swinscow
Ramalina hoehneliana Müll. Arg.
Ramalina holstii Krog and Swinscow
Ramalina inflata (Hook. f. and Taylor) Hook. f. and Taylor, syn.: *R. subpusilla* (Nyl.) Krog and Swinscow
Ramalina maritima Krog & Swinscow
Ramalina nervulosa (Müll. Arg.) Abbayes
Ramalina peruviana Ach.
Ramalina pollinaria (Westr.) Ach.
Ramalina polymorpha (Lilj.) Ach.
Ramalina pusiola Müll. Arg.
Ramalina reducta Krog and Swinscow
Ramalina tenella Müll. Arg.
Ramalina translucida Krog and Swinscow
Relicina abstrusa (Vainio) Hale
Relicina echinocarpa (Kurok.) Hale
Relicina limbata (Laurer) Hale, syn. *Pseudoparmelia sphaerospora* (Nyl.) Hale
Relicina malaccensis (Nyl.) Kirika, Divakar and Lumbsch, syn.: *Pseudoparmelia malaccensis* (Nyl.) Hale
Remototrachyna rhabdiformis (Kurok.) Divakar and A. Crespo, syn.: *Hypotrachyna rhabdiformis* (Kurok.) Hale
Rhizoplaca melanophthalma (DC.) Leuckert and Poelt
Roccella babingtonii Mont., syn.: *R. endocrocea* M. Choisy
Roccella montagnei Bél.
Rostania callibotrys (Tuck.) Otálora, P.M. Jørg. and Wedin, syn: *Collema callibotrys* Tuck.
Scytinium californicum (Tuck.) Otálora, P.M. Jørg. and Wedin, syn.: *Leptogium californicum* Tuck.
Scytinium gelatinosum (With.) Otálora, P.M. Jørg. and Wedin
Scytinium intermedium (Arnold ex Malbr.) Otálora, P.M. Jørg. and Wedin
Scytinium lichenoides (L.) Otálora, P.M. Jørg. and Wedin
Scytinium palustre (P.M. Jørg.) Otálora, P.M. Jørg. Wedin
Scytinium subfragrans (Degel.) Otálora, P.M. Jørg. & Wedin, syn.: *Collema subfragrans* Degel.
Stereocaulon anomalum I.M. Lamb
Stereocaulon atlanticum (I.M. Lamb) I.M. Lamb
Stereocaulon claviceps Th. Fr.
Stereocaulon corticatulum Nyl.
Stereocaulon delisei Bory ex Dub.
Stereocaulon humbertii P.A. Duvign.
Stereocaulon meyeri Stein
Stereocaulon nigromaculatum P.A. Duvign.
Stereocaulon pomiferum P.A. Duvign.
Stereocaulon ramulosum Raeusch.
Stereocaulon rugulosum I.M. Lamb
Stereocaulon vesuvianum Pers.
Sticta afromontana Kaasalainen and Rikkinen
Sticta ambavillaria (Bory) Ach.
Sticta andina B. Moncada, Lücking and Sérus.
Sticta aspratilis Kaasalainen and Rikkinen
Sticta ciliata Taylor
Sticta cyphellulata (Müll. Arg.) Hue
Sticta duplolimbata (Hue) Vain.
Sticta fuliginosa (With.) Ach.
Sticta kunthii Hook.

Sticta limbata (Sm.) Ach.
Sticta marginalis Bory
Sticta sublimbata (J. Steiner) Swinscow and Krog
Sticta tomentosa (Sw.) Ach.
Sticta umbilicariiformis Hochst. ex Flot.
Sticta variabilis Ach.
Sticta weigelii (Ach.) Vain.
Sticta xanthotropa (Kremp.) D.J. Galloway, syn.: *S. weigelii* (Ach.) Vainio var. *xanthotropa* (Krempelh.) Hue
Teloschistes exilis (Michx.) Vain.
Teloschistes flavicans (Sw.) Norman]
Teloschistes perrugosus Müll. Arg.
Umbilicaria africana (Jatta) Krog and Swinscow
Umbilicaria cinereorufescens (Schaer.) Frey.
Umbilicaria decussata (Vill.) Zahlbr.
Umbilicaria haumaniana Frey.
Umbilicaria subglabra (Nyl.) Harm.
Umbilicaria umbilicarioides (Stein) Krog and Swinscow
Umbilicaria vellea (L.) Michx.
Usnea albomaculata Motyka
Usnea angulata Ach., syn.: *Usnea undulata* Stirt.
Usnea aristata Motyka
Usnea articulata (L.) Hoffm.
Usnea bicolorata Motyka
Usnea bornmuelleri J. Steiner
Usnea chloreoides (Vain.) Motyka
Usnea complanata (Müll. Arg.) Motyka
Usnea cristata Motyka
Usnea elata Motyka
Usnea exasperata (Müll. Arg.) Motyka
Usnea firmula (Stirt.) Motyka
Usnea gigas Motyka
Usnea goniodes (Stirt. ex Vain.) Swinscow and Krog
Usnea haumanii Motyka
Usnea leprosa Motyka
Usnea liechtensteinii J. Steiner
Usnea maculata Stirt.
Usnea nodulosa Swinscow and Krog
Usnea perhispidella J. Steiner
Usnea perplexans Stirt.
Usnea picta (J. Steiner) Motyka
Usnea pulvinata Fr
Usnea roseola Vain.
Usnea rubicunda Stirt.
Usnea ruwenzoriana Motyka
Usnea sanguinea Swinscow and Krog
Usnea sorediosula (Müll. Arg.) Motyka
Usnea subcristata C.W. Dodge
Usnea subeciliata (Motyka) Swinscow and Krog
Usnea subflorida (Zahlbr.) Motyka
Usnea submollis J. Steiner
Usnea torulosa (Müll. Arg.) Zahlbr.
Usnea welwitschiana Motyka
Wolseleyidea ochroxantha (Nyl.) S.Y. Kondr., Farkas and Lőkös, syn.: *Phyllopsora corallina* (Eschweiler) Müller Argoviensis var. *ochroxantha* (Nylander) Brako, *Ph. martinii* Swinscow and Krog
Wolseleyidea swinscowii (Timdal and Krog) S.Y. Kondr., Farkas and Lőkös, syn.: *Phyllopsora swinscowii* Timdal and Krog
Xanthoparmelia africana Hale
Xanthoparmelia amplexula (Stirton) Elix and Johnston
Xanthoparmelia annexa (Kurok.) Elix
Xanthoparmelia atroventralis (Hale) Hale
Xanthoparmelia austroafricana (Stirton) Hale

Xanthoparmelia boyeri Elix
Xanthoparmelia congensis (Stein) Hale
Xanthoparmelia cylindriloba M.D.E. Knox
Xanthoparmelia diadeta (Hale) Hale
Xanthoparmelia hypoleia (Nyl.) Hale
Xanthoparmelia kenyana (Essl.) O. Blanco, A. Crespo, Elix, D. Hawksw. & Lumbsch
Xanthoparmelia kiboensis (Dodge) Krog and Swinscow
Xanthoparmelia krogiae Hale & Elix, syn.: *Pseudoparmelia endochromatica* Krog & Swinscow
Xanthoparmelia lusitana (Nyl.) Krog
Xanthoparmelia meruensis Krog and Swinscow
Xanthoparmelia mexicana (Gyelnik) Hale
Xanthoparmelia microspora (Müll. Arg.) Hale
Xanthoparmelia nakuruensis (Essl.) O. Blanco, A. Crespo, Elix, D. Hawksw. & Lumbsch
Xanthoparmelia phaeophana (Stirton) Hale
Xanthoparmelia salkiboensis Hale
Xanthoparmelia subramigera (Gyelnik) Hale
Xanthoparmelia subtortula (Hale) Elix
Xanthoparmelia tinctina (Maheu and A. Gillet) Hale
Xanthoparmelia verruculifera (Nyl.) O. Blanco, A. Crespo, Elix, D. Hawksw. and Lumbsch
Xanthoparmelia weberi (Hale) Hale
Xanthoria elegans (Link) Th. Fr.
Xanthoria parietina (L.) Th. Fr.

Appendix 7: Checklist of crustose lichen-forming and lichenicolous fungi of Kenya (1988-2024)

Abrothallus nephromatis Suija & Pérez-Ort.
Abrothallus secedens Wedin & R. Sant.
Acanthothecis africana Staiger & Kalb
Aciculopsora longispora (Swinscow & Krog) Kistenich, Bendiksby & Timdal
Aciculopsora salmonea Aptroot & Trest
Aderkomyces armatus (Vězda) Lücking, Sérus. & Vězda
Agonimia pacifica (H. Harada) Diederich
Allographa chlorocarpa (Fée) Lücking & Kalb
Allographa consanguinea (Müll. Arg.) Lücking & Kalb
Allographa illinata (Eschw.) Lücking & Kalb
Amandinea submontana Marbach
Anisomeridium tamarindi (Fée) R.C. Harris
Arctomia uviformis (Hue) Otálora & Wedin, syn.: Collema uviforme Hue
Arthonia complanata Fée
Arthonia pocsii Lücking & Kalb
Arthonia microcephala Vězda
Aspidothelium hirsutum Yeshitela, Eb. Fisch., Killmann & Sérus.
Asterothyrium septemseptatum Lücking
Auriculora byssomorpha (Nyl.) Kalb
Bacidina medialis (Tuck ex Nyl.) Kistenich, Timdal, Bendiksby & S. Ekman
Biatora halei (Tuck.) S.Y. Kondr.
Biatora kalbii (Brako) S.Y. Kondr.
Brigantiaea leucoxantha (Spreng.) R. Sant. & Hafellner
Byssolecania variabilis Vězda, Kalb & Lücking
Calicium abietinum Pers.
Calicium chlorosporum F. Wilson
Calicium diploellum Nyl.
Calicium hyperelloides Nyl.
Calicium lenticulare Ach.
Calicium salicinum Pers.
Caloplaca brebissonii (Fée) Zahlbr.
Candelariella vitellina (Hoffm.) Müll. Arg.
Caprettia tanzanica (Vězda) Lücking & Sérus.
Chaenotheca chloroxantha Tibell
Chaenotheca chrysocephala (Ach.) Th. Fr.
Chaenotheca furfuracea (L.) Tibell
Chaenotheca trichialis (Ach.) Th. Fr.
Chrysothrix xanthina (Vain.) Kalb
Clandestinotrema clandestinum (Ach.) Rivas Plata, Lücking & Lumbsch
Clathroporina foliicola Vězda
Coenogonium hypophyllum (Vězda) Kalb & Lücking
Coenogonium kalbii Aptroot, Lücking & L. Umaña
Coenogonium luteum (Dicks.) Kalb & Lücking
Coenogonium nepalense (G. Thor & Vězda) Lücking, Aptroot & Sipman
Coenogonium stenosporum (Malme) Lücking, Aptroot & Sipman
Coenogonium tanzanicum (Vězda & Farkas) Lücking & Kalb
Cratiria megaobscurior Marbach
Cresponea flava (Vain.) Egea & Torrente
Cystocoleus ebeneus (Dillwyn) Thwaites
Didymocyrtis melanelixiae (Brackel) Diederich, R.C. Harris & Etayo
Dimelaena oreina (Ach.) Norman
Diorygma minisporum Kalb, Staiger & Elix
Enterographa fellhaneroides Yeshitela, Eb. Fisch., Killmann & Sérus.
Enterographa meklitiae Yeshitela, Eb. Fisch., Killmann & Sérus.

Enterographa vezdae Sparrius
Fellhanera congesta (Vězda) Vězda
Fellhanera fragilis (Vězda) Lücking & Kalb
Fissurina triticea (Nyl.) Staiger
Flakea papillata O.E. Erikss.
Gassicurtia coccinea Fée
Gassicurtia coccinoides Marbach
Gassicurtia marbachii Kalb & Elix
Glaucomaria bicincta (Ramond) S.Y. Kondr., Lőkös & Farkas
Glyphis dictyospora Staiger
Graphina streblocarpa (Bél.) Müll. Arg.
Graphis proserpens Vain.
Gyalecta bicellulata (Kalb) D. Hawksw. & Lücking, syn.: Cryptolechia bicellulata Kalb
Gyalecta caudata (Kalb) D. Hawksw. & Lücking, syn.: Cryptolechia caudata Kalb
Gyalectidium atrosquamulatum Lücking & Kalb
Gyalectidium kenyanum Lücking & Kalb
Gyalideopsis africana Kalb & Vězda
Gyalideopsis krogiae Kalb & Vězda
Gyronactis elaeocarpa (Nyl.) Ertz & Tehler
Haematomma collatum (Stirt.) C.W. Dodge
Haematomma kenyense Kalb & Staiger
Halegrapha kenyana Kalb & Lücking
Herpothallon minimum Aptroot & Lücking
Lecanactis platygraphoides (Müll. Arg.) Zahlbr.
Lecanora caesiorubella Ach.
Lecanora helva Stizenb.
Lecanora kenyana Kirika & Lumbsch
Lecanora mugambii Kirika, I.Schmitt, Fankhauser & Lumbsch
Lecanora orientoafricana Kirika & Lumbsch
Lecidea atrobrunnea (DC.) Schaer.
Lempholemma fennicum (Räsänen) Degel.
Lepra scaberula (A.W. Archer) I. Schmitt, B.P. Hodk. & Lumbsch
Lepra tropica (Vain.) Lendemer & R.C. Harris
Lepraria arbuscula (Nyl.) Lendemer & B.P. Hodk.
Lepraria incana (L.) Ach.
Lepraria lobificans Nyl.
Lepraria usnica Sipman
Letrouitia flavocrocea (Nyl.) Hafellner & Bellem.
Lichenoconium erodens M.S. Christ. & D. Hawksw.
Lichenopeltella mobergii Zhurb.
Llimoniella pertusariae Diederich & Etayo
Lyromma multisetulatum Flakus & Farkas
Malmidea ceylanica (Zahlbr.) Kalb, Rivas Plata & Lumbsch
Megalospora tuberculosa (Fée) Sipman
Megalospora coccodes (Bél.) Sipman
Micarea pumila Kantelinen & Myllys
Micarea stellaris Kantelinen & Myllys
Micarea taitensis Kantelinen & Myllys
Micarea versicolor Kantelinen, Hyvärinen & Myllys
Mycoporum lacteum (Ach.) R.C. Harris
Neoprotoparmelia fuscosorediata Kalb & Aptroot
Neoprotoparmelia paulii V.J. Rico, Lumbsch & Garima Singh
Ocellularia diplotrema (Nyl.) Zahlbr.
Ocellularia eumorphoides Frisch
Opegrapha medusulina Nyl.
Pertusaria endoxantha Vain.
Pertusaria fosseyae A.W. Archer, Elix, Eb. Fisch., Killmann & Sérus.
Pertusaria krogiae A.W. Archer, Elix, Eb. Fisch., Killmann & Sérus.
Pertusaria lambinonii A.W. Archer, Elix, Eb. Fisch., Killmann & Sérus.
Pertusaria leioplacella Nyl.
Pertusaria maritima A.W. Archer & Elix

Pertusaria mesotropa Müll. Arg.
Pertusaria pilosula A.W. Archer & Elix
Pertusaria rigida Müll. Arg.
Pertusaria subplanaica A.W. Archer & Elix
Pertusaria subrigida Müll. Arg
Pertusaria verruculifera Vain.
Pertusaria melanostoma Kremp.
Phacopsis falcispora var. *sipmanii* Diederich & Triebel
Phaeographis atromaculata (A.W. Archer) A.W. Archer
Phaeographis dendritica (Ach.) Müll. Arg.
Phaeographis girringunensis A.W. Archer & Elix
Phylloblastia marattiae (Vězda) Lücking
Piccolia elmeri (Vain.) Hafellner
Placynthiella icmalea (Ach.) Coppins & P. James
Polychidium muscicola (Sw.) Gray
Porina distans Vězda & Vivant
Porina epiphylla Fée
Porina epiphylloides Vězda
Porina exocha (Nyl.) P.M. McCarthy
Porina internigrans (Nyl.) Müll. Arg.
Porina longispora Vězda
Porina lucida R. Sant.
Porina nucula Ach.
Porina nuculastrum (Müll. Arg.) R.C. Harris
Porina tetracerae (Ach.) Müll. Arg.
Porina conspersa Malme
Porina diaphana Vězda
Porina karnatakensis Makhija, Adaw. & Patw.
Porina multipunctata var. *schizospora* Vězda
Porina papillifera var. *rubrofusca* Vězda
Porina santessonii Makhija, Adaw. & Patw.
Porina sphaerocephaloides Farkas
Porina uluguruensis Vězda
Psoroglaena cubensis Müll. Arg.
Pyrenula acutispora Kalb & Hafellner
Pyrenula confinis (Nyl.) R.C. Harris
Pyrenula mastophora (Nyl.) Müll. Arg.
Pyrenula nitidula (Bres.) R.C. Harris
Pyrenula ochraceoflava (Nyl.) Willey
Pyrenula santensis (Nyl.) Müll. Arg.
Pyrenula macrocarpa A. Massal.
Pyrrhospora endaurantia Kalb & Aptroot
Ramboldia russula (Ach.) Kalb, Lumbsch & Elix
Rolfidium coccocarpioides (Nyl.) Timdal, syn.: *Toninia coccocarpoides* (Nyl.) Zahlbr.
Skyttea elachistophora (Nyl.) Sherwood & D. Hawksw.
Skyttea mayrhoferi Diederich & Etayo
Sphinctrina tubaeformis A. Massal.
Spirographa lichenicola (D. Hawksw. & B. Sutton) Flakus, Etayo & Miądl.
Taitaia aurea Suija, Kaasal. & Rikkinen
Tephromela atra (Huds.) Hafellner
Tephromela tropica Kalb
Thelotrema canarense Patw. & C.R. Kulk.
Toninia cinereovirens (Schaer.) A. Massal.
Trapeliopsis flexuosa (Fr.) Coppins & P. James
Trapeliopsis glaucolepidea (Nyl.) Gotth. Schneid.
Trapeliopsis haumanii (Zahlbr.) Gotth. Schneid.
Varicellaria velata (Turner) I. Schmitt & Lumbsch

Appendix 8: Results on lichen secondary metabolites from lichen samples from Kenya and Tanzania on HPTLC plates

2304

A			
1	control		atranorin, zeorin, norstictic acid
2	*Punctelia stictica*	Ngong	gyrophoric acid
3	*Physcia poncinsii*	Ngong	atranorin, zeorin
4	*Flavoparmelia soredians*	Ngong	usnic acid, stictic acid(?), salazinic acid
5	*Physcia undulata*	Ngong	atranorin, zeorin, terpenoids
6	*Physcia undulata*	Ngong	atranorin, zeorin, terpenoids
7	*Parmotrema hababianum*	Ngong	atranorin, lichesterinic acid, protolichesterinic acid
8	*Parmotrema reticulatum*	Ngong	atranorin, salazinic acid
9	*Parmotrema reticulatum*	Ngong	atranorin, salazinic acid
10	*Ramalina africana*	Makueni	(usnic acid), sekiakaic acid, norstictic acid
11	*Parmotrema eunetum*	Makueni	atranorin, gyrophoric acid
12	*Pyxine convexior*	Makueni	(atranorin)
13	*Parmotrema austrosinense*	Makueni	atranorin, lecanoric acid
14	*Parmotrema eunetum*	Makueni	atranorin, gyrophoric acid
15	*Parmotrema austrosinense*	Makueni	atranorin, lecanoric acid
16	*Parmotrema hababianum*	Makueni	atranorin, lichesterinic acid, protolichesterinic acid
17	*Parmotrema austrosinense*	Makueni	atranorin, lecanoric acid
B			
1	control		atranorin, zeorin, norstictic acid
2	*Usnea bornmuelleri*	Makueni 2000	usnic acid, protocetraric acid
3	*Physcia erumpens*	Makueni	atranorin, zeorin
4	*Physcia erumpens*	Makueni	atranorin, divaricatic acid, zeorin, terpenoids
5	N/A		
6	N/A		
7	N/A		
8	N/A		
9	N/A		
10	N/A		
11	N/A		
12	N/A		
13	N/A		
14	N/A		
15	N/A		
16	N/A		
17	N/A		

2401

A			
1	control		atranorin, zeorin, norstictic acid
2	*Parmotrema subschimperi*	89002/Z	atranorin, norstictic acid, gyrophoric acid
3	*Xanthoparmelia tinctina*	89002/X	usnic acid, salazinic acid
4	*Xanthoparmelia tinctina*	89004/AB	usnic acid, salazinic acid
5	*Parmotrema reticulatum*	89005/H	atranorin, salazinic acid
6	*Phaeophyscia confusa*	89011/J	no lichen secondary metabolite detected
7	*Xanthoparmelia phaeophana*	89027/AQ	usnic acid, succinprotocetraric acid/fumarportocetraric acid (protocetraric acid)
8	*Parmotrema austrosinense*	89027/AU	atranorin, lecanoric acid
9	*Parmotrema subschimperi*	89011/B	atranorin, gyrophoric acid
10	*Parmotrema cristiferum*	89031/ABA	atranorin, salazinic acid
11	*Parmotrema eunetum*	89031/ABB	atranorin, gyrophoric acid, 2 fatty acid
12	*Parmotrema tinctorum*	89031/AK	atranorin, lecanoric acid
13	*Parmotrema poolii*	89031/AP	atranorin, alectoronic acid, α-collatolic acid
14	*Parmotrema andinum*	89031/E	lecanoric acid
15	*Parmotrema andinum*	89031/E	lecanoric acid
16	*Parmotrema nilgherrense*	89053/K	atranorin, α-collatolic acid, alectoronic acid, gyrophoric acid, protocetraric acid
17	*Polyblastidium japonicum*	89145/A	atranorin, zeorin, terpenoids
B			
1	control		atranorin, zeorin, norstictic acid
2	*Polyblastidium japonicum*	89145/A	atranorin, zeorin, terpenoids
3	*Parmotrema lobulascens*	89147/M	atranorin, alectoronic acid, α-collatolic acid
4	*Phaeophyscia endococcinodes*	89149/Z	skyrin yellow pigment, terpenoids
5	*Hypotrachyna sorocheila*	89149/U	atranorin, salazinic acid
6	*Xanthoparmelia africana*	89149/E	usnic acid, terpenoids, salazinic acid
7	*Xanthoparmelia kiboensis*	89151/E	usnic acid, salazinic acid
8	*Xanthoparmelia africana*	89151/B	usnic acid, salazinic acid
9	*Xanthoparmelia africana*	89151/B	usnic acid, salazinic acid
10	*Parmotrema austrosinense*	89157/Y	chloroatranorin, atranorin, zeorin, terpenoid, lecanoric acid
11	*Parmotrema subschimperi*	89158/D	gyrophoric acid
12	*Polyblastidium microphyllum*	89160/P	atranorin, zeorin, terpenoids
13	*Polyblastidium microphyllum*	89160/P	atranorin, zeorin, terpenoids
14	*Pannaria pannosa*	89160/M	no lichen secondary lichen metabolite detected (black unidentified at atranorin height)
15	*Parmotrema nilgherrense*	89165/P	atranorin, α-collatolic acid, alectoronic acid
16	*Parmotrema andinum*	89180/S	atranorin, lecanoric acid
17	*Hypotrachyna laevigata*	89186/AN	atranorin, barbatic acid, 4-O-demethyl barbatic acid

2402

A			
1	control		atranorin, zeorin, norstictic acid
2	*Anzia afromontana*	89186/AQ	atranorin, divaricatic acid, 2 fatty acids
3	*Heterodermia speciosa*	89192/C	atranorin, zeorin
4	*Hypotrachyna orientalis*	89194/APA	atranorin, barbatic acid, 4-O-demethyl barbatic acid
5	*Hypotrachyna orientalis*	89194/APB	atranorin, barbatic acid, 4-O-demethyl barbatic acid
6	*Parmotrema subisidiosum*	89194/APC	atranorin, salazinic acid
7	*Parmotrema lobulascens*	89194/RA	atranorin, alectoronic acid, α-collatolic acid
8	*Hypotrachyna densirhizinata*	89194/RB	atranorin, alectoronic acid
9	*Hypotrachyna orientalis*	89194/M	atranorin, barbatic acid, 4-O-demethyl barbatic acid
10	*Hypotrachyna orientalis*	89194/BBA	atranorin, barbatic acid, 4-O-demethyl barbatic acid
11	*Hypotrachyna orientalis*	89194/BBB	atranorin, barbatic acid, 4-O-demethyl barbatic acid
12	*Hypotrachyna microblasta*	89217/AA	usnic acid, barbatic acid (?), galbinic acid
13	*Dirinaria flava*	89217/AB	atranorin, divaricatic acid (?)
14	*Hypotrachyna microblasta*	89217/QA	atranorin, usnic acid, barbatic acid (?)
15	*Parmotrema tinctorum*	89217/EA	atranorin, lecanoric acid
16	*Coccocarpia adnata*	89217/EB	no lichen secondary metabolite detected
17	*Dirinaria picta*	89217/EC	atranorin, divaricatic acid, terpenoids, fatty acid
B			
1	control		atranorin, zeorin, norstictic acid
2	*Parmotrema subschimperi*	89224/CLA	atranorin, ?, gyrophoric acid
3	*Heterodermia speciosa*	90008/P	atranorin, zeorin, terpenoid
4	*Parmotrema pilosum*	90008/N	(atranorin), stictic acid
5	*Parmotrema araucariarum*	900221AP	(atranorin), fatty acid
6	*Parmotrema crinitum*	90022/AA	atranorin, stictic acid, constictic acid
7	*Parmotrema lobulascens*	90022/P	atranorin, alectoronic acid, α-collatolic acid
8	*Parmotrema reticulatum*	90022/M	atranorin, salazinic acid
9	*Parmotrema subisidiosum*	90022/T	atranorin, fatty acid, salazinic acid
10	*Flavoparmelia caperata*	90022/AB	usnic acid, protocetraric acid, caperatic acid
11	*Pseudocyphellaria dozyana*	90022/OA	fatty acid, terpenoid
12	*Hypotrachyna vexans*	90030/U	atranorin, salazinic acid
13	*Umbilicaria cinereorufescens*	90030/M	(norstictic acid), gyrophoric acid
14	*Xanthoparmelia africana*	90031/T	usnic acid, salazinic acid
15	*Umbilicaria umbilicarioides*	90031/TA	norstictic acid
16	*Montanelia cf. disjuncta*	90031/O	(atranorin), perlatolic acid
17	*Hypogymnia subobscura*	90031/U	atranorin, oxphysodic acid, protocetraric acid

2501

A			
1	control		atranorin, zeorin, norstictic acid
2	N/A		
3	N/A		
4	N/A		
5	N/A		
6	N/A		
7	N/A		
8	N/A		
9	N/A		
10	N/A		
11	N/A		
12	N/A		
13	N/A		
14	N/A		
15	N/A		
16	N/A		
17	N/A		
B			
1	control		atranorin, zeorin, norstictic acid
2	N/A		
3	N/A		
4	N/A		
5	N/A		
6	N/A		
7	N/A		
8	N/A		
9	N/A		
10	N/A		
11	N/A		
12	N/A		
13	N/A		
14	*Parmotrema praesorediosum*	90031/F	atranorin, caperatic acid
15	*Phaeophyscia hispidula*	90096/O	no lichen secondary metabolite detected
16	*Bulbothrix kenyana*	90097/K	atranorin, salazinic acid
17	*Parmotrema andinum*	90097/N	atranorin, lecanoric acid

2502

A			
1	control		atranorin, zeorin, norstictic acid
2	*Hypotrachyna microblasta*	89217/AA	usnic acid, barbatic acid (?), galbinic acid
3	*Dirinaria flava*	89217/AB	atranorin, divaricatic acid (?)
4	*Hypotrachyna microblasta*	89217/AA	atranorin, usnic acid, barbatic acid (?)
5	*Parmotrema tinctorum*	89217/QB	atranorin, ?,divaricatic acid(?),lecanoric acid
6	*Parmotrema tinctorum*	89217/EA	atranorin, ?, lecanoric acid
7	*Parmotrema tinctorum*	89217/EA	atranorin, ?, lecanoric acid
8	*Parmotrema subschimperi*	89224/CLA	atranorin, ?, gyrophoric acid
9	*Heterodermia speciosa*	90008/P	atranorin, zeorin, terpenoid
10	*Heterodermia speciosa*	90008/P	atranorin, zeorin, terpenoid
11	*Heterodermia speciosa*	90008/P	atranorin, zeorin, terpenoid
12	*Parmotrema reticulatum*	90022/M	atranorin, salazinic acid
13	*Hypogymnia subobscura*	90031/U	atranorin, oxphxsodic acid, protocetraric acid
14	*Flavoparmelia pachydactyla*	90097/C	usnic acid, protocetraric acid
15	*Flavoparmelia pachydactyla*	90097/C	usnic acid, protocetraric acid
16	N/A		
17	*Usnea aristata*	89194/BBC	usnic acid, fumarprotocetraric acid
B			
1	control		atranorin, zeorin, norstictic acid
2	N/A		
3	N/A		
4	N/A		
5	N/A		
6	N/A		
7	N/A		
8	N/A		
9	N/A		
10	N/A		
11	N/A		
12	N/A		
13	N/A		
14	N/A		
15	N/A		
16	N/A		
17	N/A		

Appendix 9: List of publications supporting the thesis research

Published papers in peer reviewed journals

KANYUNGULU, C. N. & FARKAS, E. É. (2025): Awareness of Lichens and the Necessity of Their Conservation Among Citizens in Different Regions of Kenya. In: Acta Botanica Hungarica. 67(4): https://doi.org/10.1556/034.2025.00573.

KANYUNGULU, C. N. & FARKAS, E. É. (2026): Threats on lichens and their conservation – a review based on a bibliometric analysis. In: . Diversity 18(1): 30. https://doi.org/10.3390/d18010030

KANYUNGULU, C. N., KIRIKA, P. M. & FARKAS, E. É. (2026): Introduction of categorisation in the annotated checklist of macrolichens in Kenya for describing a tentative estimation of extinction risk of Data Deficient species. In: Cryptogamie, Mycologie, manuscript accepted on 30.04.2026.

FARKAS E., KANYUNGULU C. N. & VARGA N. (2025): New records of lichens and lichenicolous fungi from Kenya and Tanzania (East Africa) 2. Acta Biologica Plantarum Agriensis 13(1): 29–57. https://doi.org/10.21406/abpa.2025.13.1.29

Conference presentations related to the thesis

KANYUNGULU C. N. & FARKAS, E. (2023)The importance of lichens and their conservation [A zuzmók és természetvédelmük jelentősége]. Acta biologica plantarum agriensis 11(2): 30.

KANYUNGULU C. N. & FARKAS E. (2024): A zuzmók és természetvédelmük szakirodalmi áttekintése. In: Dima, Bálint; Papp, Viktor (eds.) VII. Magyar Mikológiai Konferencia - Absztraktkötet. Gödöllő, Hungary: MATE, Hungarian Mycological Society pp. 149-150

KANYUNGULU C. N. & FARKAS E. (2024): Hagyományos tudás a zuzmók diverzitásáról és megőrzéséről Kenyában. In: Tölgyesi, C.; Lőrinczi, G. (eds.) 13. Magyar Ökológus Kongresszus (2024) Előadások és poszterek összefoglalói, p. 111

KANYUNGULU C. & FARKAS E. (2024): Bridging within lichenology – traditional wisdom and recent science in Kenya. In: 12th International Mycological Congress (IMC12). Abstract proceedings. p. 351.

KANYUNGULU C. N. & FARKAS E. É. (2024): Traditional knowledge and lichen conservation. In: 9th Student Conference on Conservation Science, Balatonvilágos 2024: SCCS Europe - Connecting Eastern and Western Europe in conservation biology. (2024) p. 46

KANYUNGULU C. N. & FARKAS E. É. (2025): Advancing the knowledge of Kenya's macrolichen diversity. In: 10th Student Conference on Conservation Science, Balatonvilágos 2025: SCCS Europe - Connecting Eastern and Western Europe in conservation biology. (2025) p. 19.

KANYUNGULU C. N. & FARKAS E. É. (2025): Lichen species diversity and its research in Kenya. In: Molnár, Dániel; Molnár, Dóra (szerk.) Tavaszi Szél Konferencia / Spring Wind Conference 2025: Budapest, Magyarország: Doktoranduszok Országos Szövetsége (2025) p. 133.

Appendix 10: Acknowledgements

First of all, I would like to express my sincere gratitude to the Stipendium Hungaricum Scholarship Programme for providing financial support for my doctoral studies and living expenses throughout the period of 2022–2026. I am equally grateful to the National Research, Development and Innovation Fund for supporting my research through grant number NKFI K 124341 (PI Edit Farkas).

I would also like to extend my appreciation to the MATE Doctoral School of Natural Sciences, Biological Sciences Programme, for granting me the opportunity to pursue and prepare my doctoral dissertation within the framework of the Hungarian University of Agriculture and Life Sciences (MATE – Gödöllő). My deepest gratitude goes to the Institute of Ecology and Botany, HUN-REN Centre for Ecological Research, where I conducted the research work for this dissertation. I am especially grateful to my supervisor, Professor Edit Farkas, for her continuous guidance, encouragement, scientific mentorship, and invaluable expertise throughout my doctoral studies. Her support and constructive insights greatly contributed to the successful completion of this work.

I sincerely thank Dr Nóra Varga for her assistance in identifying lichenicolous fungi from specimens collected during my Kenyan lichen studies. Special appreciation is extended to Dr Paul Kirika, Curator of the East African Herbarium, Botany Department, National Museums of Kenya, for his support during the herbarium fieldwork conducted at the East African Herbarium and for his contribution to compiling the updated checklist of Kenyan lichens. I am also grateful to Dr László Lőkös for his valuable advice, support in laboratory work, and careful proofreading of manuscripts throughout the study period. My sincere thanks further go to Dr Andreas Frisch, Dr Josef Halda, and Dr Arne Thell for kindly providing literature resources that were important for the preparation of the annotated checklist of Kenyan macrolichens.

I highly appreciate the constructive comments and suggestions from the anonymous reviewers of our published research articles, which significantly improved the quality of our work. I am also thankful to my PhD dissertation reviewers, Dr Ibolya Tomory and Dr habil. Andrea Sass-Gyarmati, for their insightful evaluations and valuable recommendations that enriched this dissertation.

Finally, I would like to express my heartfelt gratitude to my family and friends for their unwavering emotional and practical support throughout this long academic journey. Their patience, encouragement, understanding, and constant motivation gave me the strength to persevere during the most demanding moments of my doctoral studies.