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Editorial

Lichenology in Africa

In the past three years *The Lichenologist* has published *c.* 90 papers but only four of these were based on African material. Two of these were physiological papers co-authored by one of us (RB), whereas the other two were taxonomic and described new species from South Africa and Kenya. This contrasts dramatically with the 31 papers based on European material. Given the relative sizes of the continents and the diversity of habitats in Africa – from Mediterranean biomes in the north and far south, through deserts, tropical rainforests and savannah to temperate biomes in the south, and from sea level to alpine regions – this is an exceedingly poor return. Even within Africa, the distribution is uneven with three of the four papers being based on South African material, one on Kenyan, and none on western or northern material.

The history of lichenology in Africa dates back at least as far as Linnaeus. Johann König, a pupil of Linnaeus, visited Cape Town on his way to India in 1768 and made several collections, including the type collection of *Lichen chrysophtalmos* (Linnaeus 1771), which we now know as *Teloschistes chrysophthalmos* [as *chrysophthalmus*]. However, the first collector to spend any time collecting lichens in southern Africa was Carl Pehr Thunberg between 1772–1775 who, although based in Cape Town, travelled extensively in the interior (Thunberg 1794). In the following 150 years, a number of local collectors became active, including Miss [Olivia?] Armstrong and Peter MacOwen, while European visitors such as Josef Brunnthaler and Friedrich Wilms made extensive expeditions into the interior. Their collections were, of course, taken back to Europe and deposited in European herbaria (LUND, G, W, ZT, etc) and many were described as new species by Johannes Müller (1885–1888), Edvard Vainio (e.g. Vainio 1901, 1926), Alexander Zahlbruckner (e.g. Zahlbruckner 1926, 1932, 1936) and especially Ernst Stizenberger in his *Lichenaea Africana* (Stizenberger 1890, 1891). These early collectors were primarily botanists who also collected other groups and more details of their activities can be found on the Biographical Database of Southern African Science (http://www.s2a3.org.za/bio/Main.php).

In the early 20th century Paul Andries van der Byl collected lichens extensively (van der Byl 1933*a*, *b*, 1935*a*, *b*), and in 1950 Ethel Doidge included lichens in her monumental compendium of southern African fungi (Doidge 1950). Subsequently, between 1956–1991, Ove Almborn issued six fascicles (150 collections) of an exsiccate, *Lichenes Africani*, and also published several other papers on African lichens (Almborn 1966, 1987, 1988, 1989). However, the first person based in South Africa to concentrate on the lichens of southern Africa was Franklin Brusse of SANBI, Pretoria who, between 1984–1994, published *c.* 40 papers describing taxonomic novelties from South Africa and Namibia. Although his main interest was in *Parmelia* s. lat., describing numerous new species and making many new combinations, he also described many new species and nine new genera across a wide range of families (e.g. Brusse 1985a, *b*, 1987*a*, *b*, *c*, *d*, 1988*a*, *b*, 1994). More recently, one of us (AF) has published an updated checklist of South African lichens (Fryday 2015).

Luciana Zedda and co-workers have carried out some important work on terricolous lichen communities in Namibia and NW South Africa (e.g. Zedda & Rambold 2009; Zedda *et al.* 2009, 2011*a*, *b*) but otherwise the ecology of southern African lichens is poorly studied.

Lichenological exploration in eastern Africa started in the mid-1800s, with collectors mainly comprised of explorers, missionaries and European visitors with an interest in nature. The earliest collector in the region is perhaps W. G. Schimper who collected in Ethiopia in the 1840s. Other personalities who made small lichen collections from different parts of East Africa in the late part of the 19th century were Marquess Antinori, O. Beccari, J. Hannington, J. M. Hildebrandt, R. L. von Hohnel, C. H. E. W. Holst, H. H. Johnstone, W. Last, H. Meyer and G. Thomson, who made collections in Tanzania and Zanzibar. Prince Heinrich of Liechtenstein, Dr Pospischill and A. K. Ritter collected in Kenya and Tanzania and G. F. Scott Elliot collected in the Ruwenzori Mountains in Uganda. These collections were reported in several works (Baglietto 1875; Krempelhuber 1877; Stirton 1877–1878; Jatta 1882; Müller 1885–1888, 1890, 1893, 1894; Stein 1889; Steiner 1897; Vainio 1898).

In the early 1900s, collectors comprised both amateur and professional botanists. Amongst these were J. Brunnthaler, B. Fink, L. Hauman, G. Lindau, R. A. Maas Geesteranus, Józef Motyka, Vicomte de Poncins, R. Pichi Sermolli, Professor Senni, B. Schroder, R. Wettstein and the Reverend Fathers of Consolata Missions. Results of these collections were published in several papers (Jatta 1908, 1909; Lindau 1911; Hue 1916; Zahlbruckner 1926, 1932; Zahlbruckner & Hauman 1936; Cengia Sambo 1937, 1938, 1939; Maas Geesteranus 1955; Motyka 1961) and later summarized in treatments of tropical lichens from Africa by Carroll Dodge (1953, 1956, 1957, 1959, 1964, 1971).

In the 1970s, Hildur Krog and Dougal Swinscow collected intensively in East Africa, their collections culminating in the publication of '*Macrolichen Flora of East Africa*' (Swinscow & Krog 1988). Subsequent excursions by other lichenologists greatly increased the knowledge of the East African lichen biota (Sérusiaux 1978, 1979, 1981, 1984*a*, *b*, 1989; Ahti *et al.* 1987; Almborn 1989; Elix 2002; Lücking & Kalb 2002; Jørgensen 2003; Kalb 2004, 2007, 2008; Alstrup & Aptroot 2005; Killmann & Fischer 2005; Sérusiaux & Diederich 2005; Frisch *et al.* 2006; Sérusiaux *et al.* 2006; Bock *et al.* 2007; Yeshitela 2008; Archer *et al.* 2009; Frisch & Tibell 2010). For the last two decades one of us (PK) has been collecting in Kenya and has updated the Kenyan lichen checklist, which will soon be published.

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Elsewhere on the continent, North African lichenology has a long history, dating back to 1798 in Algeria. Checklists have recently been prepared for Algeria (Amrani *et al.* 2015, 2018) and Tunisia (Seaward *et al.* 2021) and there have been some inventories carried out in Morocco (Mohamed *et al.* 2021) and Egypt (Hegazy 2012). Unfortunately, recent references to the ecology, physiology or taxonomy of West African lichens are less easy to locate.

There have been very few studies on the ecophysiology and physiology of African lichens. Even the potential for using African lichens medicinally has received little attention (Adenubi *et al.* 2022). This is probably because there are relatively few physiologists that are familiar with lichenology on the staff of African universities, a problem that also extends into other subject areas. Furthermore, in Africa there are relatively few truly unique (physiologically speaking) habitats that would tempt lichenologists from the rest of the world to visit for research purposes. However, within southern Africa there are vast areas dominated by soil crust communities, within which lichens often play an important role. Thanks to the studies of Lucinda Zedda, Burkhart Büdel and their colleagues, progress has been made on characterizing these ecologically important systems (see references above, and Büdel *et al.* (2009)), but disappointingly their physiology remains to be investigated. Within this 'biome' there is a rather exceptional sub-type, that of the 'desert fog' lichens. Outside southern Africa, these communities are found only in a small number of places, namely California, the Peruvian coast and the Negev Desert in Israel. Otto Lange and his co-workers (Lange *et al.* 1991, 2006, 2007) elegantly demonstrated the remarkable ability of some Namibian desert 'fog' lichens to achieve net photosynthesis with non-liquid water. This work was continued by Maphangwa *et al.* (2012*a*), who initiated discussion on the important question of the likely impact of climate change on these lichens (Maphangwa *et al.* 2012*b*).

For the last 30 years, one of us (RB) has studied various aspects of the stress physiology of lichens. Although much of this work could have been carried out using lichens from anywhere in the world, in recent years work has focused on lichens from the Afromontane vegetation. The study of Mkhize *et al.* (2022: this issue) compared the 'quenching' characteristics of photosynthesis in 'sun' and 'shade' collections of the same species of Afromontane lichens. Results suggest that Afromontane lichen photobionts can flexibly adjust the amount and type of their quenching.

It is to be hoped that in future more scientists will be prompted to study lichen physiology in Africa. What makes lichens special, and arguably separates them from the vast majority of other photosynthetic organisms, is their desiccation tolerance, and this holds innovative potential. Once the molecular mechanisms have been elucidated, technologies can be used to transfer genes for stress tolerance to crop plants (Farrant & Hilhorst 2022). These studies are of great importance, since Africa is predicted to bear the brunt of future climate change which will no doubt increase abiotic stress and challenge the security of food production.

The present volume is an attempt to bring African lichens and lichenology to the attention of the wider community, while at the same time promoting the study of lichens and lichenology within the continent itself. In this issue, Kaasalainen *et al.* study the diversity of the genus *Peltigera* on Mt Kilimanjaro in Tanzania and report eight species including the new species, *P. alkalicola*; Kirika *et al.* show that the pantropical species *Canoparmelia texana* consists of two independent lineages, both of which occur in Kenya; Medeiros & Lutzoni provide a modern treatment of the *Graphidaceae* genera with hyaline ascospores in South Africa, describing one new species, *Allographa oldayana,* making two new combinations and reporting 11 other species as new to South Africa; Nadel & Clerc provide notes on the genus *Usnea* from the islands of São Tomé and Príncipe in tropical West Africa, reporting 15 taxa, of which two, *U. beckeri* and *U. longiciliata,* are described as new to science; Temu *et al.* investigate the molecular, morphological and chemical variation of the *Usnea pectinata* aggregate in Tanzania, and São Tomé and Príncipe; Farkas & Muhoro present an identification key for parmelioid taxa in Kenya; Mkhize *et al.* investigate the adaptions of photosynthesis in sun and shade in populations of some Afromontane lichens (see above) and Kitara *et al.* examine the distribution pattern and host tree specificity of *Lobaria pulmonaria* in tropical montane forest landscapes in Tanzania. Finally, Aptroot reviews a book on foliicolous lichens and their lichenicolous fungi in Macaronesia and Atlantic Europe authored by van den Boom.

To the best of our knowledge, there are no research groups in Africa (or anywhere else for that matter) focused on the systematics or ecology of African lichens, but we know that interest exists because of our own personal experience and the number of posts on social media requesting help with identifications. However, the lack of field guides and local experts means that getting started is an almost impossible task. Additionally, most of the hundreds of species described by Stizenberger, Zahlbruckner and others have not been reported since and are known only from their type collection, and these collections are in European herbaria. Consequently, anyone attempting to find the correct name for an unknown collection is left with the thankless task of trawling through the protologues of numerous possible taxa, which invariably lack the detailed information necessary to make a positive identification.

In spite of the recent activity in southern and eastern Africa, as elsewhere on the continent, large parts of these regions still remain underexplored and the lichen biota urgently requires revision to fully understand its diversity and biogeography, especially with the use of molecular tools. However, as can be seen from the contributions to this volume, the potential for exciting new discoveries on the continent is enormous and we hope this special issue will be a springboard to future work.

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