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FLORA OF MACROLICHENS IN THE ALPINE AND SUBALPINE ZONES OF MOUNT KENYA (KENYA)

Die Flora der Blatt- und Strauchflechten in der alpinen und subalpinen Stufe des Mount Kenya (Kenia)

by

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Key words: Macrolichens, Tropical High Mountains, Mount Kenya, East Africa.

Schlagwörter: Makroflechten, Tropische Hochgebirge, Mount Kenya, Ostafrika.

Summary: First results of an inventory of the macrolichen flora in the alpine and subalpine zones of Mount Kenya (Kenya, East Africa) are presented. In the investigation area, which is located on the western side of the mountain, approximately 155 species of macrolichens in 47 genera could be found. Of the hitherto 105 reliably identified species (i.e. 67%), seven are new records for eastern Africa, nine for the Republic of Kenya and one species has not been reported before for Mount Kenya. In addition to saxicolous habitats, stands of tree heather in the lower parts of the study area show a conspicuous and species rich macrolichen vegetation, whereas the terricolous macrolichen vegetation is only poorly developed. Eutrophication is a common feature of saxicolous habitats in the alpine zone and it is hypothesized that this is caused by the influences of tourism in this area.

The identification of the remaining material is in progress and a comprehensive account of the results will be published after the end of this work.

Zusammenfassung: Erste Ergebnisse einer Studie zur Flora der Blatt- und Strauchflechten in der Alpinen und Subalpinen Stufe des Mount Kenya werden vorgestellt. Insgesamt ca. 155 Makroflechtenarten in 47 Gattungen konnten in dem an der Westflanke des Vulkans gelegenen Untersuchungsgebiet nachgewiesen werden. Von den 105 (= 67%) bis jetzt sicher bestimmten Arten sind sieben Neufunde für das östliche Afrika, neun für die Republik Kenia und eine Art, *Cetraria aculeata*, wurde erstmalig für den Mount Kenya nachgewiesen. Neben den dominierenden saxicolen Flechtenstandorten weisen v.a. die Bestände der Baumheide in den unteren Lagen eine artenreiche Flechtenvegetation auf. Im Gegensatz hierzu ist die terricole Flechtenvegetation insgesamt nur spärlich entwickelt. Eutrophierung ist ein charakteristisches Merkmal saxicoler Standorte in der Alpinen Stufe. Ein Zusammenhang mit dem langandauernden und intensiven Tourismus in diesem Teil des Untersuchungsgebietes wird vermutet.

Eine Bearbeitung des weiteren Materials wird zur Zeit durchgeführt, und eine umfassende Darstellung der Ergebnisse erfolgt nach Beendigung dieser Arbeit.

The high mountain areas of eastern Africa constitute a remarkable ecosystem, referred to as the "afroalpine archipelago" However, despite the long and intensive botanical research, especially on Mount Kenya (RHEKER et al., 1989), and the more recently published flora "Macrolichens of East Africa" (SWINSCOW & KROG 1988), the knowledge of the lichen flora and vegetation of the East African mountains is still highly incomplete. In the study presented here, new data for the macrolichen flora and vegetation in the alpine and subalpine parts of Mount Kenya is provided as an example for the afroalpine regions. Some of the preliminary results are shortly summarised below.

Materials and Methods

The lichen material used in this study was collected during a three month field trip by the first author on Mount Kenya in summer 1995. In the investigation area, the main lichen habitats were investigated according to their macrolichen species composition and some of the more dominant crustose lichens and bryophytes were included as well. Ecological data established for the species include habitat type, substrate, aspect, inclination of the location and the accompanying species.

Identification of the specimens was undertaken at the University of Bayreuth and the "Botanische Staatssammlungen München" in Munich, using light microscopy and TLC-methods. In critical cases, herbarium specimens were used for comparison and specialists for certain lichen groups were contacted.

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Preliminary results

I. Lichen habitats

I.1 Epiphytic macrolichens

The epiphytic macrolichen vegetation in the investigation area is confined largely to stands of tree heather (*Erica arborea*) in the ERICACEOUS and lower ALPINE BELT, ca. 3350-4050m a.s.l.. Trunks and branches in well lit situations commonly show a dense lichen cover, in which *Usnea, Hypotrachyna* and *Parmotrema* are the dominating genera. Further typical species of this habitat type are *Heterodermia* spp., *Hypogymnia* spp., *Anzia afromontana, Cetrariastrum sorocheilum* and *Platismatia glauca*. In damp and shady localities, for example the inner parts of dense shrubs, the cyanolichens *Leptogium* spp., *Sticta* spp., *Erioderma* cf. sp. A and *Nephroma tropicum* are characteristic species, together with *Normandina pulchella* and *Cystocoleus ebeneus*. *Ramalina fimbriata, R. reducta, R. translucida* and the *Usnea abyssinica*-agg. are common on the small outer twigs of the *Erica* shrubs. On rain shadowed trunk bases of old *Erica* individuals, the coniocarp lichens *Calicium lenticulare, C. hyperelloides, Chaenotheca chrysocephala* and *Ch. trichialis* occur together with sterile crustose species. *Lasallia papullosa* is characteristic on the hard wood of dead *Erica* trunks.

In the ALPINE BELT, above 4000 m altitude, few epiphytic macrolichens were found on the mostly moss *(Syntrichia cavallii)* clad trunks of tree groundsel *(Senecio keniodendron)*. Common species are *Peltigera* spp., *Leptogium* sp. 2 and a species of the *Xanthoria fallax*-agg.. The last species can dominate the trunks in eutrophicated localities.

I.2 Saxicolous macrolichens

The saxicolous macrolichen vegetation is well developed throughout the investigation area and occurs in a great variety of habitats. Therefore, only some examples could be given here. In the ALPINE BELT, rocks and boulders commonly are covered by a conspicuous layer of species of the *Usnea articulata*-agg., which is developed over a dense layer of acrocarpous mosses *(Andreaea cucullata, Grimmia* spp.). This vegetation type is confined to more or less steep, westerly-exposed rock faces and appears to depend to a great extent on ground fog and cloud drift, a common event in these parts of the mountain. Characteristic lichen species of this vegetation type include *Bryoria* spp., *Stereocaulon* spp., *Umbilicaria* spp., *Cystocoleus ebeneus, Hypogymnia bitteri, Pannaria* sp. 1, *Parmelinopsis swinscowii, Physconia muscigena, Placopsis gelida, Platismatia glauca, Polychidium muscicola* and *Xanthoparmelia kiboense*. On most rocks, in drainage channels or in the course of mountain streams, *Dermatocarpon* spp., *Lempholemma* spp., *Leptogium* spp., *Phaeophyscia endococcinodes, Physcia albo-plumbea, Physcia* sp. 1, *Xanthoria elegans* and *Zahlbrucknerella* spp. are typical species. *Dermatocarpon aequinoctiale* in par-

ticular is characteristic for the amphibious zone of mountain streams and tarns.

In the upper ALPINE and in the NIVAL BELT, *Umbilicaria africana* and *U. decussata* often form conspicuous stands on steep to vertical rock faces. Here, *Rhizoplaca melanophthalma* and *Xanthoria elegans* can be found on slightly overhanging, rain shadowed locations. These four species occur up to the highest altitudes (Point Lenana, 4986 m a.s.l.), together with *Xanthoparmelia kiboense, Dimelaena oreina, Sporastatia testudinea* and crustose lichen species.

I.3 Terricolous macrolichens

The terricolous macrolichen vegetation is not well developed in the investigation area. The species, mostly *Cladonia* spp. and *Peltigera* spp., occur typically as small and scattered individuals on earth banks and in gaps in the alpine and subalpine plant communities. *Cetraria aculeata, Omphalina* sp. 1, *Pannaria* sp. 1 and *Trapeliopsis* cf. *haumanii* are further terricolous macrolichen species that grow in this habitat. Only *Cladonia hedbergii* often forms larger stands in rocky places in the ERICACEOUS BELT. Above ca. 4200 m a.s.l., in the upper ALPINE BELT, the soils commonly are affected by heavy frost heaving and solifluction. Here, the species mostly become restricted to patches of higher plant vegetation, edges of boulders and rocks and other stable substrates. On the frost heaving and solifluction soils themselves, a peculiar but species poor community is developed, which consists mainly of a vagrant lichen species, *Xanthoparmelia cylindriloba*, together with a "globular moss" species *(Grimmia ovalis;* BECK et al., 1986). At the same altitudes, *Dermatocarpella squamulosa* can be found on earth covered rocks and in rock fissures.

I.4 Coprophilous macrolichens

Eutrophication is a common feature of the saxicolous lichen vegetation in the upper TELEKI VALLEY. This is mainly caused by Rock Hyrax *(Procavia johnstonii mackinderi)* together with several species of rodents and birds. The eutrophication affects greater areas around the colonies of Rock Hyrax, but it otherwise is confined to the top of larger and often single standing boulders and rocks. Here, a clear zonation in the species arrangement could be seen, most probably depending on a gradient in the nutrient concentration. Characteristic coprophilous species of such "birdrocks" are *Lecanora* (="*Placodium*") sp. 1, *Physcia caesia, Ph. dubia, Ramalina polymorpha, Xanthoparmelia africana* and *Xanthoria elegans.*

A comparable high degree of eutrophication as in the Teleki Valley could not be found in some neighbouring valleys, which were shortly visited during the present investigation. These findings are in accordance with observations on higher population densities for Rock Hyrax and the rodent

species in Teleki Valley, given by KOKWARO & BECK (1987). These authors regard this fact as an effect of influences of tourism in this valley, and if this view is correct, then most of the eutrophication is more recent in age and an indication for changes in the afroalpine ecosystem of Mount Kenya caused by human activities. This problem needs further investigation.

II. Floristic Results

Approximately 155 species of macrolichens were found in the investigation area, which belong to 47 lichen genera. 105 species (=67%) are identified to species level and a further eighteen are identified provisionally. The remaining material is identified to the generic level only. The highest species number is in *Usnea* (ca. 15), *Hypotrachyna* (12), *Cladonia* (ca. 12), *Leptogium* (10), *Peltigera* (7) and *Xanthoparmelia* (7). Twelve genera are represented by two species and eighteen by a single one. A preliminary inventory is given in the appendix.

About 33 (= 21%) of the recognised species are not included in "Macrolichens of East Africa" Mostly these were found at higher altitudes in the ALPINE BELT. Out of the species identified so far, seven were new for East Africa (EA!), nine for the Republic of Kenya (K!) and one for Mount Kenya (MK!). The new species are marked with the respective abbreviations in the appendix.

III. Preliminary list of species

K! *Anaptychia ethiopica*
Anzia afromontana
Bryoria bicolor
Bryoria fuscescens-agg.
Bryoria motykae
Bryoria nadvornikiana
Bunodophoron sp.
K! *Calicium lenticulare*
Calicium hyperelloides
MK! *Cetraria aculeata*
Cetrariastrum catawbiense
Cetrariastrum sorocheilum
EA! *Chaenotheca chrysocephala*
K! *Chaenotheca trichialis*
Cladonia hedbergii
Cladonia intermediella
Cladonia krempelhuberi
Cladonia macilenta
Cladonia poeciloclada
Cladonia pyxidata
Cladonia spp.
K! *Cystocoleus ebeneus*
K! *Dermatocarpella squamulosa*
Dermatocarpon aequinoctiale
Dermatocarpon spp.
EA! *Dimelaena oreina*
Erioderma cf. sp. A, in SWINSCOW & KROG (1988)
Flavopunctelia flaventior
Heterodermia japonica
Heterodermia leucomelos ssp. *boryi*
Hypogymnia bitteri
Hypogymnia physodes
Hypogymnia tubulosa
Hypogymnia sp. 1
Hypotrachyna densirhizinata
Hypotrachyna meyeri
Hypotrachyna ducalis
Hypotrachyna laevigata
Hypotrachyna neodissecta

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Hypotrachyna orientalis
Hypotrachyna producta
Hypotrachyna rockii
Hypotrachyna sinuosa
Hypotrachyna sp. 1
Hypotrachyna sp. 2
Lasallia papullosa
Lasallia pustulata
Lempholemma sp. 1
Lempholemma sp. 2
Leptogium adpressum
Leptogium burnetiae
Leptogium coralloideum
Leptogium laceroides
Leptogium resupinans
Leptogium spp. 1-5
EA! *Melanelia disjuncta*
K! *Melanelia elegantula., (M. infumata* sensu SWINSCOW & KROG (1988))
EA! *Melanelia subargentifera*
Melanelia subaurifera
Nephroma tropicum
Normandina pulchella
Omphalina sp. 1
EA! *Pannaria hookeri*
Pannaria rubiginosa
Pannaria sp. 1
Parmelia saxatilis
Parmelia sulcata
Parmelinella wallichiana
Parmelinopsis afrorevoluta
Parmelinopsis swinscowii
Parmotrema lobulascens
Parmotrema nilgherrensis
Parmotrema subschimperi
Parmotrema sp. 1
Peltigera didactyla
Peltigera dolichorhiza
Peltigera polydactyloides
Peltigera praetextata
Peltigera rufescens
Peltigera rufescentiformis
Peltigera ulcerata
Phaeophyscia cf. adiastola
Phaeophyscia endococcinodes
Physcia cf. *adscendens*
Physcia albata
Physcia albo-plumbea
Physcia caesia
Physcia dubia
Physcia sp. 1
Physconia muscigena
Physconia perisidiosa
EA! *Placopsis gelida*
K! *Placopsis parellina*
Platismatia glauca
EA! *Polychidium muscicola*
Pseudevernia furfuracea
Ramalina fimbriata
Ramalina translucida
Ramalina cf. *pollinaria*
Ramalina polymorpha
K! *Ramalina reducta*
Rhizoplaca melanophthalma
Stereocaulon corticatulum
Stereocaulon meyeri
Stereocaulon pomiferum
Stereocaulon vesuvianum
Stereocaulon spp.
Sticta ambavillaria
Sticta limbata
Sticta weigelii
Sticta sp. 1
Trapeliopsis cf. *haumanii*
Umbilicaria africana
Umbilicaria cf. *cinereorufescens*
Umbilicaria decussata
Umbilicaria umbilicarioides
K! *Umbilicaria vellea*
Usnea abyssinica-agg.
Usnea albomaculata
Usnea articulata
Usnea bicolorata

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Usnea bornmuelleri
Usnea haumanii
Usnea maculata
Usnea subflorida
Usnea spp.
Xanthoparmelia africana
Xanthoparmelia atroventralis
Xanthoparmelia cylindriloba
Xanthoparmelia kiboense
Xanthoparmelia tinctina, sensu SWINSCOW & KROG (1988)
Xanthoparmelia sp. 1
Xanthoparmelia sp. 2
Xanthoria elegans
Xanthoria fallax-agg.
Zahlbrucknerella sp. 1
Zahlbrucknerella sp. 2

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