

New records of lichens with cyanobacteria from Tanzania and Kenya

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Abstract – Sixtytwo lichen species containing cyanobacteria in thallus or cephalodia are reported from East Africa. *Fuscopannaria leucosticta* and *Leptogium rivulare* are new to Africa. *Collema subnigrescens*, *Parmeliella triptophylla* and *Polychidium dendriscum* are new to East Africa and further ten species are new to Tanzania. Notes on ecology and occurrence in Africa are given.

Biogeography / Cyanobacterial lichens / Kenya / Tanzania

INTRODUCTION

Apart from various publications of T.D. V. Swincow and H. Krog which in the end lead to the publication of Macrolichens of East Africa in 1988, very few modern papers deal with the lichenology of that area. However, Swincow and Krog mainly collected in S Ethiopia, Kenya and Uganda with just a few localities situated in northern Tanzania. Krog (2000) reported on corticolous macrolichens from eastern Tanzania, and Farkas (1987, 1991) dealt with foliicolous lichens from Usambara Mts. and Tanzania. Farkas (2003) dealt with *Pseudocyphellaria* and *Sticta* from East Africa, and Alstrup & Aptroot (2005) report crustose pyrenolichens from the same area as treated here. The bulk of the material reported here originates from Uluguru Mts. and Udzungwa Mts., two parts of the very old mountain chain Eastern Arc stretching from Taita Hills in Kenya through most of eastern Tanzania and including also the better known Usambara Mts. These mountains, raising to around 2500 m above sea level, separated by deep valleys and mostly covered by forest in their upper parts, are known for a great degree of endemism of plants and animals. It was therefore of interest to study also the lichen flora of these mountains. For comparison lichens were also collected in other forest areas and bushlands. Almost all the species of cyanolichens were epiphytic, with a minor part being collected from rock outcrops, mostly along rivers.

MATERIALS AND METHODS

The core of the material treated were collected by the first author in the Uluguru Mts. (1996-1999), Udzungwa Mts. (1996, 1999, 2003) and Pugu Hills in Tanzania (1996-2000), and Ngong Hills in Kenya (1988, 2000, 2001), which were intensively collected. Further collections are from various, incompletely

investigated places in both countries. A few previously unreported collections in C made by other travellers are included. Materials of *Collema*, *Leptogium* and Pannariaceae were identified by the second author, the rest by the first author. Specimens are kept in C and the herbarium of Department of Botany, University of Dar Es Salaam.

Information on world distribution and occurrences in Africa was sought in Swinscow & Krog (1988) and other papers cited in the references, and also in T. Feuerer & G. Rambold: Global diversity of lichens (<http://www.checklists.de>).

Whenever possible, the species are assigned to one of the 16 distribution patterns given by Galloway (1996).

LOCALITIES

Tanzania

Tanga district. Usambara Mts. **Amani**. 28. VII. 1974.

Bagamoyo district, Mapinga Village, **Changwahela**, 06° 31'S, 39° 04'E, alt. 0-5 m. Mangrove and dune shrubs.

Iringa district, Udzungwa Mts., **Idete**, 08° 10'S, 36° 01'E, alt. 1600-1700 m. Road brink and planted trees in rural area.

Iringa district, Lukosi River Valley, **Ilulu**, 07° 39'S, 36° 08'E, alt. 1100 m. Boulders and shrubs along river.

Iringa District, Udzungwa Mts., **Ilutile**, 08° 12'S, 35° 58'E, alt. 1900 m. Mountain rain forest.

Iringa district, Udzungwa Mts., **Itonya Forest**, 08° 12'S, 36° 02'E, alt. 1500-1700 m. Mountain rain forest.

Iringa district, Udzungwa Mts., **Itonya Village**, 08° 11'S, 36° 02'E, alt. 1500 m. Disturbed mountain forest and free-standing trees.

Iringa district, Udzungwa Mts., between **Kivulamo** and Idunda villages, 08° 08'S, 36° 04'E, 1600-1700 m. Mountain rain forest.

Morogoro district, Uluguru Mts., **Luhangalo Plateau**, 07° 07'S, 37° 35-38'E, alt. 2200-2500 m. Remnants of mountain rain forest, freestanding trees, soil and cliffs.

Morogoro district, Udzungwa Mts., **Luhega Forest Reserve**, c. 08° 25'S, 36° 00-10'E, alt. 300-900 m. Mountain rain forest.

Morogoro district, **Luhembe River**, c. 10 km S Mikumi, 07° 29'S, 37° 02'E, alt. 350 m. Cliffs and trees along river.

Iringa district, Udzungwa Mts., **Massisiwe**, c. 08° 23'S, 36° 01'E, 2200-2500 m. Mountain rain forest.

Kyela district, Livingstone Mts., **Matema Beach**. Mountain forest on slope towards Lake Nyassa.

Bagamoyo district. Peninsula outside **Mbeganif**, shrubs in dune vegetation, 1-5 m.

Monduli district, **Monduli**, c. 03° 18'S, 36° 28'E, on road-side trees.

Morogoro district, Uluguru Mts., **Morningside** outside Morogoro, cliffs and shrubs in farmland.

Morogoro district, Uluguru Mts., **Morogoro**, c. 06°18'S, 37° 40'W. Forested valley at outskirts of town.

Iringa district, Lukosi River Valley, **Mtandike**, 07° 31'S, 36° 32'E, alt. 550 m. Riverine forest and valley slope with *Adansonia digitata*.

Mbeya district, **Ngozi Crater** near Tukuyu., c. 09° 08'S, 33° 25'E. Mountain forest.

Kissarawe district, **Pugu Hills**, c. 06° 54'S, 39° 05'E, alt. 300 m. Mountain forest.

Morogoro district, Udzungwa Mts., **Sanje Waterfall**, c. 07° 43'S, 36° 55'E. Mountain rain forest.

Morogoro district, Uluguru Mts., **Tschenzema Slope**, 07° 07'S, 37° 34'E, alt. 1900-2200 m.

Kenya

Mweiga, **Endarasha Hill**. On fallen branch. Alt. 2500 m. Date 14.XII. 1962. Nairobi, **Kamera Forest**, c. 01° 20'S, 36° 42'E.

Kitui district, **Kathunga** c. 10 km S Ngoni. Rock outcrop with shrubs.

Kitui district, **Kyalungwa**, 13.6 km N Mwingi, inselberg.

Kitui district, 5 km S **Mutito** on road to Zombe. Semi-arid bushland.

Nairobi, **Ngong Hills**. C. 01° 24'S, 36° 36'E. Shrubs, rocks and remnants of mountain forest.

Nairobi, **Ngong Police Post**, c. 01° 23'S, 36° 38'E. Road trees.

SPECIES LIST

* = new to Tanzania; ** = new to East Africa; *** = new to Africa.

EArc: Eastern Arc Mountains; mt: other mountains; bush: semiarid bushland; riv: riverine forest; coast: mangrove and coastal dune.

**Coccocarpia adnata* L. Arv.

Luhega Forest, TZ2018. (EArc)

The species was known from Kenya, Mauritius, Indonesia and Pacific Islands.

Coccocarpia dissecta Swinscow & Krog.

Luhega Forest, TZ2257. Sanje Waterfall, TZ3618. (EArc)

The species was already known from Kenya, Tanzania, Philippines and Pacific Islands.

Coccocarpia erythroxyli (Sprengel) Swinscow & Krog.

Ilutite, TZ887. Itonya Village, TZ1749. Luhangalo Plateau, TZ2735. Changwahela, TZ4088. (EArc + coast).

C. erythroxyli is widespread in tropical and temperate regions.

**Coccocarpia flavicans* L. Arv.

Luhega Forest, TZ2305. (EArc).

Previously known from Kenya, Angola and S America.

Coccocarpia palmicola (Sprengel) L. Arv. & D. Gall.

Idete, TZ592. Kivulamo, T1515. Itonya Village, T1733. Luhega Forest, TZ2016, TZ2017, TZ2306. Luhangalo Plateau, TZ2734, TZ3207. Sanje Waterfall, TZ3604. (EArc)

C. palmicola is widespread in temperate and tropical regions.

Coccocarpia pellita (Ach.) Müll. Arg.

Itonya Village, TZ1748. Itonya Forest, TZ1847. Luhega Forest, TZ2014, TZ2015. Luhangalo Plateau, TZ2781. Sanje Waterfall, TZ3605. (EArc).

The species is widespread in the tropics.

Collema callibotrys Tuck.

Luhangalo Plateau, C5636. Luhega Forest, TZ2022, TZ2072. (EArc).

The spores, 10-12 µm long, are constantly 8-celled (four cells seen in view) and have a granulated outer cell-wall (clearly seen in Melzer). Exipulum proprium is euthyplechtenchymatous. It deviates in all essential characters from the habitually similar *C. laevisporum* described by Swinscow & Krog (1986). C5636 has a 150-180 µm high hymenium and is referable to var. *coccophyllizum* (Zahlbr.) Degel. However, var. *coccophyllizum* is not well separated from var. *callibotrys* (Degelius, 1974). Hence, they are here treated as one taxon as also done by Swinscow & Krog (1988).

It is a widespread temperate to tropical species (Pantropical).

****Collema coilocarpum*** (Müll. Arg.) Zahlbr.

Kivulamo, TZ1562b. Luhega Forest, TZ2089. Changwahela, TZ4018. (EArc + coast).

A rare but easily recognizable species due to the characteristic paraplechtenchymatous tissue at the base of the apothecium (Degelius, 1974: Fig. 43 ; Swinscow & Krog; 1988: Fig. 29).

The species is known from Kenya, tropical Asia and Pacific Islands (Paleotropical).

Collema furfuraceum (Arn.) DR. var. ***luzonense*** (Räs.) Degel.

Luhega Forest, TZ2163, fertile.

Fertile specimens are distinguished from var. *furfuraceum* by the euparaplechtenchymatic exipulum proprium, the isidiate thalline margin, the not strongly ridged thallus and the coarser isidia.

Sterile specimens:

Ilutile, TZ633. Luhega Forest, TZ2020, TZ2163. Morogoro, leg. Pocs. TZ3410. Sanje Waterfall, TZ3608. (EArc).

Sterile specimens of *C. furfuraceum* cannot easily be referred to variety on morphological grounds. Var. *furfuraceum* is boreal to tropical and var. *luzonense* is temperate to tropical in distribution, and both varieties are known from East Africa (Swinscow & Krog 1988). See note under *Collema rugosum*.

Var. *luzonense* has a Pantropical distribution pattern.

Collema pulchellum Ach. var. ***subnigrescens*** (Müll. Arg.) Degel.

Ngong Hills, on shrub in the lower fog zone, K383, C1518. (mt).

C. pulchellum is widespread in tropical and temperate areas (Pantropical).

****Collema rugosum*** Krempelh.

Luhega Forest, TZ2019, C6052. Changwahela, TZ4017. Mbeganif, TZ3563. Sanje Waterfall, TZ3652a. Mutito, C1561. (EArc + bush + coast).

Aptroot (1991) considers this species as "doubtfully differing from *C. furfuraceum*". In the present material specimens with *japonicum*-type thallus (with irregular ridges and no pustules) and isidia both on and between ridges (= *C. rugosum*) are well distinguished from specimens with *nigrescens*-type thallus (with prominent ridges and pustules) and isidia confined to the ridges and pustules (at least in the young peripheral part of the thallus; in the central part isidia may also occur between ridges) (= *C. furfuraceum*). Though the position of the isidia may be a little tricky in separating the species, the difference in thallus morphology is rather clear.

C. rugosum is widespread in the tropical zone of Asia and Pacific Islands, in E Africa known from Kenya and Uganda (Paleotropical).

****Collema subflaccidum* Degel.**

Sanje Waterfall, TZ3609. (EArc)

Although a cosmopolitan species, *C. subflaccidum* was not recorded from Tanzania before.

*****Collema subnigrescens* Degel.**

Ilutile, TZ788. (EArc).

The spores are broadly acicular, 5-6 celled, $30-42 \times c. 5 \mu\text{m}$, a little on the short side [(34) $40-75 \times (4.5) 6-6.5$ (7) μm according to Degelius (1954)].

C. subnigrescens occurs in western Europe and Madeira. In Africa it is known from South Africa (Degelius, 1974), Algeria and Tunisia (Degelius, 1954). The distribution pattern is broadly Atlantic.

***Collema uviforme* Hue.**

Mutito, on shrub, C1562. Kathunga, on *Xerophyta* sp., C1578. (bush).

The species is only known from Ethiopia, Kenya and Tanzania (Endemic).

***Collema* sp.**

Morningside, TZ3435. (EArc).

Minutely squamulose thalli with laminal globular isidia/granules. Lobe tips not swollen. Terricolous.

******Fuscopannaria leucosticta* (Tuck.) P. M. Jørg.**

Luhangalo Plateau, TZ3212a. (EArc).

New to Africa. The species occur in South East Asia, south to New Guinea, South Europe (Italy), the West Indies and South East U.S.A., reaching north to the Great Lakes (Jørgensen, 2000). Allowing for the presence in temperate areas of Europe and North America, the species may be considered as a pantropical species.

Thallus squamulose. Squamules light brown with white felted lobe ends. Apothecia with white felted crenulated thallus margin. Spores ellipsoid, apiculate, about $16 \times 10 \mu\text{m}$ ($24 \times 11 \mu\text{m}$ inclusive of epispore). Apiculi acuminate at both ends or acuminate at one end and rounded at the other end (cf. Jørgensen, 1978: Fig 21B, left and central drawing).

****Kroswia crystallifera* P. M. Jørg.**

Luhangalo Plateau, on twig of freestanding tree, TZ3101. (EArc).

The species was recently described from India (Jørgensen, 2002). It is known from the tropical to subtropical areas of Africa, South India and Taiwan, where it grows epiphytically in damp, montane forests (Jørgensen, 2002). Jørgensen (2002) consider the distribution as paleotropical. As the species is not known from the Pacific Islands, the distribution pattern may as well be interpreted as belonging to the Western Pacific element (*sensu* Galloway, 1996).

***Leptogium austroamericanum* (Malme) Dodge.**

Ilutile, TZ805a sterile. Luhembe River, TZ2409 sterile. Matema Beach, TZ3490. Sanje Waterfall, con ap., TZ3652. (EArc + mt + riv).

Sterile specimens of this species are not easily separated from *L. cyane-scens*. It seems that the degree of thughnes and striation of the thallus are the uly, subjective, characters available. Only specimens with clearly though and striate thalli are referred to *L. austroamericana*. Paper-thin specimens may be

markedly striate, e.g. TZ634. They are referred to *L. cyanescens*. Rather though specimens with only faint striae, but with apothecia with well developed thalline margins (section), e.g. TZ3652, are placed here.

The species, known from the Americas and E Africa (Swinscow & Krog 1988), and Australia (Verdon, 1992), is pantropical according to Sierk (1964).

***Leptogium azureum* (Ach.) Mont.**

Ilutite, TZ857. Massisiwe, TZ1068, TZ1124. Kivulamo, TZ1554. Itonya Village, TZ1720. Itonya Forest, TZ1809. Luhega Forest, TZ2021, TZ2048, TZ2183 (on stone). Luhangalo Plateau, TZ2776. Tschenzema Slope, TZ3306. Ngozi Crater, TZ3530. Ngong Hills, C1505. Ngong, K382. (EArc + mt + bush).

The species is widespread in tropical and temperate regions including E Africa. Pantropical.

***Leptogium burnetiae* Dodge**

Luhega Forest, TZ2049, TZ2052a. Ngozi Crater, TZ3526. (EArc + mt).

L. burnetiae is widespread in the tropics and in some temperate areas. Pantropical?

***Leptogium cochleatum* (Dickson) P. M. Jørg. & P. James.**

Ilutite, TZ805, with *Leptogium coralloideum* TZ867, TZ624 (cfr.), TZ795 (cfr). Kivulamo, TZ1559. Luhangalo Plateau, TZ2776a, C4537, C4547. Ngong Hills, shrub, C1516. (EArc + mt).

Widespread in tropical and temperate areas of South America, western Europe, South and East Africa, India and eastern Australia (Aragon *et al.*, 2005). Pantropical.

***Leptogium coralloideum* (Meyen & Flotow) Vainio.**

Ilutite, TZ867, TZ675. Kivulamo, TZ1557. Itonya Village, TZ1732, TZ1769. Luhega Forest, with *Leptogium marginellum* TZ2051. Luhangalo Plateau, TZ2779, TZ3022, C5635. Ngong Hills, C1503. (EArc + mt).

L. coralloideum is widespread in tropical and warm temperate regions including E Africa (Swinscow & Krog 1988). It is known from South America, Europe, the Philippines, Papua New Guinea, Australia and New Zealand (Verdon, 1990, 1992). Pantropical.

***Leptogium cyanescens* (Rabenh.) Körber**

Ilutite, TZ609, TZ634, TZ653, with *L. coralloideum* TZ867, with *L. phyllocarpum* TZ633a. Kivulamo, TZ1555. Itonya Forest, TZ1722, TZ1848, TZ1891. Mtandike, TZ1988. Luhega Forest, TZ2054. Pugu Hill, TZ2554. Luhangalo Plateau, TZ2778, TZ3014, C5060, C5633. Tschenzema Slope, TZ3307. Ngozi Crater, TZ3527, TZ3531. Sanje Waterfall, TZ3602, TZ3615. Matema Beach, TZ3491. Ngong Hills, K313, K381, C1523. Kamera Forest, K376. Endarasha Hill, leg. K. Bjørnkiær. (EArc + mt, + riv).

Some sterile specimens of *L. austroamericana* may be included here (see note under that species). Some specimens have phyllidia and flattened isidia marginally in addition to laminal cylindrical isidia, and in a few cases only the former occur (TZ2779, TZ3531), cf. Swinscow & Krog (1988).

The species is widespread in tropical and temperate areas including E Africa (Swinscow & Krog, 1988). The species is probably cosmopolitan (Verdon, 1992).

****Leptogium gelatinosum* (With.) Laundon.**

Luhega Forest, TZ1986, TZ1987. (EArc + mt).

Not reported from East Africa by Swinscow & Krog (1988), but according to Frisch & Hertel (1988), it is common in the upper alpine zone of Mt. Kenya.

A north temperate species known from North America, Europe and Asia (Sierk, 1964 as *L. sinuatum* (Huds.) Mass.).

***Leptogium hibernicum* Mitchell ex P. M. Jørg.**

Massisiwe, TZ1049. Kivulamo, TZ1556. Itonya Village, TZ1757. Luhangalo Plateau, TZ2774, TZ3466. Tschenzema Slope, TZ3308. (EArc).

Known from South America (Ecuador to Central Chile), the West Indies, Macaronesia, Europe, East Africa to South Africa, and New Guinea (Jørgensen, 1997). Pantropical.

***Leptogium javanicum* Mont.**

Massisiwe, TZ1053, TZ1130. Kivulamo, TZ1558. (EArc).

Known from Central and South America, East Africa (Kenya and Tanzania), India, the Philippines, Indonesia, Papua New Guinea, Australia and Pacific Islands (Swinscow & Krog, 1988 ; Verdon, 1992). Pantropical.

***Leptogium laceroides* B. de Lesd.**

Itonya Village, TZ1721, TZ1768. (EArc).

This species was known from Europe, the Americas, New Zealand, Tristan da Cunha and E Africa except Uganda. Pantropical.

***Leptogium marginellum* (Swartz) Gray.**

Massisiwe, TZ1050. Luhega Forest, TZ2051, TZ2053. (EArc).

Known from tropical America, Philippines, Australia and E Africa except Ethiopia. Pantropical (Sierk, 1964).

***Leptogium phyllocarpum* (Pers.) Mont.**

Ilutile, TZ633a, TZ872 (sterile, cf.). Massisiwe, TZ1048, TZ1069. Luhega Forest, TZ2052 (sterile, cf.). Luhangalo Plateau, TZ2777. Ngozi Crater, TZ3525, with *L. cyanescens* TZ3531. Sanje Waterfall, TZ3602. Amani 28/9 1974, coll. NN. Endarasha Hill, leg. Kristen Bjørnkiær (sterile, cfr.). Ngong Hills, C3668, K380. (EArc + mt).

L. phyllocarpum is widespread in tropical and subtropical areas including E Africa (Swinscow & Krog 1988). Pantropical (Sierk, 1964).

******Leptogium rivulare* (Ach.) Mont.**

Ilutile, TZ889. Luhega Forest, TZ2184. On siliceous rocks along mountain rivulets in forests. (EArc).

Description based on TZ889: Lobes up to 3 1/2 mm wide, flat with raised, more or less undulating margins; surface smooth, grey to bluish grey. Without isidia, lobules or apothecia. Pycnidia at or close to the lobe margin, globose, semi-immersed, 0.1 mm. Pycnoconidia bacilliform, colourless, 3 × 1 µm. Thallus thin, 45-55 µm, cellular throughout. The specimens were compared morphologically and anatomically with “Malme, Lichenes suecici exsiccati no. 851” and “Lichenes fennicae exsiccati no. 625”.

It is a temperate species confined to periodically inundated margins of fresh waters. Not previously reported from Africa. The species is hitherto known from NW Russia, Sweden, Estonia, France, NE USA and Canada (Jørgensen & James, 1983 ; Jørgensen, 1994). The distribution is Atlantic.

Leptogium sessile Vainio.

Massisiwe, TZ1055. (EArc).

Known from West Indies, Florida and E Africa except Ethiopia (Swinscow & Krog 1988). This Northeast American-East African disjunction is not easily accommodated within any of the distribution patterns of Galloway (1996).

Lobaria discolor (Bory) Hue.

Ilutile, TZ866. Itonya Village, TZ1758. Kivulamo, TZ1552. (EArc).

The species was known from Kenya, Tanzania, Madagascar, Reunion, Indonesia and Australia.

Lobaria patinifera (Taylor) Hue.

Ilutile, TZ731. (EArc).

It is a widespread species in the tropics.

Lobaria pulmonaria (L.) Hoffm.

Luhangalo Plateau, TZ3066, TZ2781, C4536, C5059. Tschenzema Slope, TZ3302, TZ3319. Enderasha, Moyo River, Mweiga, alt. 2400 m, leg. K. Bjørnkær. Kenya, Mt. Kulal, 6300 ft., in forest on tree trunks, 10 Oct 1947, leg. P. R. O. Bally. (EArc + mt).

L. pulmonaria is widespread in temperate and boreal zones of the northern hemisphere and on tropical mountains.

Lobaria retigera (Bory) Trev.

Ilutile, TZ627, TZ711. Kivulamo, TZ1552. Luhangalo Plateau, TZ2782, TZ3003, TZ3103, TZ3465. Tschenzema Slope, TZ3308a, TZ3321. Massisiwe, TZ1156. Ilutile, TZ627, TZ640, TZ869, TZ884. Itonya Forest, TZ1811. Ngozi Crater, TZ3523. (EArc + mt).

L. retigera is widespread in montane forests of E and S Africa, Australasia, Asia and Alaska.

Nephroma tropicum (Müll. Arg.) Zahlbr.

Luhangalo Plateau, TZ2788, TZ4548. Massisiwe, TZ1054. (EArc).

It is a widespread tropical species already known from E Africa.

****Pannaria conoplea*** (Ach.) Bory.

Ilutile, TZ725. (EArc).

P. conoplea is a widespread species in temperate zones of the northern hemisphere as well as South America, East Africa and South East Australia (Jørgensen & Galloway 1992). The distribution is cosmopolitan.

Pannaria stylophora Vainio.

Kivulamo, TZ1596. Luhangalo Plateau, TZ2880, TZ3212. Sanje Waterfall, TZ3606. (EArc).

The species was already known from Tanzania, West Indies, Philippines and Australia. Allowing for the few records, the species seems to be pantropical.

Parmeliella* cfr. *granulifera P. M. Jørg.

Luhangalo Plateau, TZ2791, det. P. M. Jørgensen. (EArc).

The species was recently described from N Australia and there is another uncertain collection from Indonesia where the habitats are mangroves and dipterocarp forest, respectively (Jørgensen, 2001). The present specimen was found in a mountain forest at c. 2500 m alt. The distribution seems to be Western Pacific.

Parmeliella nigrocincta (Mont.) Müll. Arg.

Kivulamo, TZ1596. Luhangalo Plateau, TZ2790, TZ3053. (EArc).

According to Jørgensen (2003) E African specimens belong to *P. coelestina* Zahlbr., however our specimens are grey-brown without any blue colour. The species is widespread in the tropics and subtropics, primarily on the Southern Hemisphere (Jørgensen & Galloway, 1992) - including Kenya and Tanzania (Swinscow & Krog 1988). Pantropical.

Parmeliella pannosa (Swartz) Müll. Arg.

Massisiwe, TZ1079. Luhangalo Plateau, TZ2789, TZ3001. (EArc).

It is widespread in the tropics and subtropics including E Africa except Ethiopia.

*****Parmeliella triptophylla*** (Ach.) Müll. Arg.

Kivulamo, TZ 1596a. (EArc).

Jørgensen (2003) described *P. triptophylloides* from Kenya, which has grey-brown, shallowly incised areoles and blue-grey isidia. Our specimen, however, has deeply incised, grey areoles and grey isidia. This is a subtropical to arctic species widespread on the Northern Hemisphere. In Africa it is only known with certainty from Macaronesia. This distribution pattern can not be accommodated within any of the 16 patterns described by Galloway (1996). The distribution is subtropical to arctic circumpolar.

****Parmeliella triptophylloides*** P. M. Jørg.

Ilutite, TZ600. Luhangalo Plateau, TZ3109. (EArc).

Both specimens are sterile. They are, however, in accordance with the description by Jørgensen (2003) in all other characters, except that the isidia besides occurring marginally and laminally on the squamules, seemingly also arise directly from the hypothallus. The species was hitherto only known from the type locality in the Cherangi Mts. in Kenya. Endemic to East Africa?

Peltigera dolichorhiza (Nyl.) Nyl.

Luhangalo Plateau, TZ 2794, TZ3112. Ngozi Crater, TZ3522. (EArc + mt).

It is probably widespread in tropical regions and temperate regions of the southern hemisphere including E Africa except Ethiopia.

Peltigera ulcerata Müll. Arg.

Idete, TZ582. Itonya Village, TZ1885. (EArc).

The species is widespread in tropical areas including E Africa and in the temperate zone of the southern hemisphere.

****Peltula patellata*** (Bagl.) Swinscow & Krog.

Ilulu, TZ1925. Mtandike, TZ1957. Luhembe River, TZ2416. Luhangalo Plateau, C4531. Kyalungwa, C1566. (EArc, lowland rocks).

P. patellata is widespread in the tropics and warm temperate regions.

Peltula umbilicata (Vainio) Swinscow & Krog.

Kyalungwa, C5360. (Lowland rock).

This species was already known from Kenya, Uganda, Ivory Coast and S Africa.

*****Polychidium dendriscum*** (Nyl.) Henssen.

Kivulamo, TZ1594. Changwahela, TZ4121. (EArc + coast).

Known from humid woodlands in W Europe, Macaronesia, Brazil, Hawaii and New Caledonia (Purvis *et. al.*, 1992).

Pseudocyphellaria argyracea (Del.) Vainio.

Itonya Forest, TZ1841, TZ1888. Itonya Village, TZ1723. Ilutile, TZ620, TZ743, TZ852, TZ868. Kivulamo, TZ1587. Massisiwe, TZ1157, TZ1106. (EArc).

It is widespread in the tropics.

Pseudocyphellaria aurata (Ach.) Vainio.

Ilutile, TZ643, TZ785. Ngong Hills, C6437, C5758, C1525. (EArc + mt)

It is widespread in the tropical and temperate regions including E Africa.

Pseudocyphellaria clathrata (De Not.) Malme.

Ngong Hills, C6438. (mt)

This species was already known from E Africa and S America.

Pseudocyphellaria crocata (L.) Vainio.

Luhangalo Plateau, C4532, TZ2801, TZ3002. Kivulamo, TZ1588. Ngong Hills, C1501, C4233. (EArc + mt).

Cosmopolitan.

Pseudocyphellaria intricata (Del.) Vainio.

Luhangalo Plateau, TZ2802, TZ3222. (EArc).

Pseudocyphellaria intricata is widespread in the tropics and the temperate regions, in E Africa known from Kenya and Tanzania.

Stereocaulon anomalum Lamb.

Luhangalo Plateau, TZ2809. (EArc, on rock).

This species was known from Kenya, Tanzania, Rwanda, Congo (Zaire) and Madagascar.

Sticta ambavillaria (Bory) Ach.

Massisiwe, TZ1046, TZ1080. Kivulamo, TZ1592a. Luhangalo Plateau, TZ2810. (EArc).

It is widespread in the tropics including E Africa.

Sticta cyphellulata (Müll.Arg.) Hue.

Kivulamo, TZ1562a. (EArc).

The species was known from Kenya, Tanzania and Australasia.

Sticta dichotoma Delise.

Ilutile, TZ689b. Massisiwe, TZ1151. (EArc).

This species was only known from Tanzania, Madagascar and Mauritius.

Sticta fuliginosa (Hoffm.) Ach.

Luhangalo Plateau, TZ2811, C4540, C4535. Ilutile, TZ691. Kivulamo, TZ1592. Itonya village, TZ1753. Ngozi Crater, TZ3502. Ngong Hills, C5757, C1509. (EArc + mt).

S. fuliginosa is widespread in tropical and temperate areas including E Africa.

Sticta orbicularis (Braun) Hue.

Ilutile, TZ856. (EArc).

Previously known from Tanzania, Uganda, Réunion and Asia.

***Sticta tomentosa* (Sw.) Ach.**

Ilutila, TZ673. Massisiwe, TZ1129. Itonya Village, TZ1765. Itonya Forest, TZ1808. (EArc).

S. tomentosa is widespread in the tropics including E Africa except Ethiopia.

***Sticta variabilis* Ach.**

Ilutila, TZ645, TZ666a. (EArc).

It is probably widespread in the tropics and subtropics of the old world.

***Sticta weigelii* (Ach.) Vainio.**

Luhaga Forest, TZ2047. Changwahela, TZ4123. Kivulamo, TZ1591, TZ1589. Massisiwe, TZ1105, TZ1123. Itonya, TZ1752. Ilutila, TZ632, TZ599, TZ791. Luhangalo Plateau, forest, C4544, C4539, TZ2813. Ngong Hills, C1517. (EArc + mt).

The species is widespread in tropical and temperate areas including E Africa.

DISCUSSION

Most of the cyanolichens reported are epiphytic in moist forests. The *Peltula* spp., *Stereocaulon anomalum* and *Leptogium rivulare* are found on rocks in dry and moist habitats respectively, while the *Peltigera* spp. are found on soil e.g. at forest margins.

The mountain forests are generally rather moist rainforest locally influenced by streams. While the visited forests in the Uluguru Mts. are rather disturbed by selective felling of trees and almost annual burning of the grass at Luhangalo Plateau, the forests on Udzungwa Mts. are disturbed only marginally. This is reflected in the occurrence of cyanolichens of which 49 were found in Udzungwa against 26 in Uluguru. However more undisturbed forests are supposed to be found on Uluguru Mts., but unfortunately these were not visited. The other mountain forests were also rather disturbed.

None of the 62 species reported here are endemic to the Eastern Arc with a possible exception for the undetermined *Collema* sp. but 40 of the species were found only in the Eastern Arc of the investigated areas, and 50 only in mountain areas. This shows that the Eastern Arc mountains are very important for the conservation of this group of lichens in East Africa. *Fuscopannaria leucosticta*, *Leptogium rivulare*, *Collema subnigrescens* and *Parmeliella triptophylla* have their only known East African occurrences in Eastern Arc mountains.

None of the species were restricted to coastal or riverine forests.

The vast majority of the species have areas of distribution which include other continents than Africa. 42 of the reported species are widespread, pantropical to cosmopolitan, 9 species have a Pacific-East African distribution, 2 are known from S America and Africa, and 2 were previously classified as Atlantic species. This distribution pattern might be related to the NE North American-East African distribution of *Leptogium sessile*. 5 species are known only from Africa.

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