New or otherwise interesting Cladonia species in East Africa

TEUVO AHTI, HILDUR KROG and T.D.V. SWINSCOW


The following nine species of Cladonia Hill ex Browne (Ascomycotina: Lecanorales) are described from East Africa as new: Cladonia insolita Ahti & Krog, C. leucophylla Ahti & Krog, C. modesta Ahti & Krog, C. pallens Ahti & Krog, C. parva Ahti & Krog, C. tapperi Ahti & Krog, C. umbellata Ahti & Krog, C. usambarensis Ahti & Krog, and C. varians Vainio ex Ahti. Cladonia andesita Vainio is reported as new to Africa. The major lichen substances of each species are reported.

Key words: lichens, lichen substances, Cladonia, East Africa

T. Ahti, Department of Botany, University of Helsinki, Unioninkatu 44, SF-00170 Helsinki, Finland; H. Krog, Botanical Museum, University of Oslo, Trondheimsveien 23B, N-0562 Oslo 5, Norway; T.D.V. Swinscow, 24 Monmouth Street, Topsham, Exeter EX3 4OJ, England

Quantitatively Cladonia Hill ex Browne is not an important lichen genus in East Africa, except perhaps in some high mountain regions. It is nevertheless represented by a fairly high number of species, several as yet unknown to science. The aim of this paper is to report on nine new species and to comment on one which has been poorly known since the time it was described. The study is part of the first author’s worldwide monographic treatment of the genus, and it is also part of the preliminary work for a macrolichen flora of East Africa under preparation by T.D.V.S. and H.K.

This study is mainly based on material collected in Ethiopia, Kenya, Tanzania, and Uganda by two of us (H.K. and T.D.V.S.) during the years 1969 to 1977. We have also included recent undetermined collections in BM, H, O and UPS, as well as some specimens sent to us from TENN, TUR and VBI. All specimens were subjected to TLC by means of standard methods (e.g. White & James 1985).

Basal squamules evanescent. Podetia whitish-grey to olive-green, exposed parts becoming brown, melanotic at base, up to 5 cm high, tapering to a point or gradually expanding to form shallow, closed scyphi 2-5 mm diam., proliferating from the margins, corticate, the cortex areolate with convex areolae which grow into numerous microsquamules (formed by cortex and underlying tissue breaking away from the podetium while remaining attached by the upper edge) mixed with frequent large, entire or weakly crenate macroscamules up to 7 × 4 mm, with upper side olivaceous-green and maculate, under side white or tinged with pale brown. Soredia absent. Apothecia not seen. Pycnidia brown-black, at the margin of scyphi.

Chemistry: Fumarprotocetraric acid, squamatic acid.

Typus: Uganda, Ruwenzori, SE slope of Mt Stanley, on moraine, 4550 m s. m., 9.4.1948, O. Hedberg 724i (UPS — holotypus, H — photograph).

This species belongs in sect. Cladonia. It comes close to C. phyllophora Hoffm., but is heavily microsquamulose. It also resembles C. andesita Vainio, but no signs of central proliferations were observed. In addition, unlike those species, C. insolita contains squamatic acid besides fumarprotocetraric acid, a combination of compounds which is very rare in Cladonia. Because C. insolita was detected in a specimen

NEW TAXA

-Cladonia insolita Ahti & Krog sp. nov. (Fig. 1) Squamulae basales evanescentes. Podetia ad 5 cm alta, gradatim contracta aut in scyphis vadosis clausis expansa, ex margine proliferantia. Soredia nulla. Pycnidia fuliginosa. Acidum fumarprotocetraricum et acidum squamaticum continens.
where it is associated with *C. squamosa* (Scop.) Hoffm., one might suspect that there are squamules of *C. squamosa* (containing squamatic acid) growing on *C. insolita*, but this does not seem to be the case. When tested individually, podetia with their squamules removed proved to contain either fumarprotocetraric or squamatic acid. Squamules tested separately were found to have either fumarprotocetraric acid with a trace of squamatic acid or vice versa. Podetia with their squamules intact contained both substances in abundance. Other combinations of substances would undoubtedly have been found if more material were tested. Under long wave UV light it was mainly the middle portion of the plant (squamules and podetia) that showed the white fluorescence indicative of squamatic acid. The species is thus chemically as well as morphologically distinct.

*Cladonia insolita* is known only from the type locality, where it grew on the ground in the alpine zone.

*Specimens examined:* — See above under typus.

**Cladonia leucophylla** Ahti & Krog sp. nov. (Fig. 2)


Basal squamules persistent, up to 2 cm long and 4 mm wide, crenate-incised to deeply divided, ascending to involute, upper side even or pitted, pale green to olivaceous or pale brown, under side white or partly tinged pale brown, with submarginal patches of sparse, white or pale green granular soredia, sometimes with tufts of hyphae from the under side or the margin. Podetia pale grey-green, up to 3 cm high but often less, simple or sparingly branched with closed axils, tapering or forming gradually ex-
Cladonia leucophylla belongs in sect. Cladonia. Superficially it may resemble some morphotypes of the highly variable species C. poeciloclada des Abb. (des Abbayes 1964) but is distinguished by its large, frequently sorediate squamules, the shallow, invariably closed scyphi, and the constant presence of both homosekikaic and sekikaic acids (in C. poeciloclada homosekikaic acid may be present or absent, sekikaic acid always absent). It may also resemble the neotropical species C. dactylota Tuck. (Tuckerman 1859), but that species has tuberculose soralia (Vainio 1894) and contains psoromic acid.

The species grows on the ground among mosses or on decaying wood in the lower montane forest between 1800 and 2400 m alt.

Specimens examined. — Kenya. Eastern Province, Meru District, Mt Kenya, east side, Swinscow 3K 15/13 (BM), Mt Kenya, east side, at Themwe, Krog 3K 16/272 (O). Central Province, Kirinyaga District, Castle Forest station, Swinscow 5K 7/16 (BM — holotypus, O — isotypus).

Fig. 2. Cladonia leucophylla Ahti & Krog. Tanzania, Pács, Kondela & Nchimbi 6300/Z (BM). Bar = 1 cm.

Typus: Kenya, Central Province, Kirinyaga District, Castle Forest Station, 0°23'S, 37°20'E, 2100 m alt., 2/1977, T.D.V. Swinscow 5K 7/16 (BM — holotypus, O — isotypus).
Cladonia modesta Ahti & Krog sp. nov. (Fig. 3)

Basal squamules persistent, horizontal or ascending, up to 5 mm long and 3 mm wide, entire or sparingly incised, pale green above, white below. Podetia whitish to pale green-grey, up to 1.5 cm high, simple or sparingly branched with closed axils, tapering, acuminate or with blunt apices or shortly bifurcate, corticate near base for about half of their length or less, covered with farinose to granular, pale green soredia in distal parts, eroded areas exposing the white medulla or the opaque chondroid cylinder. Podetial macrosquamules few, similar to basal squamules, rounded, concave in lower half of podetia; minute microsquamules occasionally present in sorediate parts. Scyphi absent. Apothecia not seen. Pycnidia brown, at apex of podetia.

Chemistry: Psoromic acid, atranorin.

Typus: Kenya, Central Province, Kirinyaga District, Mt Kenya, near Castle Forest Station, 0°23'S, 38°18'E, 1900 m alt., 1/1972, H. Krog & T.D.V. Swinscow K 49/156 (O — holotypus).

Cladonia modesta belongs in sect. Cladonia. It is similar to the Australian C. praetermissa A.W. Archer (Archer 1984), but is distinguished by the presence of psoromic acid, farinose soredia, and smaller basal squamules. From C. subpityrea Sandst. (Nuno 1976), which contains psoromic acid but no atranorin, C. modesta is distinguished by the absence of scyphi and cortex in apical parts. C. subradiata (Vainio) Sandst. is almost ecorcticate and has no psoromic acid or atranorin.

The species is known from only two localities, where it grew on bare earth in the lower montane forest at 1900 and 2100 m alt.

Specimens examined. — Kenya. Central Province, Kirinyaga District, Mt Kenya, near Castle Forest Station, Krog & Swinscow K 49/156 (O — type collection), Mt Kenya, shady valley 2 km N of Castle Forest Station, Swinscow K 51/29 (BM).
Cladonia pallens Ahti & Krog sp. nov. (Fig. 4)

Basal squamules few and soon disappearing, up to 1.5 mm long and 1 mm wide, thick, irregular, pale grey-white above, white below. Podetia fragile, in dense cushions, pale grey-white, up to 1.5 cm high, cylindrical, tapering to a point or terminating in several short, pycnidium-bearing branchlets, sparingly, mainly dichotomously branched with subparallel branches, axils closed or rarely open, cortex discontinuous, areolate or transversely cracked. Podetial squamules rare, similar to basal squamules. Scyphi absent. Soredia absent. Apothecia not seen. Pycnidia brown, containing hyaline jelly.

Chemisty: Thamnolic acid.


A South American species, C. polytropa Vainio (Vainio 1887), is similarly pale grey and contains thamnolic acid, but has regularly open axils and a blackening medulla. C. rugulosa Ahti, described from the Venezuelan Andes (Ahti 1986), is also similar, but the cortex is rugulose-variegated. All these species seem to belong in the “Cladonia mutabilis group” which was included in sect. Cladonia ser. Squamosae Dahl ex Oxner by Ahti (1986).

Cladonia pallens has been collected in only two localities, where it was growing on the ground and on Agauria salicifolia stems and branches at 2480 and 2600 m alt.


Cladonia parva Ahti & Krog sp. nov. (Fig. 5)
Squamulae basales horizontales vel ascendentes. Podetia cinereo-virescentia, ad 8 mm alta et 0.6 mm lata, cylindrica, parce ramosa axillis clausis aut scyphis clausis expansa, squamulis paucis. Soredia nulla. Apothecia pallide carnea, parva, ad marginem scyphorum fasciculis stipitatis. Pycnidia brunnea. Acidum psoromicum et acidum didymicum continens.

Basal squamules persistent, horizontal or ascending, up to 3 mm long and 2 mm wide, entire or crenate, olivaceous-green above, white tinged with brown below, darkening towards the base. Podetia grey-green, up to 8 mm high and 0.6 mm wide, cylindrical and sparingly branched with closed axils or expanding to form closed scyphi (or scyphoid structures) up to 2 mm diam., corticate, the cortex continuous, smooth to somewhat rugose. Podetial squamules few, similar to basal squamules but generally smaller. Soredia absent. Apothecia pale carneous, small, in shortly stipitate clusters at margins of scyphi. Pycnidia carneous.
Chemistry: Psoromic acid, didymic acid.


Cladonia parva is one of the smallest species of Cladonia. From the carious colour of the hymenium and the presence of didymic acid it seems to belong in the vicinity of C. botrytes (Hagen) Willd. It is thus a member of sect. Cociciferae, if the group Ochroleucaceae (with carious apothecia) is included in that section. There is no other species in Cladonia that shares the chemistry of C. parva.

The species is known only from the type locality, where it grew on bare earth.

Specimens examined. — See above under typus.

Cladonia tapperi Ahti & Krog sp. nov. (Fig. 6)

Basal squamules persistent, horizontal or with upturned margins, imbricate, up to 6 mm long and wide, entire or crenate, olivaceous-green above, white below. Podetia stout, pale green-grey or with a brownish tinge, up to 2 cm high and 3 mm wide, simple and tapering or terminating in 2–4 short apical branchlets, corticate, the cortex discontinuous, covering the green areolae on the partly denuded, often longitudinally furrowed chondroid cylinder (inside mainly hollow but cibrose and trabeculate), some of the areolae growing out to form isidiod microsquamules or regular macrosquamules. Scyphi absent. Soredia absent. Apothecia on apical branchlets or on expanded end of podetium, up to 3 mm diam., medium brown, sometimes with a central perforation or fissure. Pycnidia brown, terminal on podetia.

Chemistry: The stictic acid complex, fumarprotocetraric acid.

Typus: Ethiopia, Bale Province, mountain pass between Adaba and Goba, 3600 m alt., 1/1972, H. Krog E 22/97 (O holotypus, H — photograph).

Cladonia tapperi is clearly a member of the group Helopodium (Podostelidyes), being close to C. cariosa (Ach.) Sprengel. However, no other species in this group is known to have exactly the same chemistry as C. tapperi, and the relatively large squamules and the little branched, stoutish podetia are also unlike those of other species in the group.

Cladonia tapperi has been collected on soil and among mosses in the ericaceous and low alpine zones at 2800 to 4000 m alt. It seems to be most common above 3500 m.

Specimens examined. — Ethiopia. Beghemdir Province, Simien Mts, Mietgogo, Tapper 44, 45b (BM), Simien Mts, Geech camp, Tapper 20a (BM), between Geech and Djinn Bahr, Tapper 86 (BM). Bale Province, Darkenna, Tapper 1053, 1055 (BM), Mt Orobo lava flows, Saneti end, Tapper 776, 777 (BM), mountain pass between Adaba and Goba, Winnem 355/45 (O), Krog E 22/97 (O — type collection). Sidamo Province, 5 km NW of Hagere Selam, Winnem 578/46 (O).

Cladonia umbellata Ahti & Krog sp. nov. (Fig. 7)
Fig. 6. *Cladonia tapperi* Ahti & Krog. Holotype (O). Bar = 1 cm.

Fig. 7. *Cladonia umbellata* Ahti & Krog. Part of holotype (O). Bar = 1 cm.
Basal squamules persistent, up to 5 mm diam., entire or sparingly crenate, horizontal with ascending margins, greenish-grey to brown, more or less pruinose above, dirty white below. Podetia grey-green to light brown, 5–8 mm high, stalks up to 1.5 mm wide, simple, abruptly flaring into umbrella-like heads up to 7 mm diam., filled with a flat or slightly convex apothecium, or sparingly branched with closed axils, corticate, the cortex continuous or areolate-rugose. Podetial squamules absent. Soredia absent. Apothecia brown. Pycnidia brown to black, borne on margins of basal squamules.

Chemistry: Norstictic acid.


In the fertile state, when the broad, flat hymenial discs are at the tip of each podetium, Cladonia umbellata is a very conspicuous species of the group Helopodium. No such morphotypes are known in the undoubtedly related C. poly- carpoides Nyl., which also contains norstictic acid alone; C. umbellata is therefore described here as new.

The species is known only from the type locality, where it grew on bare earth in grassland at 2500 m alt.

Specimens examined. — See above under typhus.

Cladonia usambarensis Ahti & Krog sp. nov. (Fig. 8)


Basal squamules not seen. Podetia up to 10 cm high, pale yellow to pale grey-green, repeatedly branched, the branching mainly trichotomous and tetrachotomous, with open axils. Branches 1–1.5(2.5) mm wide, with a discontinuous corticoid layer covering pale green areolae on a white to pale brown, arachnoid background, blackening towards the base. Podetial squamules very rare, about 1 mm long and wide, finely incised. Scyphi absent. Soredia absent. Apothecia brown. Pycnidia brown to blackish-brown, with purple jelly.

Chemistry: Thamnolic acid, barbatic acid (±), usnic acid.


Fig. 8. Cladonia usambarensis Ahti & Krog. Isotype (O). Bar = 1 cm.

Cladonia usambarensis is a member of sect. Unciales. It is distinguished from related species such as C. pachyclados (Vainio) Ahti (Ahti 1986) and C. siamea des Abb. (des Abbayes 1956) by frequent polytomous branching, open axils and melanotic basal parts.

The specimen Pócs 8443/H, cited below, agrees with the description except for a slightly more slender habit and the absence of usnic acid. It is tentatively included here as an usnic acid deficient strain of C. usambarensis.
Cladonia usambarensis grew in dense mats on the ground in Philippia heath between 1700 and 2000 m alt.

Specimens examined. — Tanzania. Tanga Province, Lushoto District, West Usambara Mts, on the E side ridge of Kilimandege summit in Balangai West Forest Reserve, at 1730 m alt., Borhidi & Hedrén 8414/P (VBI, O — type collection), West Usambara Mts, Philippia heath at the summit of Baga I Forest Reserve, Borhidi, Hedrén & Sebsebe 8424/A (VBI), West Usambara Mts, Shagayu Forest Reserve on the summit 3 km ENE from Shagayu sawmill, Pócs 8443/H (VBI, O).

COMMENTS ON TWO PREVIOUSLY REPORTED SPECIES

Cladonia andesita Vainio


This species is characterized by podetia up to 10 cm tall which proliferate from the centre of scyphi, producing 3–9 successive tiers. It is normally brown and at the base clearly melanotic. The cortex is areolate but gradually disintegrates between the scyphi so as to make the podetia variegate in appearance and largely denuded. The cortical areolae may also become squamulose giving the internodes a rough surface. It usually contains the fumarprotocetraric acid complex, but may also (in Colombia) contain the stictic acid aggregate. Cladonia andesita is very common in the northern Andes in Colombia and Venezuela, particularly in the páramos of high mountain ranges. In the East African high mountain belts a very similar species occurs, and it is regarded as conspecific with C. andesita, at least until a worldwide revision of the so-called “Cladonia verticillata group” has been undertaken. The East African specimens are perhaps more squamulose and smaller in stature than the Andean material. The species has been collected in Kenya and Uganda, where it grew on the ground and on boulders among mosses in the ericaceous and low alpine zones at 3200 to 3900 m alt. In the East African mountains it can be confused with C. krempehuberi (Vainio) Zahlbr., which, however, produces abundant atranorin in addition to fumarprotocetraric acid.

Cladonia varians Vainio ex Ahti, sp. nov.

(Fig. 9)


The Latin description of Cladonia varians var. glaucoflava by Vainio in Hue (1898: 267) is repeated here to validate C. varians:

"Podetia late decorticata, areolis corticatis dispersis, albido, stramineo, glauco et cinereofuscenti variegata, K(CaCl) lutescentia, squamulosae, ascypha, crebre dichotome aut partim trichotome ramosa, fragilia. Conceptaculata pycnocnidiorum materiam coccineam continentia."

Podetia slender, yellowish-grey, with basal parts melanotic, intricately branched, dichotomous and trichotomous common, axes usually open, narrow divided small squamules common on podetia, corticoid layer discontinuous, no soredia, no scyphi, pycnidial jelly red.

Typus: Réunion ("Bourbon"), 1890 Frère Rodriguez (TUR-V 15077 — holotypus, PC — isotypus); contains usnic and barbatic acids (TLC).

Though Vainio (in Hue 1898) published the descriptions of the two new varieties Cladonia varians var. glaucoflava and C. varians var. erythrospermoideis, he never gave a description for the species C. varians. According to Art. 43 in the Code of Nomenclature all the three names were then technically invalidly published. Since no later validating description for C. varians seems to exist, it is described here as new, being actually based on the description of C. varians var. glaucoflava Vainio. The type specimen contains usnic and barbatic acid (reactions K–, PD–), while the material referred to var. erythrospermoideis by Vainio contains usnic, barbatic and thannolic acids (reactions K+ and PD + yellow). The latter variety is not formally recognised here as a separate taxon, but is regarded as representing an unnamed chemical strain of C. varians.

This species belongs either to sect. Cladonia or Squamosae or sect. Unciales, being distinguished from C. usambarensis by abundant squamules and constant presence of barbatic acid, while thannolic acid is accessory. Usnic acid is known from very few species of sect. Squamosae (present e.g. in the neotropical C. scholanderi des Abb.).

In East Africa the species is known only from Tanzania, occurring on Pemba and Mafia Islands where it grew on low stems and branches and on peat soil, probably near sea level (one locality at 6 m alt.). Vainio (in Hue 1898) reported C. varians from Réunion, Mauritius and Madagascar, and the author Ahti has confirmed his identifications (in PC and TUR-V).

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