

The genus *Ramalina* in East Africa

HILDUR KROG & T. D. V. SWINSCOW

Krog, H. & Swinscow, T. D. V. 1976. The genus *Ramalina* in East Africa. *Norw. J. Bot.* 23, 153–175.

Twenty-eight species of *Ramalina* are recorded from East Africa. Their chemistry, ecology and distribution are discussed, and a key to the species is provided. The following new species are described: *Ramalina disparata* Krog & Swinsc., *R. dume-ticola* Krog & Swinsc., *R. fecunda* Krog & Swinsc., *R. maritima* Krog & Swinsc., *R. pentecostii* Krog & Swinsc., *R. pocsii* Krog & Swinsc., and *R. reducta* Krog & Swinsc. The name *Ramalina ecklonii* (Sprengel) Mey. & Flot. is rejected, and *R. sprengelii* Krog & Swinsc. is proposed as a nomen novum. The new combinations *Ramalina celastri* (Sprengel) Krog & Swinsc. and *R. subpusilla* (Nyl.) Krog & Swinsc. are made. The following taxa are reduced to synonymy: *Ramalina euphorbiae* Vain. and *R. yemensis* (Ach.) Nyl. with *R. celastri* (Sprengel) Krog & Swinsc., *R. digitel-lata* Nyl., *R. meyeri* Stein, and *R. protecta* H. Magn. with *R. polymorpha* (Ach.) Ach., and *R. usneoides* var. *capensis* Nyl. with *R. sprengelii* Krog & Swinsc.

H. Krog, Botanical Museum, University of Oslo, Trondheimsveien 23 B, Oslo 5, Norway.

T. D. V. Swinscow, 24 Monmouth Street, Topsham, Exeter, Devon, England.

In two previous publications (Krog & Swinscow 1974, 1975b) eight *Ramalina* species with fistulose thalli and four species with punctiform pseudocyphellae have been reported from East Africa. The aim of this paper is to provide a key to all *Ramalina* species at present known in East Africa, with a detailed discussion of those species not previously dealt with.

The most recent review of African *Ramalinas* was given by Dodge (1971), who recorded 10 taxa from our area. Unfortunately we have been unable to locate the type specimen of *R. spinifera* Dodge, described from Uganda. The description of this species does not seem to fit any of the specimens seen by us. *R. cuspidata* var. *variabilis* (Hue) Dodge, described from Chad, was recorded from a number of localities in Kenya and Uganda. This taxon is also unknown to us, but in Dodge's account it appears to cover specimens which we have included in *R. disparata*. Our species concept differs to a certain extent from that applied by Dodge, since species which in our experience have a restricted

distribution, such as *R. abyssinica* and *R. consanguinea*, are reported by Dodge (op. cit.) from a wide ecological range.

MATERIALS AND METHODS

The following account is based on collections made by the authors as follows: Uganda (T. D. V. S. 1969, 1970, 1971), southern Ethiopia (H. K. 1972), Kenya (H. K. & T. D. V. S. 1972, 1973, 1974), and northern Tanzania (H. K. & T. D. V. S. 1974). In addition to specimens in institutional herbaria we have been permitted to examine material collected in recent years by the following botanists: Bjørnstad (Tanzania), Lye (Uganda, Kenya), Pócs (Tanzania), Sipman (Tanzania), Tapper (Ethiopia), and Winnem (Ethiopia). Specimens cited with a number but without a collector's name were collected by one of the authors.

Specimens have been deposited in O, BM, and East African herbaria.

All the material referred to in this paper,

including the type specimens, was subjected to thin layer chromatography (TLC) with the techniques described by Culberson & Kristinsson (1970) and Culberson (1972), amended by Menlove (1974). Micro-crystal tests (MCT) were applied as an additional confirmation of the identity of some substances.

Spores were examined in squash preparations in Melzer's Reagent. Freezing microtome sections of the thallus were mounted in lactophenol cotton blue.

The line drawings of the species are based on East African material.

CHEMICAL PROPERTIES OF THE SPECIES

Varying amounts of usnic acid and traces of atranorin are produced in the cortex of most *Ramalina* species. These cortical substances are of no diagnostic value and have been omitted in the following discussion of lichen substances, as well as in the note on chemical properties under each species.

The diagnostic medullary substances found in East African *Ramalina* species are orcinol para-depsides (divaricatic acid, evernic acid, obtusatic acid, stenosporic acid, unknown R1), orcinolmeta-depsides (cryptochlorophaeic acid, boninic acid, sekikaic acid agg.), and β -orcinol depsidones (norstictic acid, salazinic acid, psoromic acid). Although most of these compounds are easily determined by TLC, certain problems have been encountered among the substances in the orcinol series. The sekikaic acid aggregate, for example, comprises several related substances with similar Rf values. The aggregate as such is easily recognized with TLC, but the individual substance is difficult to distinguish by this method. Sekikaic acid, ramalinolic acid, possibly homosekikaic acid, and undetermined related substances are represented in the various species, usually in mixtures of two or three. In the following account they will be referred to collectively as the sekikaic acid aggregate.

Evernic and obtusatic acids, two closely related compounds often occurring together in lichens, cannot be separated by the usual TLC methods. In *R. pollinaria*, the only East African *Ramalina* species where the evernic acid aggregate occurs, both substances are

reported to be present (cf. Culberson 1969).

The substance referred to above as unknown R1 is believed to be related to divaricatic acid, since it replaces that compound in chemical strains of *Ramalina* species (Krog & Swinscow 1974) and *Dirinaria* species (unpublished data), and occurs together with – or instead of – divaricatic acid in *Protousnea* species (Krog 1976). It is here tentatively included among the orcinol para-depsides.

In *R. maritima* boninic acid is accompanied by an undetermined substance in Rf classes 3–3. When treated with dilute sulphuric acid and heat it gives a bluish grey spot on plate A, yellow spots on plates B and C (A, B and C referring to the solvent systems of Culberson 1972).

In an unnamed *Ramalina* species, collected once on the Kenyan coast, an undetermined substance in Rf classes 5–5–5 occurs, giving a KC+ red reaction in the medulla. With dilute sulphuric acid and heat it gives a red spot on plate A, brownish spots on plates B and C.

Chemical strains occur in some species. The type specimen of *Ramalina aspera*, from South America, contains divaricatic acid (Krog & Swinscow 1975b), while the African specimens of this species contain boninic or cryptochlorophaeic acid. *R. dumeticola*, described as new in this work, contains substances in the sekikaic acid aggregate or unknown R1. *R. disparata* and *R. translucida* are both regarded as species each comprising three chemical strains. No consistent morphological variation appears to accompany the chemical variation in these cases. Ecological requirements are the same for the different chemotypes within the species.

The diagnostic medullary substances of the East African *Ramalina* species are given below. It should be noted that salazinic acid occurs as an accessory substance in *R. africana*. Fatty acids of an accessory nature have been observed in several species. In the apothecial hymenium of *R. calcarata* traces of salazinic acid and in the hymenium of *R. pusiola* traces of norstictic acid may occur.

Diagnostic medullary substances in East African *Ramalin*as

R. abyssinica – sekikaic acid agg.

R. africana – sekikaic acid agg.

R. aspera (1) – cryptochlorophaeic acid

- R. aspera* (2) – boninic acid
- R. asperula* – divaricatic acid
- R. calcarata* – divaricatic acid
- R. celastri* – none
- R. consanguinea* – divaricatic and norstictic acids
- R. dendriscoides* – salazinic acid
- R. disparata* (1) – divaricatic and stenosporic acids
- R. disparata* (2) – sekikaic acid agg.
- R. disparata* (3) – boninic acid
- R. dumeticola* (1) – sekikaic acid agg.
- R. dumeticola* (2) – unknown RI
- R. exiguella* – none
- R. fecunda* – salazinic acid
- R. fimbriata* – divaricatic acid
- R. hoehneliana* – none
- R. holstii* – salazinic and cryptochlorophaeic acids
- R. maritima* – boninic acid
- R. pentecostii* – none
- R. peruviana* – sekikaic acid agg.
- R. pocsii* – sekikaic acid agg.
- R. pollinaria* – evernic and obtusatic acids
- R. polymorpha* – none
- R. pusiola* – sekikaic acid agg.
- R. reducta* – psoromic acid
- R. sprengelii* – none
- R. subpusilla* – salazinic acid
- R. tapperi* – sekikaic acid agg.
- R. tenella* – salazinic acid
- R. translucida* (1) – unknown RI
- R. translucida* (2) – divaricatic acid
- R. translucida* (3) – sekikaic acid agg.
- R. sp.* – undetermined substance

ECOLOGY

Most lichens have specific requirements in regard to moisture, light, and temperature, which effectively restrict their distribution range. In East Africa the variation in altitude is from sea level to almost 6000 m, the climatic conditions are extremely diverse, and the habitats range from desert to tropical forests, supporting a greatly varied lichen flora. The habitat preferences of the East African *Ramalina* species, which reflect their adaptation to the environment, are summarily outlined below. The altitudes given are based mostly on data from Kenya and Uganda, and may be expected to be somewhat lower in the southern parts of Tanzania.

Coastal and lowland species

In East Africa the genus *Ramalina* is prominent in the coastal lichen vegetation, which is comparatively poor in species. Characteristic of the mangroves are *R. consanguinea*, *R. dumeticola*, *R. fecunda*, *R. maritima*, and *R. tenella*. With the exception of *R. maritima* these species also occur in the low coastal hills at 300–350 m altitude, where they grow in dry shrub vegetation together with *R. exiguella*.

A more widespread but scattered lowland species, absent from the immediate coast, is *R. holstii*. It occurs within 250 km from the coast in dry shrub vegetation up to 1000 m. At about 1000 m it is joined by *R. dendriscoides*, another species of dry shrubs, apparently with restricted distribution in East Africa.

The desert, semidesert, and low, arid bushland are practically devoid of lichens.

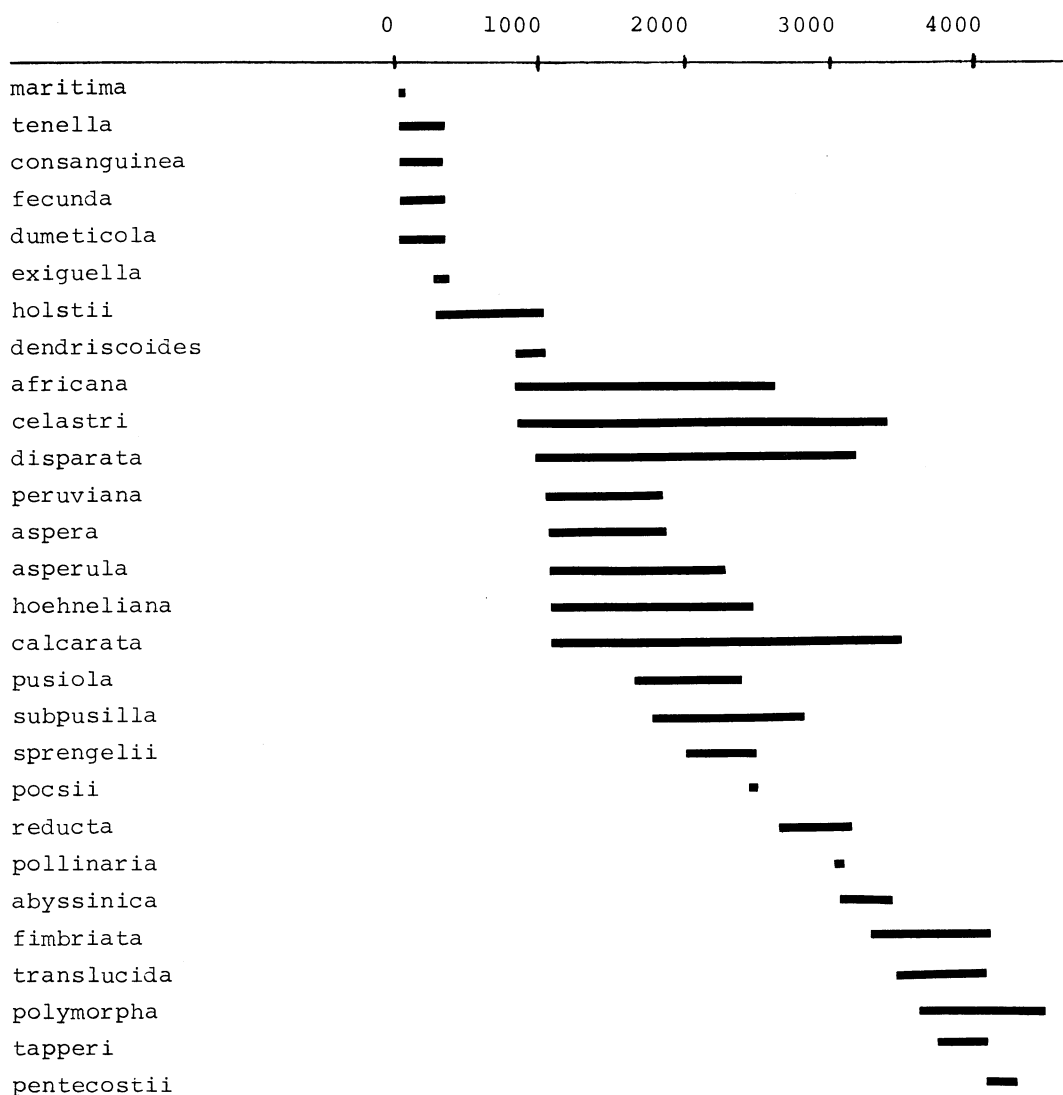
Grassland species above ca. 1000 m

In bushed and wooded grassland and in many artificial habitats, such as parks, plantations and town avenues, one finds photophilous species with a fairly low moisture requirement. In this type of habitat *Ramalina africana* is common and widespread; it often grows on the trunks and thicker branches of solitary trees and on fence posts between 800 and 2700 m. *R. peruviana* grows on shrubs in grassland and on twigs and branches of trees at the edge of woodlands between 1000 and 1800 m. In similar habitats *R. aspera* and *R. asperula* occur. *R. hoehneliana*, widespread but scattered between 1000 and 2400 m, is tolerant of high light intensity, but appears to require the moisture of habitats which are to a certain degree influenced by mist. This is also the case with the common and widespread species *R. calcarata* and *R. celastri*.

Montane forest species

In the montane and riverine forests and in mist-affected woodland and inselbergs one finds species with a more or less pronounced preference for moisture and/or shade, such as *R. disparata*, occurring between 900 and 3100 m, and *R. pusiola*, with a more restricted range between 1600 and 2300 m. In similar habitats *R. calcarata* (1000–3400 m) and *R. celastri* (800–3400 m) occur; these species have a wider ecological tolerance and are

Table I. Vertical distribution of East African Ramalina species.
Altitude in metres.



also found in grassland (see above). In the mixed *Hagenia-Hypericum* forest at about 2600–3100 m *R. pollinaria* and *R. reducta* occur.

A group of species which inhabit the ericoid shrub vegetation, mostly between 3000 and 3500 m, includes *R. abyssinica*, *R. fimbriata* and *R. translucida*.

Alpine species

Above the ericaceous zone, from about 3500 m upwards, the saxicolous alpine species *R. pentecostii* (also on *Senecio* stems), *R. polymorpha*, and *R. tapperi* are found, together with saxicolous forms of *R. fimbriata* and *R. translucida*. Very few lichens have been collected above 4000 m, so we do not know

the upper distribution limit for these species.

The altitudinal intervals in which the various species have been collected are shown in Table I.

GEOGRAPHICAL DISTRIBUTION

Although some of the lichen genera occurring in East Africa include a number of species with a wide distribution in the temperate and boreal zones of the Northern Hemisphere (cf. Krog & Swinscow 1975a), this trend is less pronounced in the genus *Ramalina*. Of the 28 species at present known from East Africa, only two – *R. pollinaria* and *R. polymorpha* – are widely distributed in the Northern Hemisphere.

The majority of East African *Ramalina* species are not known outside the African continent. However, several of these species have recently been described, and little is therefore known of their distribution.

At present the following species appear to belong in what may provisionally be termed the African element: *R. abyssinica*, *R. calcarata*, *R. consanguinea*, *R. disparata*, *R. fecunda*, *R. fimbriata*, *R. hoehneliana*, *R. holstii*, *R. maritima*, *R. pentecostii*, *R. pocsii*, *R. pusilla*, *R. reducta*, *R. sprengelii*, *R. tapperi*, and *R. translucida*.

The following species have a wide distribution in tropical and subtropical regions: *R. celastri*, *R. dendriscoides*, *R. exiguella*, *R. peruviana*, and *R. subpusilla*.

Occurring in Africa and South America are *R. aspera*, *R. asperula*, and *R. tenella*.

Known from Africa and Asia: *R. africana* and *R. dumeticola*.

KEY TO THE RAMALINA SPECIES OF EAST AFRICA

- 1a. Thallus hollow, usually with perforations into the central cavity .. 2
- 1b. Thallus solid 10
- 2a. (1a). Soralia or apical granules present; apothecia rare 3
- 2b. Soralia and apical granules absent; apothecia common 4

- 3a. (2a). Soredia produced from exposed medulla beneath finely divided apices. With divaricatic acid. Corticolous or saxicolous in the ericaceous and alpine zones. 13. *R. fimbriata*
- 3b. Non-corticate thalline fragments or granules produced singly from the apices. With substances in the sekikaic acid aggregate. Saxicolous in the alpine zone 26. *R. tapperi*
- 4a. (2b). Thallus to 5 cm high, densely branched, branches terete, slender, 0.1–0.5 mm wide; apothecia apical, or lateral on geniculate branches. With substances in the sekikaic acid aggregate. Montane forest (2400 m), rare 19. *R. pocsii*
- 4b. Thallus smaller or branches coarser; apothecia mostly apical or subapical and spurred. Chemistry and distribution various 5
- 5a. (4b). Apothecia longly spurred; spores 4–5 times as long as broad. With divaricatic and norstictic acids. Coastal lowland species 7. *R. consanguinea*
- 5b. Apothecia without or with short spurs; spores 2–3 times as long as broad. Chemistry otherwise. Above 1000 m 6
- 6a. (5b). Apothecia distinctly spurred; spores 10–15 μm long 7
- 6b. Apothecial spurs rare or absent; spores mostly longer 8
- 7a. (6a). Thallus to 2.5 cm high. Salazinic acid present throughout the thallus (PD+ orange, K+ red). Open woodlands, 1700–2800 m .. 25. *R. subpusilla*
- 7b. Thallus to 4 cm high. With divaricatic acid. Wooded grassland, open woodlands, and moderately shady forests to 3400 m 5. *R. calcarata*
- 8a. (6b). Thallus pellucid, medullary layer discontinuous, thin, arachnoid. Three chemical strains (unknown RI, divaricatic acid, or sekikaic acid agg.). Corticolous and saxicolous in the ericaceous and alpine zones 28. *R. translucida*
- 8b. Thallus opaque, medullary layer dense, continuous. With substances in the sekikaic acid aggregate. Corticolous species 9

- 9a. (8b). Thallus to 1 cm high; spores 18–20 (–22) μm long. In the ericeous zone above 3000 m
1. *R. abyssinica*
- 9b. Thallus to 4 cm high; spores 15–17 μm long. In mist-affected woodlands, 1600–2300 m 22. *R. pusiola*
- 10a. (1b). Lower side with a few anastomosing strands of cartilaginous tissue resting on the medulla. With psoromic acid (PD+ sulphur yellow, K–). Upper montane forests, rare 23. *R. reducta*
- 10b. Medullary tissue on lower side not exposed. Chemistry various, psoromic acid never present 11
- 11a. (10b). Without soralia, apothecia common 12
- 11b. With soralia, apothecia rare 22
- 12a. (11a). With punctiform pseudocyp-hellae raised on tubercles or im-pressed in the thallus 13
- 12b. Pseudocyp-hellae, if present, linear or irregular 16
- 13a. (12a). Pseudocyp-hellae flat or con-cave. Divaricatic acid present. In open woodlands and on shrubs in grassland, 1000–2200 m .. 4. *R. asperula*
- 13b. Pseudocyp-hellae raised on tubercles. Chemistry various 14
- 14a. (13b). Pseudocyp-hellae predomi-nantly marginal. With salazinic and cryptochlorophaeic acids (PD+ orange, K+ red). Lowland species to 1000 m 15. *R. holstii*
- 14b. Pseudocyp-hellae predominantly la-minal. Salazinic acid, if present, ac-cessory 15
- 15a. (14b). Plant robust, 3–5 (–8) cm high. With substances in the seki-kaic acid aggregate. In wooded grassland and artificial habitats, 800–2700 m, widespread and com-mon 2. *R. africana*
- 15b. Thallus small, to 1.5 cm high. With boninic or cryptochlorophaeic acid. On shrubs in grassland, 1000–1800 m, rare 3. *R. aspera*
- 16a. (12b). Thallus longly pendulous, 20–60 cm. No medullary substances present 17
- 16b. Thallus shrubby or subpendulous, less than 15 cm in length. Chemistry various 18
- 17a. (16a). Branches 0.5–1 (–2) cm wide, flattened along their length; dis-tinctly striate. Wooded grassland and open woodlands, 1800–2400 m
14. *R. hoehneliana*
- 17b. Branches 0.3–1.0 mm wide, apices terete, capillaceous; fine striae pres-ent only on the larger branches. Woodlands, rare 24. *R. sprengelii*
- 18a. (16b). Thallus sparingly to mode-rately branched; branches lanceolate or strap-shaped, flat or \pm canali-culate. Chemistry and distribution various 19
- 18b. Thallus moderately branched; branches predominantly subterete, with longitudinal grooves and cracks. No medullary substances. Dry shrubs in low coastal hills
11. *R. exiguella*
- 19a. (18a). Branches lanceolate. Apothe-cia predominantly laminal. No me-dullary substances. Widespread above 800 m 6. *R. celastri*
- 19b. Branches linear, strap-shaped, flat or weakly channelled. Apothecia predominantly marginal. Chemistry various. Coastal species 20
- 20a. (19b). Thallus tufted, rarely more than 4 cm high. With salazinic acid or an undetermined substance 21
- 20b. Thallus erect or subpendulous, usually more than 4 cm long. With boninic acid 16. *R. maritima*
- 21a. (20a). Branches 1.2–1.5 (–3) mm wide. Spores 18–26 μm long. With salazinic acid 12. *R. fecunda*
- 21b. Branches 2–4 mm wide. Spores 16–20 μm long. With undetermined substance (29). *R. sp.*
- 22a. (11b). Saxicolous species; soredia coarsely granular. No medullary substances. Alpine .. 21. *R. polymorpha*
- 22b. Corticolous or saxicolous species; soredia farinose or subgranular. Chemistry and distribution various 23
- 23a. (22b). With apical, subcapitate so-ralia on short branchlets. Salazinic acid present (PD+ orange, K+ red) 24
- 23b. Soralia marginal or laminal, not subcapitate. Salazinic acid absent (PD–, K–) 25

- 24a. (23a). Thallus to 5 cm high, densely and intricately branched; branches predominantly terete. In dry scrub about 1000 m 8. *R. dendriscoides*
- 24b. Thallus to 2 cm high, dichotomously branched; branches distinctly flattened. Coastal species 27. *R. tenella*
- 25a. (23b). Thallus sparingly to moderately branched; branches angular or subterete, tapering. With unknown RI or substances in the sekikaic acid aggregate. Coastal species 10. *R. dumeticola*
- 25b. Thallus moderately to densely branched. Chemistry various. Inland species above 1000 m 26
- 26a. (25b). With marginal parietal soralia formed from cracks between the upper and lower cortex. No medullary substances. Saxicolous or corticolous in the alpine region .. 17. *R. pentecostii*
- 26b. Soralia not restricted to marginal cracks. Lowland or forest species .. 27
- 27a. (26b). Thallus delicate and fragile, densely branched; soralia punctiform or ellipsoid. With substances in the sekikaic acid aggregate. On shrubs in dry grassland, 1000–1800 m 18. *R. peruviana*
- 27b. Thallus coarser, moderately or densely branched. Soralia partly ellipsoid, partly irregularly spreading on to the lamina, especially in apical parts. Chemistry various. ... 28
- 28a. (27b.) Thallus 5–10 cm high. Three chemical strains (divaricatic acid, sekikaic acid agg., boninic acid). Widespread in woodland and montane forest between 1000 and 3100 m 9. *R. disparata*
- 28b. Thallus \pm caespitose, 2–3 cm high. With evernic and obtusatic acids. Upper montane forests, about 3000 m 20. *R. pollinaria*

1. *RAMALINA ABYSSINICA* Nyl., see Krog & Swinscow (1974, p. 114, Fig. 7).

2. *RAMALINA AFRICANA* (Stein) Dodge, see Krog & Swinscow (1975b, p. 270, Fig. 1).

3. *RAMALINA ASPERA* Räs., see Krog & Swinscow (1975b, p. 274, Fig. 2).

4. *RAMALINA ASPERULA* Kremp., see Krog & Swinscow (1975b, p. 274, Fig. 3).

5. *RAMALINA CALCARATA* Krog & Swinsc., see Krog & Swinscow (1974, p. 115, Figs. 8–9).

6. *RAMALINA CELASTRI* (Sprengel) Krog & Swinsc. comb. nov. *Parmelia celastri* Sprengel, Syst. Veget. 4 (2) : 328 (1827). Holotype: Cap. [B. Spei], Ecklon (S!). – Figs. 1–2.

Ramalina fraxinea β *yemensis* Ach., Lich. Univ.: 602 (1810). Holotype: 'Arabia', Forskål [in pencil], herb. Acharius (H!). – *Ramalina yemensis* (Ach.) Nyl., Bull. Soc. Linn. Normand., Ser. 2, 4: 144 (1870).

Ramalina euphorbiae Vain., Cat. Afr. Pl. Welwitsch 2 (2): 398 (1901). Holotype: Angola. Ad caules Euphorb. in collinis maritimis prope Mossamedes in Benguella. F. Welwitsch, n. 23, 1859 (herb. Vain. 01569–TUR!).

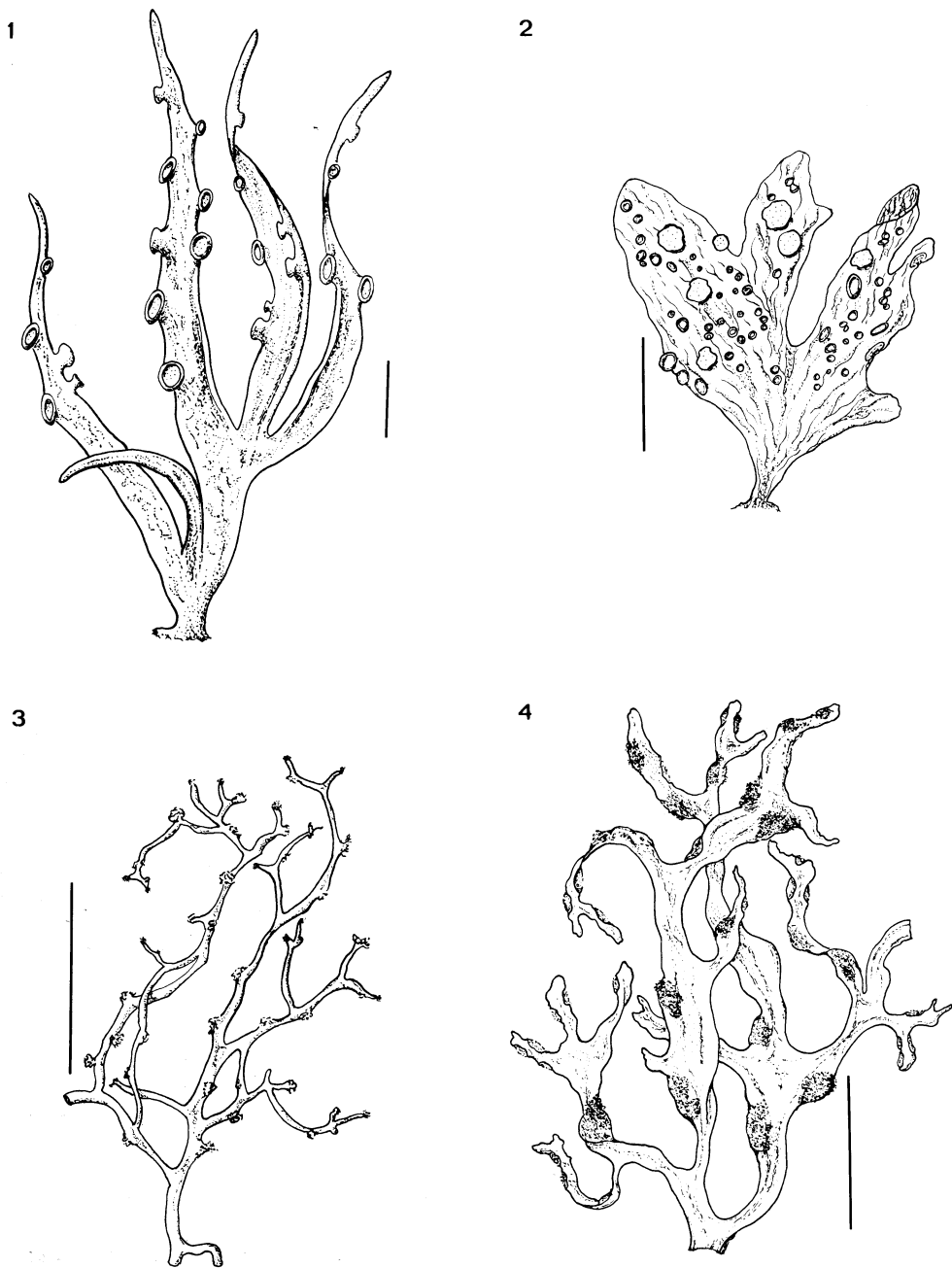
Ramalina ecklonii auct. non Sprengel 1827.

Thallus corticolous, rigid, erect or subpendulous, to 15 cm long, sparingly to moderately branched from an often broad base. Branches stramineous or pale green grey, solid, flattened, lanceolate, plane or somewhat canaliculate, width variable, 1–20 mm, commonly 3–5 mm; young branches thin, more or less smooth, older branches longitudinally or reticulately ridged from strands of cartilaginous tissue, often with holes or cracks; shortly linear or irregular laminal pseudocyphellae common. Soralia absent.

Apothecia numerous, lateral, predominantly laminal, stipitate; disc flat or convex, thalline exciple smooth; spores $4-7 \times 11-16 \mu\text{m}$.

TLC: no medullary substances.

Morphologically *R. celastri* is rather variable. Short specimens with a broad, undivided base have been known as *R. euphorbiae* Vain. (Fig. 2). One of our specimens, 3K 16/211, from the east side of Mt. Kenya, approaches *R. cumanensis* Fée in having narrow, canaliculate branches with linear, marginal pseudocyphellae on the under side, but the branches are less divergent than those of *R. cumanensis*. At present we regard it as a growth form of *R. celastri*.



Figs. 1-4. All rules = 1 cm. Figs. 1-2. *Ramalina celastri* (Sprengel) Krog & Swinsc., whole thalli. Fig. 3. *Ramalina dendriscoides* Nyl., apical branches. Fig. 4. *Ramalina disparata* Krog & Swinsc., apical branches.

A widespread pantropical species, *R. celastri* has been known in the literature mostly as *R. ecklonii* or *R. yemensis*, while the epi-

thet *celastri* has been largely overlooked since its introduction in 1827. However, the holotype of *R. ecklonii* (S!) is a longly pen-

dulous species with capillaceous apices (see under *R. sprengelii*), which is clearly distinct from *R. celastri*.

Ramalina continentalis Malme, Paraguay (S!) and *R. sulcatula* Nyl., Peru (H!) resemble *R. celastri* in having lanceolate branches, laminal, shortly linear pseudocyphellae, and numerous apothecia, but differ in the coarser thalli and saxicolous habit. *R. fasciata* Kremp., Peru (M!), also saxicolous and with a thick coarse thallus, contains a medullary substance in the sekikaic acid aggregate. *R. laevigata* Fr., Insul. Malovinae (UPS!) has apothecia with a crenulate margin, and small spores, $3 \times 10\text{--}12\ \mu\text{m}$. The substrate of this species is not stated in the protologue.

Ramalina celastri is one of the commonest *Ramalina* species in East Africa. It is found in wooded grassland, woodland, and montane forests with a low to moderate degree of shade, between 800 and 3400 m. The records are too numerous to list individually.

7. *RAMALINA CONSANGUINEA* Müll.

Arg., see Krog & Swinscow (1974, p. 117, Fig. 10).

8. *RAMALINA DENDRISCOIDES* Nyl.

Flora 59: 412 (1876). Lectotype: In ins. Cuba, C. Wright, Ser. 2, 738 (herb. Nyl. 37025-H!). — Fig. 3.

Thallus corticolous, shrubby, to 5 cm high, densely and intricately branched. Branches pale stramineous or pale green grey, solid, brittle, predominantly terete but sometimes slightly flattened in basal parts, 0.2–0.5 mm wide; cortex glossy. Soralia punctiform, efflorescent, lateral on main branches and apical on short lateral branchlets. Apothecia not seen.

TLC: salazinic acid.

Moore (1968) reported sekikaic acid in *R. dendriscoides* from Florida. The East African specimens all contain salazinic acid in accordance with the type specimen.

Ramalina dendriscoides has been collected in dry shrub vegetation at altitudes of about 900–1000 m in Kenya and Tanzania. *R. tenella* Müll. Arg., a coastal species, resembles *R. dendriscoides* in its apical, subcapitate soralia and in the production of salazinic acid. However, it differs in having a shorter, less delicate thallus to 2 cm high, with main

branches 0.6–0.8 mm wide, distinctly flattened, and regular, predominantly dichotomous branching. *R. peruviana* Ach. superficially resembles *R. dendriscoides* in its subterete branches and mode of branching, but differs in having lateral rather than apical soralia, and in producing substances in the sekikaic acid aggregate instead of salazinic acid.

Specimens examined

Kenya. Eastern Province: Machakos District, lava flow 5 km NW of Kibwezi, 2K 22/117, 118, 3K 23/10, 17, 20, 140.

Tanzania. Tanga Province: Tanga District, east Usambara Mountains, Amani Forest Reserve. *T. & S. Pócs* 6087/P, 6100/w, 6101/c (herb. Swinscow); Tanga District, Usambara Mountains, Amani, in the surroundings of Forestry House, 900 m, *Santesson* 23298, 23384 (UPS).

9. *RAMALINA DISPARATA* Krog & Swinsc. sp. nov. — Fig. 4.

Thallus corticolus, fruticosus, erectus, usque ad 10 cm altus, modice ramosus. Rami straminei vel cinereo-virentes, applanati vel leviter canaliculati, 2–3 mm lati, soraliis laminalibus marginalibusque, ellipsoidibus, apicem versus irregulariter extendentibus. Apothecia ignota. Acidum divaricaticum et acidum stenosporicum vel acidum sekikaicum aggregatum plus minusve acidum aliphaticum vel acidum boninicum continens.

Thallus corticolous, fruticose, erect, usually 5–6 cm high, more rarely 8–10 cm and then becoming subpendulous, moderately branched. Branches stramineous or greenish grey, solid, flattened, plane or somewhat canaliculate, main branches 2–3 mm wide, in abnormal specimens to 15 mm, apices flat, more or less finely divided. Soralia lateral, marginal and laminal, at first ellipsoid but becoming confluent and irregular with age, in distal parts laminal, irregularly spreading to the apices; soredia predominantly farinose, branchlets from soralia not uncommon. Apothecia unknown.

TLC: strain 1 (typical strain) with divaricatic and stenosporic acids, strain 2 with substances in the sekikaic acid aggregate and a fatty acid as an accessory substance, strain 3 with boninic acid.

Holotype: *Ethiopia*. Shewa Province: Wondo Gennet, 20 km S of Shashemenne, on trees at edge of forest, 1800–2000 m, Krog E5/33 (O, isotype in BM).

Certain slight morphological differences may be found between the three chemotypes. Specimens in the sekikaic acid strain often appear to be more cartilaginous, with generally narrower, often canaliculate branches, and with the soralia convex rather than flat as in the two other strains. However, all intermediates can be found. In the boninic acid strain a certain tendency toward ventricose soralia has been observed, but the material at hand is too limited to decide whether this is a character distinguishing it from the other two strains. Although the specimens in the three strains frequent the same type of habitat, the divaricatic acid strain has been collected more often in Ethiopia, the sekikaic acid strain more often in Kenya. The boninic acid strain is so far known only from three localities in Kenya.

Ramalina disparata has been collected in open forests and woodland between 1100 and 3100 m. Although primarily corticolous, specimens from both the divaricatic and the sekikaic acid strains have been found to occur secondarily on earth banks and rock.

Ramalina disparata recalls *R. farinacea* (L.) Ach. in its mode of branching, but differs in its laminally spreading soralia and in chemical properties (*R. disparata* contains orcinol depsides, *R. farinacea* β -orcinol depsidones). *R. farinacea* is not known to occur in East Africa. Forms of *R. peruviana* with flattened branches may resemble small specimens of *R. disparata*, but the branching is much denser, the soralia punctiform, and the whole thallus more brittle and fragile.

Ramalina pollinaria, which also has both laminal and marginal soralia, differs from *R. disparata* mainly in a more irregular branching and coarser soredia, and in the content of evernic acid. It has a more restricted range in East Africa than *R. disparata*, being known only from the upper montane forest. However, where the two species grow together in mixed populations, as was the case on the west slope of Mt. Kenya, stunted specimens of *R. disparata* can be separated with certainty from *R. pollinaria* only on the basis of chemical tests.

Ramalina pentecostii, a high alpine, pre-

dominantly saxicolous species, described as new in this work, differs from *R. disparata* in its marginal pseudocypheae, its marginal, parietal soralia, and in the lack of lichen substances.

Specimens examined

Divaricatic acid strain:

Ethiopia. Shewa Province: Wondo Gennet, 20 km S of Shashemenne, E5/33 (type collection), Winnem 427/25 (O); between Shashemenne and Kofele, E 27/13; Menegesha, Suba Forest at top, Tapper 501 (BM, O); Menegesha, Suba, below camp, Tapper 538 (BM). Sidamo Province: 5 km NW of Hagere Selam, Winnem 578s/44 (O); 30 km SE of Hagere Selam, Winnem 507/5 (O); 40 km SE of Hagere Selam, E 15/10; NW of Kebre Mengist, Winnem 587/13a. Bale Province. Muna-Muna, Tapper 603b (BM), 604 (BM, O). Gemu Gofa Province: Gidole, E 26/21, Winnem 641/10 (O).

Kenya. Rift Valley Province: Laikipia District, Naro Moru River Lodge, 2K 34/108. Central Province: Kiambu District, Limuru, Burnet 8/1967 (BM).

Uganda. Masaka District: Koki County, 1 km S of Lyantonde, 3U 63/2A. Kigezi District: Rubanda County, above Rubanda, ca. 18 miles NW of Kabale near Kisoro Road, Burnet AMB 211 (BM).

Sekikaic acid strain:

Ethiopia. Sidamo Province: Hagere Selam, Winnem 578/35 (O); north of Kebre Mengist, Winnem 587/13b (O). Bale Province: Muna-Muna, Tapper 603a (BM, O); Arussi Province: W slope of Mount Chilalo, E of Asella, Winnem 751/22 (O).

Kenya. Rift Valley Province: Elgeyo Marakwet District, forest 2 km NE of Kapcherop, 2K 13/101; Elgeyo Marakwet District, Chebiemit Forest 1 km W of Cheptongei, 2K 11/109; Nakuru District, Sipman 6271 (Herb. Sipman). Central Province: Nyeri District, Mt. Kenya, bridge where Naro Moru track crosses River Naro Moru, K 32/111; Nyeri District, Mt. Kenya, above entrance to National Park, 2K 32/114; Nyeri District, Mt. Kenya, Royal Engineers bridge across River Naro Moru, K 34/115; Nyeri District, Mt. Kenya, 2900 m, 2K 33/122, 3000 m, K 13/19, 3100 m, 2K 35/132; Kiambu District, Redhill,

Limuru, *Burnet* 65 (BM). Eastern Province: Machakos District, Mua Hills, 3K 2/116; Meru District, Mt. Kenya, E side, at Themwe, 3K 16/188. Coast Province: Taita District, above Wundanyi, 2K 25/115, 116.

Tanzania. Northern Province: Arusha District, Mt. Meru, W side, 2650 m, T 12/10-1, 115, 116, 118, 126.

Uganda. W Mengo District: Busiro County, 16 km SW of Kampala, 3U 9/26. Kigezi District: Rubanda County, 8 km W of Hamurwa, 3U 47/101.

Boninic acid strain:

Kenya. Rift Valley Province. Elgeyo Marakwet District, Chebiemit Forest 1 km W of Cheptongei, 2K 11/112, 114d. Central Province: Nyeri District, Mt. Kenya, 2400 m, K37/5; 3100 m, 2K 35/134.

10. *RAMALINA DUMETICOLA* Krog & Swinsc. sp. nov. – Fig. 5.

Thallus corticolus, fruticosus, usque ad 4 cm altus, modice ramosus. Ramificatio dichotoma, angulis latis. Rami straminei vel cinereo-virentes, prope basem applanati, apicem versus angulato-teretes, 0.3–0.8 mm lati, soraliis marginalibus, ellipsoidalibus vel irregulariter elongatis. Apothecia rara, lateralia, stipitata; sporis fusiformibus, 5–6 × 16–22 µm. Acidum sekikaicum aggregatum vel acidum innotum continens.

Thallus corticolous, fruticose, to 4 cm high but often shorter, moderately branched, branching predominantly dichotomous, with wide angles. Branches pale stramineous or pale greenish grey, solid, more or less flattened near the base, angular – terete in distal parts, 0.3–0.8 mm wide, tapering apically, with marginal pseudocyphellae and faint longitudinal laminal striae, occasionally perforated; longitudinal cracks in the cortex not uncommon. Soralia marginal, ellipsoid, or confluent and then irregularly elongate.

Apothecia rare, lateral, stipitate, to 2.5 mm in diameter, flat or convex; spores fusiform, straight or slightly curved, 5–6 × 16–22 µm, appearing three-septate.

TLC: strain 1 (typical strain) with substances in the sekikaic acid aggregate, strain 2 with unknown RI and additional undetermined substances.

Holotype: *Kenya*. Coast Province, Kwale

District, 2 km N of Gazi, edge of mangrove, on twigs and shrubs, sea level, *Krog & Swinscow* 3K 30/127 (O, isotype in BM).

Ramalina dumetica is one of the commoner Ramalinas in mangroves on the Kenyan coast. It has also been collected in the low coastal hills in Kenya and at Dar es Salaam in Tanzania (habitat unstated).

In BM and PC some specimens from Ceylon (Sri Lanka), coll. G. H. K. Thwaites, represent *R. dumetica*; they contain the compound 'unknown RI'. Leighton (1871) reported this collection as No. 19, *R. angulosa* Laur., and gave its locality as 'Damboul, 2000–3000 ft. alt.' However, *R. angulosa* Laur. was only a manuscript name mentioned in passing by Nylander (1858, p. 293). Laurer's species was subsequently validly described by T. M. Fries (1861) as *R. capensis*. It is a non-sorediate species with strongly angulate branches, lacking medullary substances. For further discussion see under *R. sprengelii*. We regard the specimens from Sri Lanka as belonging to a chemical strain of *R. dumetica*.

Ramalina peruviana, which contains substances in the sekikaic acid aggregate, differs from *R. dumetica* mainly in its dense, intricate branching and smaller soralia. *R. thraustoides* Vain., Society Islands (holotype herb. Vain. 01566–TUR!), with similar chemistry, differs in having a pendulous habit and thin, distinctly flattened branches. *R. disparata* differs in its flattened branches with irregularly spreading laminal soralia.

Specimens examined

Sekikaic acid strain:

Kenya. Coast Province: Kwale District, 2 km N of Gazi, K 44/121, 3K 30/112, 127 (type collection), 128, 129, 160; Kwale District, Shimba Hills, Pengo Hill, 300 m, *Santesson* 20903b, p.p. (UPS); Kilifi District, Mida Creek, 3K 29/9, 103, 125.

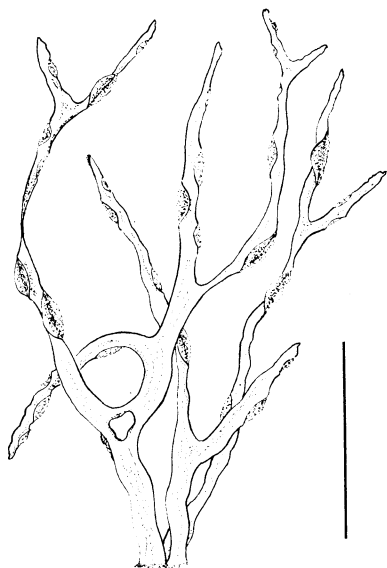
Tanzania. Dar es Salaam, collector unstated, no. 23/1933, comm. Dogget, Dec. 1952 (BM, EA).

Unknown RI strain:

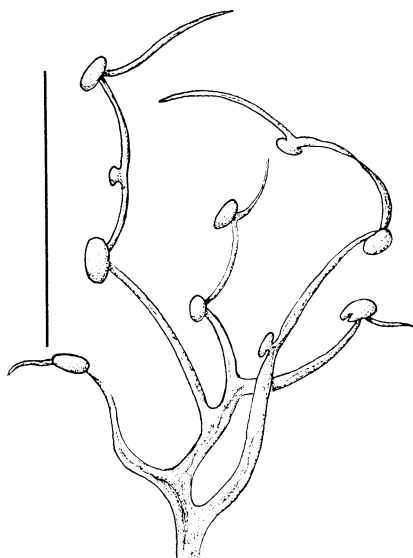
Kenya. Coast Province: Kwale District, 2 km N of Gazi, K 44/113, 3K 30/69.

Sri Lanka. Damboul 2000–3000 ft., *Thwaites* (BM, PC).

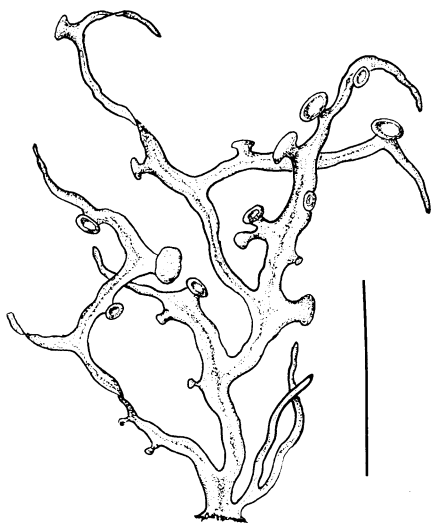
5



6



7



8



Figs. 5–8. All rules = 1 cm. Fig. 5. *Ramalina dumeticola* Krog & Swinsc., apical branches. Fig. 6. *Ramalina exiguella* Stirt., apical branches. Fig. 7. *Ramalina fecunda* Krog & Swinsc., whole thallus. Fig. 8. *Ramalina hochneiliana* Müll. Arg., part of main branch with lateral branchlets.

11. *RAMALINA EXIGUELLA* Stirt.

Trans. Proc. Roy. Soc. Victoria 17:68 (1881).

Holotype: Queensland, Brisbane, I. M. Bailey No. 91 (GLAM!). – Fig. 6.

Thallus corticolous, fruticose, rigid, 2–3 cm

high, moderately branched. Branches stramineous, solid, predominantly subterete, 0.2–0.8 mm wide, with longitudinally disposed, shortly linear pseudocyphellae, grooves, and cracks, apices tapering, slender, often with scattered black spots. Soralia absent.

Apothecia numerous, lateral on geniculate branches; disc flat to strongly convex, 1–1.5 mm in diameter; spores broadly ellipsoid, $6.5\text{--}7.5 \times 13\text{--}15\ \mu\text{m}$.

TLC: no medullary substances.

The blackened apices seem to be a somewhat variable character. It is not apparent in the Kenyan specimens, and is absent from the holotype of *R. exiguella*, although it is mentioned in the protologue as one of the characteristic features of the species.

Ramalina gracilis (Pers.) Nyl. subsp. *antillarum* Vain., West Indies (herb. Vainio 01453–TUR!), conforms with *R. exiguella* in mode of branching, spore size, and lack of medullary substances. Although the type specimen has irregularly foveate rather than longitudinally furrowed branches, this may not be characteristic of the material, since the protologue reads 'longitudinaliter parallele canaliculato-striatus'. Blackened apices are present. When more material is studied, *R. gracilis* subsp. *antillarum* may prove to be synonymous with *R. exiguella*.

Ramalina attenuata (Pers.) Tuck., St. Domingo, holotype L (!) resembles *R. exiguella* in general habit but differs in its flat apothecial discs and subfusiform spores, $6\text{--}7.5 \times 16\text{--}20\ \mu\text{m}$, and in producing psoromic acid in the medulla.

In East Africa *R. exiguella* is known from the low coastal hills in Kenya, where it grows in dry shrub vegetation.

Specimens examined

Kenya. Coast Province: Kwale District, Shimba Hills, 25 km SW of Mombasa, Kivumoni Forest, 350 m, K 42/105; Kwale District, Shimba Hills, Pengo Hill, Santesson 20903b (UPS).

12. *RAMALINA FECUNDA* Krog & Swinsc. sp. nov. – Fig. 7.

Thallus corticolus, caespitosus, rigidus, ad 8 cm altus, sparse vel modice ramosus. Rami straminei vel flavo-virentes, applanati vel leviter canaliculati, 1.2–3.0 mm lati, pseudo-

cyphellis linearibus, marginalibus et laminalibus. Soralia nulla. Apothecia numerosa, lateral, breviter stipitata; sporis fusiformibus, $4\text{--}5 \times 18\text{--}26\ \mu\text{m}$. Acidum salazinicum continens.

Thallus corticolous, caespitose, rigid, 3–4 cm high, rarely up to 8 cm and then subpendulous, sparsely to moderately branched. Branches stramineous or yellowish green, solid, bilateral, flat or weakly channelled, 1.2–1.5(–3) mm wide, tapering distally, laminar pseudocyphellae shortly linear, marginal pseudocyphellae often continuous, margins sometimes with irregular tubercles, marginal splitting between upper and lower cortex common. Soralia absent.

Apothecia numerous, shortly stipitate, to 3.5 mm in diameter, with flat disc; spores fusiform, one-septate but often with 2–4 pseudosepta, $4\text{--}5 \times 18\text{--}26\ \mu\text{m}$ (commonly 20–22 μm long), straight or slightly curved.

TLC: salazinic acid.

Holotype: *Kenya*. Coast Province: Kwale District, 2 km N of Gazi, at edge of mangrove, on shrubs, Krog & Swinscow 3K 30/121 (O, isotype in BM).

Ramalina fecunda is a species of the coast and the low coastal hills off the Indian Ocean. It is plentiful and well developed on twigs in mangrove vegetation at sea level, and it has also been collected in the Shimba Hills near the Kenyan coast at 350 m. It usually grows together with other *Ramalina* species such as *R. consanguinea*, *R. exiguella*, *R. dumeticola*, *R. maritima*, and *R. tenella*.

Ramalina exiguella Stirt. may resemble slender forms of *R. fecunda*, but differs in its subterete branches, broadly ellipsoid spores, and lack of salazinic acid. For differences from *R. maritima* see under that species. *R. moranii* Bowler & Rundel, described from New Mexico (holotype US, not seen) differs – according to the description – in its much smaller spores ($3.3\text{--}4.4 \times 8.8\text{--}15.4\ \mu\text{m}$). *R. zollingeri* Szat., from Java (UPS – isotype!), has many characters in common with *R. fecunda*, including chemistry, but differs in a coarser thallus, 10 cm long, with branches 2–5 mm wide, and smaller spores ($5 \times 14\text{--}17\ \mu\text{m}$).

Specimens examined

Kenya. Coast Province: Rabai Hills, Mombaz., East Africa, Taylor 1885 (BM); Kwale

District, 2 km N of Gazi, edge of mangrove, K 44/115, 3K 30/2, 3K 30/36a, 3K 30/71, 3K 30/121 (type collection), 3K 30/123, 3K 30/158; Kwale District, Shimba Hills, 25 km SW of Mombasa, Kivumoni Forest, K 42/6, K 42/106; Kwale District, Shimba Hills, Pengo Hill, *Santesson* 20903c (UPS); Kilifi District, Mida Creek, in mangrove, 3K 27/103, 3K 29/3, 3K 29/11, 3K 29/101, 3K 29/127, 3K 29/128, 3K 29/129.

Tanzania. Dar es Salaam, collector unstated, no. 23/1933, comm. Dogget Dec. 1952 (BM, EA).

13. *RAMALINA FIMBRIATA* Krog & Swinsc., see Krog & Swinscow (1974, p. 117, Fig. 11).

14. *RAMALINA HOEHNELIANA* Müll. Arg.

Flora 73:337 (1890). Holotype: [Kenya] Leikipia, alt. 1500–2000 m, *Ritter v. Höhnell* 179 (G!). – Fig. 8.

Thallus corticolous, pendulous, to 60 cm long, main branches subparallel with short side branches diverging at wide angles. Branches stramineous or greenish grey, solid, bilateral, flat, 4–6 (–10) mm wide, longitudinally ribbed, with laminal, linear or irregular pseudocyphellae, often perforate or with longitudinal cracks. Soralia absent.

Apothecia lateral, marginal or laminal; spores one-septate, some appearing three-septate, straight to strongly curved, $5\text{--}6 \times 13\text{--}15$ (–17) μm .

TLC: no medullary substances.

Ramalina hoehneliana is an African species found in open woodlands and on trees in grassland and pastures at intermediate altitudes, mostly between 1800 and 2400 m. This large, characteristic lichen is not easily mistaken for any other species. *R. sprengelii*, which can also grow quite long, has narrower branches with terete, capillaceous apices.

Specimens examined

Ethiopia. Sidamo Province: Wadera, *Winnem* 510/17, 512/14 (O); E 8/8; ca. 10 km NW of Wadera, *Winnem* 509/11 (O). Gemu Gofa Province: Gidole, *Winnem* 638/4, 640/3 (O), E 26/20.

Kenya. Eastern Province: Machakos Dis-

trict, Mua Hills, 45 km SE of Nairobi, K 5/40. Rift Valley Province: Laikipia District, at Naro Moru River near Naro Moru Lodge, *Sipman* 6474 (herb. Sipman). Masailand, Narok District, Entasekera River, *Glover, Gwynne, Samuel & Tucker* 2070B (EA). Chyulu Hills, *Bally* 321 (EA).

Tanzania. Mt. Kilimanjaro, W slope, Simba Farm, 1700 m, *Santesson* 21075 (UPS). Moshi District, Mt. Kilimanjaro, near Lemosho, *Lye* L 264 (herb. Lye); Kilimanjaro, 1000 m *Endlich* (H); nahe der Kenya-Grense, Loliondo, 6800 ft., *Schüz* (UPS). Iringa District, Ruaha National Park, on the summit of Magangwe Hill, *Björnstad* AB 1771, AB 1780b (O). Iringa, Mt. Lukota, 6000 ft., *Lynes* 1932 (UPS).

Uganda. Kigezi District: Kinkizi County, Mafuga Forest, 3U 41/1; Mafuga, 8000 ft., *Dale* 1947 (UPS). Masaka District: Koki County, 12 km W of Kakuto, 3U 64/4; Koki County, 3 km S of Mabira village, *Lye* L 570 (herb. Lye); Lake Nabugabo, *Chandler* 1935, 3800 ft. (UPS). Karamoja District: Matheniko County, SE of Sogolomon, Mt. Moroto 2U 36/37, *Lye* L 469 (herb. Lye).

15. *RAMALINA HOLSTII* Krog & Swinsc., see Krog & Swinscow (1975b, p. 275, Fig. 4).

16. *RAMALINA MARITIMA* Krog & Swinsc. sp. nov. – Fig. 9.

Thallus corticolous, rigidus, usque ad 10 cm altus, sparse subdichotome ramosus. Rami cinereo-virentes, applanati vel plus minusve canaliculati, 2–4 mm lati, pseudocyphellis striatibus marginalibus et laminalibus inconspicuis. Soralia nulla. Apothecia lateralia, marginalia et laminalia, breviter stipitata; sporis fusiformibus, $5\text{--}6 \times 18\text{--}25$ μm . Acidum boninicum et acidum ignotum continens.

Thallus corticolous, rigid, erect to subpendulous, to 10 cm long, sparsely subdichotomously branched. Branches greenish grey, solid, bilateral, linear, flat or more or less canaliculate, 2–4 mm wide, gradually tapering, with occasional short, longitudinal depressions, marginal pseudocyphellae linear, inconspicuous, laminal pseudocyphellae shortly linear, rare; margins with numerous raised tubercles.

Apothecia lateral, predominantly marginal

but sometimes laminal, shortly stipitate; margins smooth or slightly crenate; spores fusiform, $5-6 \times 18-25 \mu\text{m}$, one-septate, with 2-4 pseudosepta, straight or somewhat curved. TLC: boninic acid and an undetermined substance.

Holotype: *Kenya*. Coast Province: Kilifi District, Mida Creek, in mangrove, Krog & Swinscow 3K 27/101 (O, isotype in BM).

Ramalina maritima is known only from the African coast of the Indian Ocean. In *Kenya* it has been collected in mangroves; it appears to have grown in a similar habitat in *Tanzania*.

Young specimens of *R. maritima* may be difficult to distinguish morphologically from *R. fecunda*, with which it often grows, but they can be separated by chemical tests since *R. fecunda* contains salazinic acid, while *R. maritima* contains boninic acid. Mature specimens differ morphologically in that *R. fecunda* normally has a shorter, more tufted thallus, rarely more than 3-4 cm high, with apothecia often on geniculate branches which are generally narrower than those of *R. maritima*.

Ramalina boninensis Asah., described from the Bonin Islands in the Pacific Ocean, seems to come close to *R. maritima*. Both species have a subpendulous thallus, the branches are more or less flat with shortly linear pseudocypbellae, and the diagnostic medullary substance is boninic acid. However, the branching of *R. boninensis* is irregular rather than subdichotomous, the branches are broader and irregularly widened at points of branching, marginal pseudocypbellae are usually absent, and the spores are generally smaller. We have not seen the type specimen of *R. boninensis* (TNS), but the species was issued in Kurokawa Lich. Rar. Crit. Exs. nos. 132 and 133, of which specimens in BM, LD, O, S, and UPS have been examined.

Two of the syntypes of *R. subfraxinea* Nyl., one from Bourbon Island, *Boivin* 1847-1852 (herb. Nyl. 37185-H!) and one from Mauritius, collector unstated (herb. Nyl. 37178-H!), contain boninic acid. The specimen from Bourbon Island resembles *R. boninensis* in having an irregular branching, while the specimen from Mauritius has linear branches with a predominantly dichotomous branching, recalling forms of *R. maritima*; the spores are also similar to those of *R. maritima*.

However, the syntype specimen – a scrap at most 4 cm in diameter – is too small for a satisfactory comparison with *R. maritima*. *R. subfraxinea* may perhaps more satisfactorily be lectotypified on one of the other syntypes extant, for instance on material in the Goudot collection from Nova Granata, of which there is a good specimen in PC and a rather small specimen in herb. Nyl. 37187 (H). The Goudot specimens contain substances in the sekikaic acid aggregate.

Neither *R. boninensis* nor the syntypes of *R. subfraxinea* contain the undetermined substance which occurs with boninic acid in *R. maritima*.

Specimens examined

Kenya. Coast Province: Kwale District, 2 km N of Gazi, K 44/5, K 44/116, 3K30/15, 3K30/101, 3K 30/118, 3K 30/162; Kilifi District, Mida Creek, 3K 27/101 (type collection), 3K 27/102, 3K 29/123.

Tanzania. Dar es Salaam, no. 23/1933 p. p., collector unstated, comm. Dogget Dec. 1952 (BM, EA).

17. RAMALINA PENTECOSTII Krog & Swinsc. sp. nov. – Fig. 10.

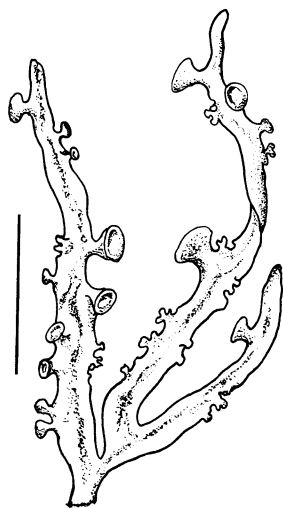
Thallus saxicolus vel corticolus, caespitosus, usque ad 8 cm altus, repetite dichotome ramosus. Rami straminei basi saepe discolores, applanati, e basi 1-1.5 mm lati, apicem versus ad 0.1 mm decrescentes, interdum perforati, soraliis marginalibus erumpentibus. Apothecia ignota. Materia medullosa desunt.

Thallus saxicolous or corticolous, caespitose, to 8 cm long, repeatedly dichotomously branched. Branches stramineous, often discoloured at base, solid, bilateral, flat, 1-1.5 mm wide near base, tapering to 0.1 mm apically, occasionally perforated, with marginal, linear pseudocypbellae. Soralia parietal, erupting marginally in cracks between the upper and lower cortex or, more rarely, laminally from longitudinal cracks, apices often recurved, with ecorticate granules. Apothecia not seen.

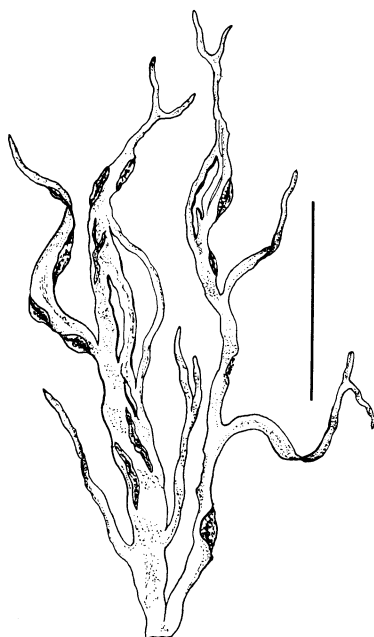
TLC: no medullary substances.

Holotype: *Uganda*. Toro, Ruwenzori, locally abundant on trunks of *Senecio adnivalis* by Bujuku Lake, alt. 13,150 ft., 5 Aug. 1971, Imperial College Expedition, *Pentecost* RE 115 (BM, isotype in O).

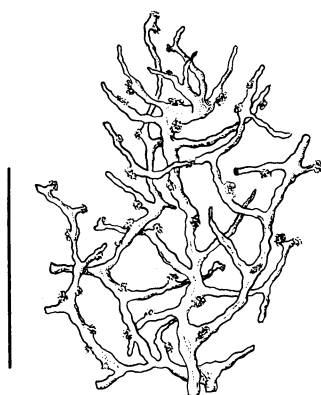
9



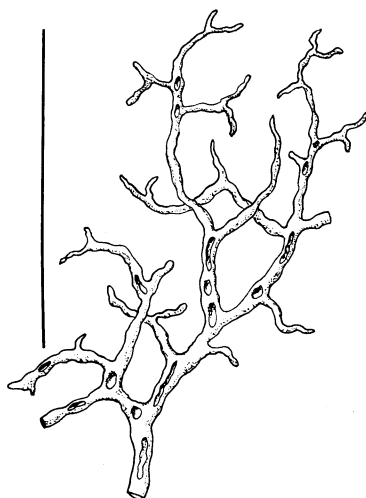
10



11



12



Figs. 9–12. All rules = 1 cm. Fig. 9. *Ramalina maritima* Krog & Swinsc., apical branches. Fig. 10. *Ramalina pentecostii* Krog & Swinsc., apical branches. Fig. 11. *Ramalina peruviana* Ach., apical branches. Fig. 12. *Ramalina pocsi* Krog & Swinsc., apical branches.

Named in honour of the collector, Dr. A. Pentecost, of Great Britain.

Ramalina pentecostii is a high alpine species, known from *Senecio* trunks and rock at or above 4000 m altitude in the Ruwenzori range. Its mode of branching may recall forms of *R. disparata*, but it differs from that

species in its parietal, mainly marginal soralia which never spread irregularly on to the lamina, and in the lack of medullary lichen substances.

Specimens examined

Uganda. Toro District: Bunyangabu Coun-

ty, Ruwenzori Mountains by Bujuku Lake, 4000 m, *Pentecost* RE 115 (type collection – BM, O). Ruwenzori Mountains, Mt. Speke, on rocky gully on W slope, 14,000 ft., *Esterhuysen* ex herb. Bol. 25229 (LD).

18. *RAMALINA PERUVIANA* Ach.

Lich. Univ. 1599 (1810). Holotype: Peru, *Lagasta* (Herb. Acharius – H!). – Fig. 11.

Thallus corticolous, fruticose, 2–3 cm high, densely and intricately branched. Branches greenish grey, solid, flattened, becoming terete or subterete in apical parts, 0.1–0.8 mm wide, weakly striate in basal parts. Soralia punctiform, lateral, on flattened branches marginal, frequently giving rise to minute branchlets, soredia farinose. Apothecia not observed.

TLC: substances in the sekikaic acid aggregate.

The type specimen in H is a tiny scrap about 1 × 1.5 cm, with flattened linear branches and a weakly striate cortex. The soralia are not very clear, but a few indistinct nodules or granules are present. In S there is a better specimen marked '*R. peruviana* Ach., Herb. Swartzii', which shows the same features as the specimen in H, but the soralia, although eroded, are more distinct. The specimen in S contains substances in the sekikaic acid aggregate.

Some of the East African specimens appear to be more slender and fragile than the type specimen, with more consistently terete branches.

Ramalina dendriscoides Nyl. resembles *R. peruviana* in its mode of branching, but differs in having most soralia situated apically on short lateral branchlets, and in containing salazinic acid. For differences from *R. disparata* see under that species.

Ramalina farinacea (L.) Ach. var. *squarrosa* Müll. Arg., described from Australia (G!), appears to come close to *R. peruviana*. It also contains substances in the sekikaic acid aggregate.

Ramalina peruviana has been collected between 1000 and 1800 m on twigs of trees and shrubs in bushed and wooded grassland. It seems to have a somewhat wider range than *R. dendriscoides*, with which it sometimes grows.

Specimens examined

Kenya. Eastern Province: Machakos District, lava flow 5 km NW of Kibwezi, K 20/13, 3K 23/111, 143. Rift Valley Province: Kajiado District, Chyulu Hills, K 39/102. Coast Province: Taita District, Taita Hills near Wundanyi, 1350 m, 2K 24/101, 1700 m, 2K 26/108; Taita District, N of Mwanda Summit, 2K 28/112.

Tanzania. Tanga Province: Tanga District, east Usambara Mountains, Amani Forest reserve, T. & S. Pócs 6101/c (G, mixed with *R. dendriscoides*).

Uganda. Ankole District: Bunyaruguru County, W edge of Kalinzu Forest, 2U 9/12; Isingiro County, Kantsyore Island in Kagera River 8 miles E of Kikagati, *Burnet* AMB 192 (BM). W Mengo District: Busiro County, Entebbe Botanical Garden, 2U 24/12; Masaka District: Buddu County, 2 km NW of Bale, Lake Nabugabo, *Lye* L 129 (herb. Lye); Bukoto County, N edge of Malabigambo Forest, 3U 25/5; Koki County, 1 km S of Lyantonde, 3U 63/4; Koki County, 9 km W of Kakuto, 3U 65/1; Koki County, 3 km S of Mabira village, *Lye* L 574 (herb. Lye); Kalungu County, 0.5 km S of Masaka-West Mengo border, *Lye* L 533 (herb. Lye).

19. *RAMALINA POCSII* Krog & Swinsc. sp. nov. – Fig. 12.

Thallus corticolus, fruticosus, usque ad 5 cm altus, dense et intricate ramosus. Rami straminei, cavi, perforati, 0.1–0.5 mm lati. Soralia nulla. Apothecia apicalia vel lateralia; sporis 4–6 × 10–16 µm. Acidum sekikaicum aggregatum continens.

Thallus corticolous, fruticose, ca. 5 cm high, densely and intricately branched. Branches pale stramineous, terete, hollow, perforated, 0.1–0.5 mm wide. Soralia absent.

Apothecia apical or lateral; spores one-septate, 4–6 × 10–16 µm, straight or somewhat curved, eight to the ascus.

TLC: substances in the sekikaic acid aggregate.

Holotype: *Tanzania*. S Uluguru Mountains in Morogoro District. On branches in elfin forest at the E edge of Lukwangule plateau. Alt. 2400 m. Coll. T. Pócs 6827/T, 13. Nov. 1972 (herb. Pócs, isotypes in BM and O).

Named in honour of the collector, Dr. T. Pócs, of Hungary.

Superficially *R. pocsii* resembles forms of *R. dendriscoides* and *R. peruviana* in its intricately branched thallus with slender, terete, fragile branches; it differs from these species above all in its hollow thallus, but also in the absence of soralia. The mode of branching sets *R. pocsii* apart from all other East African Ramalinas in section *Fistularia*.

Ramalina pocsii is known only from the type locality.

20. *RAMALINA POLLINARIA* (Westr. ex Ach.) Ach.

Lich. Univ.: 608 (1810). – *Lichen pollinarius* Westr. ex Ach., Kgl. Vetensk. Acad. Nya Handl. 18: 263 (1797). – Fig. 13.

Thallus corticolous or saxicolous (in East Africa so far only corticolous), fruticose-caespitose, 2–3 cm high, densely (rarely moderately) and irregularly branched. Branches stramineous, solid, bilateral, flat, of irregular width, 0.2–3.0 mm, apices often finely divided. Soralia ellipsoid at the margins, irregularly spreading laminally and apically, with subgranular soredia and coarse, corticate granules. Apothecia not seen in East African material.

TLC: evernic and obtusatic acids.

Ramalina disparata, which also has laminally spreading soralia, differs from *R. pollinaria* in its larger size, its regular, moderate branching, its lack of corticate granular soredioid bodies, and in chemical properties.

Ramalina peruviana may resemble densely branched forms of *R. pollinaria* with slender branches. However, it lacks the laminally spreading soralia and coarse granules of *R. pollinaria*, it differs chemically, and it does not inhabit the montane forests where *R. pollinaria* is found.

Ramalina pollinaria has been collected only in the upper montane forest on the west side of Mt. Kenya, where it was growing abundantly on trees at 2900–3000 m.

Specimens examined

Kenya. Central Province: Nyeri District, Mt. Kenya, W side, K 13/113, 2K 33/121, 2K 35/14, 15, 125–131, 133.

21. *RAMALINA POLYMORPHA* (Ach.) Ach.

Lich. Univ.: 600 (1810). – *Lichen polymorphus* Ach., Kgl. Vetensk. Acad. Nya Handl. 18: 270 (1797). Lectotype: Suecica (herb. Acharius–H!). – Fig. 14.

Ramalina capitata (Ach.) Nyl. in Cromb., Grevillea 7: 141 (1879). – *Ramalina polymorpha* var. *capitata* Ach., Lich. Univ.: 601 (1810). Lectotype: Suecica (herb. Acharius–H!).

Ramalina digitellata Nyl., Flora 63:10 (1880). Holotype: Lusitania, Monte Arrabida, Newton, Majo 1879 (herb. Nylander 37460–H!).

Ramalina meyeri Stein, Jahresber. Schles. Gesell. Vaterl. Cultur 66: 135 (1888). Coll. orig.: [Tanzania] Kilimandscharo [Kilimanjaro] 3000–4000 m (? 4500–5000 m), leg. Hans Meyer nr. 11, 9. 1. 87 (WRS�!).

Ramalina protecta H. Magn., Bot. Not. 109: 150 (1956). Holotype: Hispania, Castilla la nueva, El Escorial, overhang. rocks. Leg. Gunnar Degelius 20. 5. 1931 (herb. Degelius!).

Thallus saxicolous; rigid, erect or decumbent, 2–5 cm high, subdichotomously, irregularly or more or less palmately branched, some specimens richly branched towards the apices; branches stramineous or yellow-grey, solid, flattened or often more or less terete and longitudinally furrowed distally, with irregular or shortly linear pseudocyphellae; soralia either laminal and linear-ellipsoid, or apical-subapical and labriform-capitate, with coarsely granular soredia. Apothecia not seen in East African material.

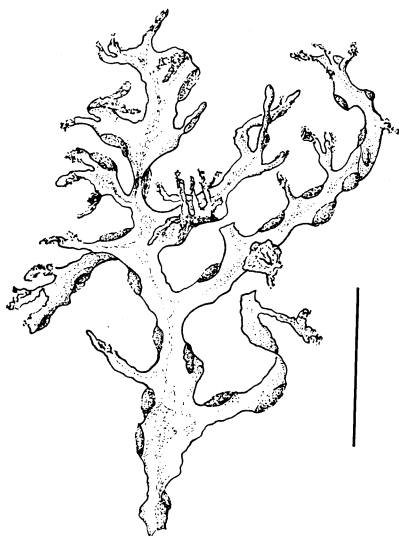
TLC: no medullary substances.

As shown by Krog & James (1977 in press) there is a continuous variation from *R. polymorpha* var. *polymorpha* through var. *strepsilis* Ach. to var. *capitata* Ach. Of the East African specimens *Tappe* 748 corresponds to var. *polymorpha*, the Kilimanjaro specimens are of the morphotype which has been known as var. *strepsilis*, while most of the Ethiopian specimens come close to the *capitata* morphotype.

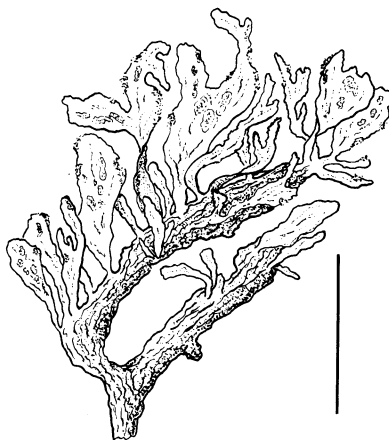
In East Africa *R. polymorpha* is an alpine species, occurring upwards from 3500 m altitude.

The original material of *R. meyeri* Stein in WRS� consists of three specimens glued to one small sheet, bearing the number 11 and annotated '3–4000 m'. However, the packet,

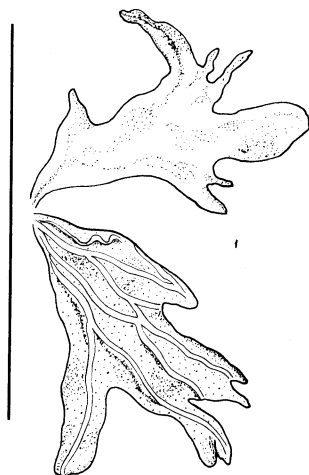
13



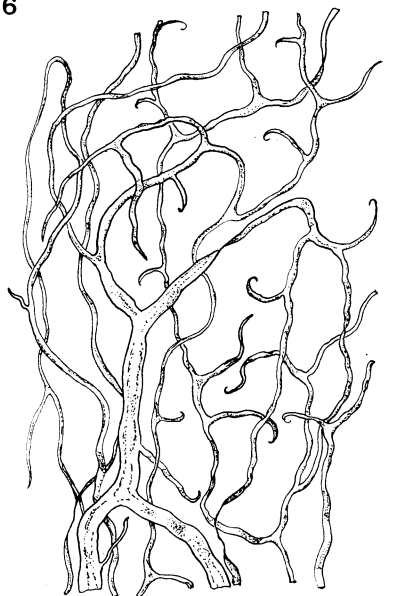
14



15



16



Figs. 13–16. All rules = 1 cm. Fig. 13. *Ramalina pollinaria* (Westr. ex Ach.) Ach., apical branches. Fig. 14. *Ramalina polymorpha* (Ach.) Ach., apical branches. Fig. 15. *Ramalina reducta* Krog & Swinsc., whole thalli showing smooth upper side and latticed under side. Fig. 16. *Ramalina sprengelii* Krog & Swinsc., part of thallus.

also marked 11, bears the annotation '4500–5000 m'. The protologue (Stein 1888, p. 137) reads 'An Steinen bei 4200 m'. The specimens belong to the *strepsilis* morphotype.

Ramalina digitellata Nyl. and *R. protecta* H. Magn. have flattened, more or less palmate

branches and predominantly labriform soralia, falling within the *capitata* morphotype.

Specimens examined

Ethiopia. Mt. Brachit, Schimper 1890 (H-herb. Nyl. 37453). Bale Province, mountain

pass between Adaba and Goba, 10 km W of Gurie, E 22/26, *Winnem* 354/5, 355/28, 355/29 (O); WNW of Tullu Deemt, *Tapper* 779 (BM, O); Likumsa, *Tapper* 737 (BM), 1184 (BM, O); Mt. Orobo lava flows, Saneti end, *Tapper* 755, 748 (BM); Dinshu, at edge of plain to west of Dinshu, near Ueb river gorge, *Tapper* 646 (BM, O).

Kenya. Central Province: Nyeri District, Mt. Kenya, Hausberg Valley, *Queen Elizabeth College Expedition* 4B (BM).

Tanzania. Kilimanjaro Province, Mt. Kilimanjaro, 3000–4000 m (4500–5000 m), *Meyer* 11 (WRSL, coll. orig. of *Ramalina meyeri* Stein); Kilimanjaro, saddle between Kibo and Mawenzi, 4530 m, *Hedberg* 1269a (UPS, O).

Uganda. Ruwenzori Mountains, Mt. Speke, rocky gully on W slope 14,000 ft., *Esterhuysen* ex herb. Bol. 25229a (LD).

22. *RAMALINA PUSIOLA* Müll. Arg., see Krog & Swinscow (1974, p. 119, Figs. 12–13).

23. *RAMALINA REDUCTA* Krog & Swinsc. sp. nov. – Fig. 15.

Thallus corticolus, caespitosus, usque ad 12 mm altus, integer vel sparse ramosus. Rami straminei, applanati, usque ad 2 mm lati, cortice inferiore filis ramosis reticulatim reducto. Apothecia ignota. Acidum psoromicum continens.

Thallus corticolous, to 12 mm high, tufted, unbranched or sparingly branched. Branches pale stramineous, flattened, to 2 mm wide; a continuous lower cortex lacking, but medulla overlaid by a few anastomosing strands of cartilaginous hyphal tissue. Soredia produced from the exposed medulla. Apothecia unknown.

TLC: psoromic acid.

Holotype: *Ethiopia*. Bale Province: 1 km E of Dinshu, open *Hypericum/Hagenia* forest, on mature, ecorticate *Hypericum* boughs, elev. 10,400 ft., coll. R. Tapper 933 (BM, isotype in O).

Ramalina reducta is an inconspicuous and easily overlooked species. However, its latticed underside and the content of psoromic acid sets it apart from all other known *Ramalina* species. In East Africa it is known from

the upper montane forest between 2600 and 3100 m altitude. An additional specimen from Transvaal has been seen in LD. In TUR the holotype specimen of *Usnea fragilis* Vain., from Ruwenzori, is mixed with a small specimen of *R. reducta*.

Specimens examined

Ethiopia. Bale Province, 1 km E of Dinshu, *Tapper* 932 (BM), 933 (BM, O – type collection), 912 (BM), 923 (BM); SE of Dinshu Hill, *Tapper* 980 (BM).

Tanzania. Northern Province, Arusha District, Mt. Meru, W side, 2650 m, T12/125.

Uganda. Ruwenzori, *Scott-Elliot* 83 (TUR, mixed with the holotype specimen of *Usnea fragilis* Vain.).

Transvaal. Distr. Pietersburg, Houtbosch, on road-side trees, *Almborn* 6788 (LD).

24. *RAMALINA SPRENGELII* Krog & Swinsc. nom. nov.

Parmelia ecklonii Sprengel, Syst. Veg. 4 (2): 328 (1827). Holotype: Uitenhagen [South Africa], [Ecklon] 212, Nov. 25 (S!). – *Ramalina ecklonii* (Sprengel) Mey. & Flot., Nov. Act. Acad. Leopold. Carolin. 19, Suppl.: 213 (1843), nomen rejiciendum. – Fig. 16.

Ramalina usneoides var. *capensis* Nyl., Bull. Soc. Linn. Normand., Ser. 2, 4: 123 (1870). Coll. orig.: Cap Drège (G! PC!). – *Ramalina capensis* (Nyl.) Müll. Arg., Flora 73: 337 (1890), non *Ramalina capensis* Th. Fr., Flora 44: 411 (1861).

Thallus corticolous, longly pendulous, irregularly branched. Branches subparallel, solid, flattened, to 1 mm wide, becoming terete and capillaceous in distal parts, colour yellowish grey, with a narrowed blackened zone at the base, cortex glossy, turning a reddish brown in the herbarium, pseudocyphellae linear, marginal and in part laminal. Soredia absent.

Apothecia lateral, sessile, to 0.8 mm in diameter; spores straight, 4–5 × 15–17 µm.

TLC: no medullary substances.

The name *R. ecklonii* (Sprengel) Mey. & Flot. has been incorrectly applied to a different species, *R. celastri*, for a long time; it must therefore be rejected under Article 69 of the Code. *R. sprengelii* is here proposed as a nomen novum for *R. ecklonii*.

Nylander (1870) described *R. usneoides* (Ach.) Fr. var. *capensis* Nyl. on material collected by Drège in Cap. B. Spei. Original material in G and PC shows this taxon to be synonymous with *R. sprengelii* (the specimen in G is indeed marked 'No. 12, *Parmelia ecklonii* Spr. n. sp., Cap. M. Drège', but since the locality 'Uitenhagen' is not included, it cannot be considered a type of *R. ecklonii*). Müller (1890) made the combination *R. capensis* (Nyl.) Müll. Arg. However, being a later homonym the name is not available for *R. sprengelii*. Fries (1861) validly described as *R. capensis* the species representing *R. angulosa* Laur., nomen nudum, by Nylander (1860) regarded as a dubious form of *R. scopulorum*.

A specimen from Herb. Swartz (S) marked *Alectoria ecklonii*, Cap, *Ecklon* and annotated '*Ramalina usnea* (L.) Howe var. *capensis* (Nyl.)' by Malme 1837, is close to *R. sprengelii* in its pendulous habit, narrow, flattened branches with terete, capillaceous apices, and marginal pseudocyphellae. However, it differs in its more slender and delicate thallus (main branches at most 0.3 mm wide), its regular, repeatedly dichotomous branching, and its lack of laminal pseudocyphellae. It contains small amounts of a lichen substance with Rf values close to those of divaricatic acid, but divaricatic acid could not be proved by MCT. This species may belong in the *R. usnea* aggregate, discussed by Imshaug (1972). Another specimen of the same species from Cap. B. Sp., in G, is marked '*Alectoria Dregeana* Delise in herb. et monog. ined. (herbier Delise et Lenormand)'.

Ramalina sprengelii has many characters in common with *R. hoehneliana* Müll. Arg., a widespread species in East Africa. Both species are longly pendulous, have laminal and marginal linear pseudocyphellae, and lack medullary substances. The main difference lies in size. *R. hoehneliana* grows up to 60 cm long, with main branches to 1 cm wide, flattened along their length. A further difference is in the laminal pseudocyphellae, which are much more pronounced in *R. hoehneliana*.

R. sprengelii appears to be rare in East Africa. We have seen only two fragmentary specimens of it, sorted out from packets of *Usnea* spp.

Specimens examined

Kenya. Nyanza Province: Kisumu-Londiani District, Tinderet Forest Reserve, Camp 2, alt. 2420 m, *Maas Geesteranus* ex 1303f (L).

Tanzania. Eastern Province: Morogoro District, Uluguru Mountains, Bondwa Peak, on branch of evergreen shrub in subalpine heath, 1950 m, *Pócs & Gibbon* ex 6052/cu-b (herb. Swinscow).

25. *RAMALINA SUBPUSILLA* (Nyl.) Krog & Swinsc. comb. nov. *Ramalina geniculata* Hook. f. & Tayl.* *R. subpusilla* Nyl., Bull. Soc. Linn. Normand., Ser. 2, 4: 164 (1870).

In Krog & Swinscow (1974) the combination was erroneously accredited to Zahlbruckner (1930).

For discussion and illustration of the species see Krog & Swinscow (1974, p. 121, Figs. 14–15).

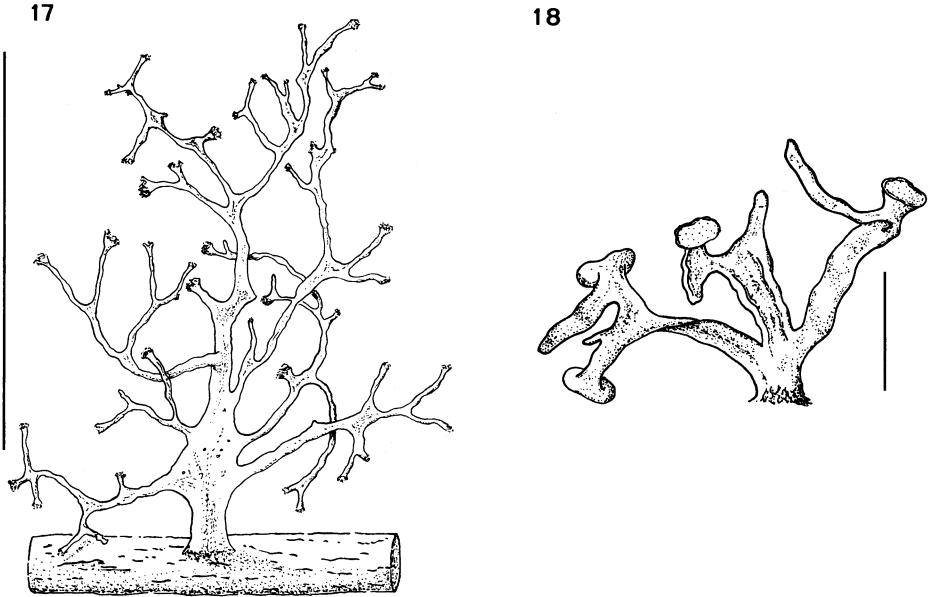
26. *RAMALINA TAPPERI* Krog & Swinsc., see Krog & Swinscow (1974, p. 121, Figs. 16–17).

27. *RAMALINA TENELLA* Müll. Arg. Flora 62:162 (1879). Holotype: Apiahy, prov. S. Paulo in Brasilien, leg. J. I. Puiggari no. 152, Jan. 1877 (G!). – Fig. 17.

Thallus corticolous, fruticose – caespitose, to 2.5 cm high, moderately to densely subdichotomously branched, with short, slender lateral branchlets. Branches stramineous, solid, main branches flattened, to 0.8 mm broad, with shortly linear pseudocyphellae, secondary branches terete. Soralia apical and lateral on main branches and apical on secondary branchlets, sometimes with spinules. Apothecia unknown.

TLC: salazinic acid.

Ramalina tenella resembles *R. dendriscoi-des* in its type of soralia and in chemical properties, but differs in its shorter thallus with distinctly flattened branches and in the mode of branching. It has been sparingly collected on twigs in mangroves on the Kenyan coast and in the nearby coastal hills.



Figs. 17–18. Rules = 1 cm. Fig. 17. *Ramalina tenella* Müll. Arg., whole thallus. Fig. 18. Undescribed *Ramalina* species from the Kenyan coast, whole thallus.

Specimens examined

Kenya. Coast Province: Kilifi District, Mida Creek, edge of mangrove, 3K 29/11, 124; Kwale District, 2 km N of Gazi, in mangrove, K 44/23, 3K 30/36b, 125, 156; Kwale District, Shimba Hills, 25 km SW of Mombasa, Kivumoni Forest, 350 m, K 42/6 (admixture with *R. fecunda*).

28. *RAMALINA TRANSLUCIDA* Krog & Swinsc., see Krog & Swinscow (1974, p. 123, Fig. 18).

(29). *RAMALINA* sp. – Fig. 18.

Thallus corticolous, caespitose, rigid, to 2 cm high. Branches solid, linear, flattened, to 4 mm wide, with linear marginal pseudocyphellae and a few shorter linear laminal pseudocyphellae. Soralia absent. Apothecia apical and spurred or subapical on geniculate branches; disc flat, 4–7 mm in diameter; spores $5-6 \times 16-20 \mu\text{m}$.

TLC: undetermined substance in Rf classes 5–5–5, causing a KC+ red reaction in the medulla.

This species is undoubtedly distinct, but

more material is needed before it can be formally described. It resembles coarse, rigid forms of *R. fecunda*, but the spores come closer to those of *R. maritima*. Chemically it differs from both species.

Specimens examined

Kenya. Coast Province: Kwale District, Diani Beach, 25 km S of Mombasa, near sea level, K 40/7, 101.

ACKNOWLEDGEMENTS

We thank Mr. A. Bjørnstad, Mr. K. A. Lye, Dr. T. Pócs, Dr. R. Santesson, Dr. H. Sipman, Mr. R. C. Tapper, and Miss B. Winnem for the loan of specimens recently collected in East Africa, and the directors and curators of the following herbaria: BM, herb. Degelius, EA, G, GLAM, H, L, LD, M, PC, S, TUR, UPS, and WRS� for the loan of herbarium specimens. H. K. gratefully acknowledges the receipt of grants from NORAD and from the Norwegian Research Council for Science and the Humanities. T. D. V. S. gratefully acknowledges the receipt of grants from the Royal Society and the Linnean Society of London.

REFERENCES

- Culberson, C. F. 1969. *Chemical and Botanical Guide to Lichen Products*. Chapel Hill, N. C.
- Culberson, C. F. 1972. Improved conditions and new data for the identification of lichen products by a standardized thin-layer chromatographic method. *J. Chromatogr.* 72, 113-125.
- Culberson, C. F. & Kristinsson, H. 1970. A standardized method for the identification of lichen products. *J. Chromatogr.* 46, 85-93.
- Dodge, C. W. 1971. Some lichens of tropical Africa. V. Lecanoraceae to Physciaceae. *Beihfte Nova Hedwigia* 38, 1-225.
- Fries, T. M. 1861. Miscellanea lichenologica. *Flora* 44, 409-413.
- Imshaug, H. 1972. Typification of *Ramalina usnea* (L.) R. H. Howe. *Lichenologist* 5, 317-318.
- Krog, H. 1976. *Lethariella* and *Protousnea*, two new lichen genera in Parmeliaceae. *Norw. J. Bot.* 23, 83-106.
- Krog, H. & James, P. W. 1977. The genus *Ramalina* in Fennoscandia and the British Isles. In press.
- Krog, H. & Swinscow, T. D. V. 1974. *Ramalina* species with a hollow thallus (*Fistularia*) in East Africa. *Norw. J. Bot.* 21, 111-124.
- Krog, H. & Swinscow, T. D. V. 1975a. Parmeliaceae, with the exclusion of *Parmelia* and *Usnea*, in East Africa. *Norw. J. Bot.* 22, 115-123.
- Krog, H. & Swinscow, T. D. V. 1975b. Some *Ramalina* species with punctiform pseudocyphellae in East Africa. *Norw. J. Bot.* 22, 269-276.
- Leighton, W. A. 1871. The lichens of Ceylon collected by G. H. K. Thwaites, Esq., Ph. D., F. R. S., F. L. S., Director of Royal Botanic Garden, Peradeniya, Ceylon. *Trans. Linn. Soc.* 27, 161-185.
- Menlove, J. E. 1974. Thin-layer chromatography for the identification of lichen substances. *Brit. Lich. Soc. Bull.* 34, 3-5.
- Moore, B. J. 1968. The macrolichen flora of Florida. *Bryologist* 71, 161-266.
- Müller, J. 1890. Lichenes Africae tropico-orientalis. *Flora* 73, 334-347.
- Nylander, W. 1860. *Synopsis Methodica Lichenum* (2). Paris.
- Nylander, W. 1870. *Recognito monographica Ramalinarum*. *Bull. Soc. Linn. Normand., Ser.* 2, 4, 101-181.
- Stein, B. 1888. Ueber afrikanische Flechten. *Jahresber. Schles. Gesell. Vaterl. Cultur* 66, 133-142.
- Zahlbruckner, A. 1930. *Catalogus Lichenum Universalis, Band 6*. Leipzig.

Received 10 May 1976

Published September 1976

