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Key to *Ramalina* species known from Atlantic islands, with two new species from the Azores

Bestimmungsschlüssel für *Ramalina* Arten von den atlantischen Inseln, mit zwei neuen Arten aus den Azoren

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Key words: *Ramalina*, Azores, Atlantic, Macaronesia, island, new species.

Schlagwörter: Ramalina, Azoren, Atlantik, Makaronesien, Insel, neue Arten.

Summary: A key to all *Ramalina* species known from islands in the Atlantic ocean (from Iceland to the South Shetlands) is provided, with notes on their distribution and chemistry. All species have been illustrated with at least a habitat picture and a detail photograph (all on the same scale). Two new species from the Azores, *Ramalina azorica* and *R. wirthii*, are described. Some range extensions are reported, e.g. *R. subfarinacea* is confirmed from the Canary Isles.

Zusammenfassung: Es wird ein Bestimmungsschlüssel für alle *Ramalina* Arten für die Inseln im Atlantischen Ozean vorgestellt (von Island bis zum südlichen Shetland), mit Hinweisen zu ihrer Verbreitung und Chemie. Alle Arten sind bildlich zumindest mit einem Foto und einer Makroaufnahme (im selben Maßstab) dokumentiert. Zwei neue Arten aus den Azoren, *Ramalina azorica* und *R. wirthii*, werden beschrieben. Die Erweiterung einiger Verbreitungsgebiete wird berichtet, zum Beispiel *R. subfarinacea* konnte auf den Kanarischen Inseln bestätigt werden.

Introduction

Lichens are generally widespread in their distribution. However, there are notable exceptions to this rule: endemic lichens are especially known from isolated tropical mountains, fog-induced lichen zones in coastal deserts (Namibia, N. Chile, Baja California) and Atlantic and some Pacific Islands (like Hawaii and the Galapagos).

The lichen flora of the oceanic Islands is still rather little known, although the Canary and Cape Verde Isles and Madeira are relatively well-studied. About

500 publications are cited in a bibliography and checklist of the lichens of Macaronesia by HAFELLNER (1995) and many have appeared since, most notably a recent checklist of Azores lichens (RODRIGUES & APTROOT 2005).

The lichen flora of oceanic islands is characterized by two main elements:

1. A pan(sub)tropical element in the humid, usually upland parts. This element could contain endemics, but mainly because much of the wet vegetation has been destroyed, it generally consists of widely distributed lichens.
2. A dry mediterranean to semi-desert element, which contains numerous endemics (restricted to an island group or even a single tiny island), a phenomenon that in lichens has been observed within a few taxonomic groups only.

Endemism is low in most taxonomic lichen groups, but decidedly higher in others. In the Roccellaceae, a family which mostly occurrs in coastal regions and most abundantly on islands and coastal deserts, some genera are even endemic to small areas, like *Combea* to Namibia, *Ingaderia* to Chile and *Roccellographa* to Socotra. In the Physciaceae, two convincing endemics in an even endemic genus *(Santessonia)* occur in the Namibian desert. The genus *Xanthoparmelia* has numerous endemic species occurring in small areas of South Africa, Namibia or Australia.

By far the richest in strict and regional endemism is the genus *Ramalina*. The genus *Ramalina* is one of the larger lichen genera, with over 200 species currently accepted. Over the years, in total over 80 species have been reported from Macaronesia or one of the other islands in the Atlantic Ocean, many of which are not known outside these islands (KROG 1990, KROG & ØSTHAGEN 1980a, b). Some occur on many Atlantic Islands, others only on all or few of the islands of one archipelago. The most striking endemism is to be found on the small (much smaller than St Helena), mostly flat island of Porto Santo near Madeira: on the old volcanic cones, no less than six endemic species of *Ramalina* occur, none of which have ever been found elsewhere (KROG 1990, KROG & ØSTHAGEN 1980b). Many reported species are not currently accepted from the area for various reasons, often because the identification with a species from outside the area proved wrong, occasionally because the species is not separated any more from another species, which applies chiefly to chemical races.

Our recent study of numerous collections from all Atlantic islands, but especially from the Azores, Ascension and St Helena (APTROOT 2008), led us to the realization that several species from these islands are yet undescribed. In order to evaluate the status of the new species, we studied specimens of nearly all species occurring in the region. We noticed that none of the available keys treated more than half of the relevant species, and that several species had never been included in any identification key. Other species were difficult to identify when they were not growing on their usual substratum. In the process, we

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drafted an identification key that does not rely on substratum or chemistry as a primary identification tool. We included all species known to occur on an island in the Atlantic Ocean, ranging from Iceland to the Falklands, including Great Britain but excluding some tropical islands of the African or American coast. Two new species which are common on the Azores are described to science for the first time; a few further new species from St Helena are treated in the key, but will be described elsewhere (APTROOT 2008). We hope that this key synthesizes all reliable records from the region and presents them in a rather concise way.

Materials and Methods

This study is largely based on material collected on field trips by the authors to all island groups mentioned except the Selvagem Islands, the Cape Verdes and the subantarctic islands, augmented by specimens from various other collectors, most notably G. FOLLMANN and B. MIES from the Cape Verdes. About 500 *Ramalina* specimens from the region (mostly in ABL) were investigated morphologically. In addition, about 500 specimens in ABL from the rest of the world, representing the majority of the known species, have been studied for comparison. A large selection of specimens has been investigated for cortical and medullary chemistry by thin layer chromatography using TDA.

Species concept

Although there have been some different perceptions of the species concept in the past in the genus *Ramalina,* there is now a general agreement about the species concept, which is predominantly morphological, allowing for some chemical variation, and ideally based on field observation of co-occurrences. The main disagreement seems to be about the desirability to name chemically deviant populations as varieties, as is done by e.g. STEVENS (1987) or to number the chemical races, as is done by e.g. KASHIWADANI & KALB (1993), or to cite the variation in this character without distinguishing strains, as is the common practice which is also followed here. The acceptance of even relatively small morphological difference as species character, especially when co-occurring with the closest relatives, is shown well by e.g. KASHIWADANI & NASH (2004), who raise previous morphological varieties to species level, and by two recently distinguished morphologically clearcut endemics from Hong Kong by APTROOT & SIPMAN (2001).

While chemistry alone is not taken as a distinguishing species character, it does help to characterize and to some extent to distinguish between species. Even more surprising is the fact that a certain chemistry is often prevalent in a certain region. The Galapagos *Ramalina* flora, for instance, is dominated by spe-

cies containing salazinic acid, often with sekikaic or divaricatic acid as accessory or replacement substance (APTROOT & BUNGARTZ 2007). This can already be observed to some extent in the field: salazinic acid turns red when decaying, and dying parts of the lichen thalli, often including the attachment zone, can be observed to turn red while the remaining part of the thallus is still viable. Detailed calculations in Australia (STEVENS 1987) show that the predominance of salazinic acid in *Ramalina* is related with proximity to the tropics; on higher latitudes first sekikaic and divaricatic acids dominate, and at even Southern higher latitudes psoromic, boninic and cryptochlorophaeic acids become noticeable. On higher Northern latitudes in Australia species and strains with bourgeanic, hypoprotocetraric and protocetraric acids become common, which is more in accordance with Macaronesia.

The genus *Ramalina* and segregate genera

The genus *Ramalina* is a large, but undoubtedly monophyletic group, characterized within the family Bacidiaceae by the fruticose thalli containing usnic acid and the one-septate, often bent ascospores. Several groups of species have in the past been segregated from the large genus *Ramalina*. Most of these genera, like *Desmaziera, Dievernia, Fistulariella, Ramalinopsis, Trichoramalina* and *Vermilacina*, were essentially based on one character, and eventually found to combine apparently non-related species. The genus *Niebla* may encompass a possibly monophyletic group of species, at least when all the species mentioned in the key as belonging to the genus, some of which have so far been overlooked by the mostly American workers on this group, are included. However, it undoubtedly leaves the remainder of the genus *Ramalina* an undesirably paraphyletic and possibly even also polyphyletic group (e.g. in case the bourgeanic acid-containing *Ramalinas* that are not in *Nieblas* are actually an ingroup of *Niebla)*. It is also surpising how opinions differ on these taxa: *R. subwebbiana* is not even recognized as a different species by KROG & ØSTHAGEN (1980a), but it has been combined in Niebla, while the species it included in by KROG & ØSTHAGEN (1980a), *R. decipiens*, does not belong to this segregate.

Description of new species

1. *Ramalina azorica* APTROOT & SCHUMM spec. nov.

Ramalina saxicola, thallo laciniis applanatis, tortuosis, pseudocyphellatis, acidis divaricaticis continens.

Type: Azores, Sao Miguel, Ponta da Ferraia, 1 m alt., 4 June 2003, F. SCHUMM 11104 (B–holotype; ABL, Hb SCHUMM–isotypes).

Thallus dull, shrubby, consisting of dense groups of 5-25 branches rooting in a common, often blackish base, up to 11 cm long, upright to hanging, green-

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ish to yellowish grey, somewhat fragile, rather variable in branching pattern, with very few antler-like branches or with dense branches that become terete towards the tips, with wrinkled surface, cartilaginous strands reaching the surface and forming lines of pseudocyphellae, branches in section flattened, partly distinctly cork-screwlike contorted, up to c. 5 mm diam, but usually much thinner; soredia absent; apothecia marginal, 2-4 mm diam, flat to convex, ascospores 1-septate, hyaline, straight to slightly bent, 8.8-12 × 3.3-4.4 µm; pycnidia submarginal, pale; medulla C–, K–, P–, UV+white (divaricatic acid and unknown pigment); cortex with usnic acid.

Known only from coastal rock and on lava of walls along coastal fields on the Azores islands of Pico, Terceira, Faial and Sao Miguel, where it is locally abundant. See the key for distinction from similar species.

Selected specimens: Pico, Madalena, July 1986, A. APTROOT 16486 (ABL); Pico, Lages, 19 August 2003, A.F. RODRIGUES (ABL); Faial, Laginha 4km W of Horta, July 1986, A. APTROOT 16427 (ABL); Terceira, Feteira, Serra de Esperanca, 8 June 1978, P.W. JAMES (BM, ABL); Terceira, Negrito, 12 July 2003, A.F. RODRIGUES (ABL); Terceira, Cinco Ribieras, Sept. 1992, B. KLÜCK (ABL); Sao Miguel, Ponta do Rosto de Cao near San Roque, 5 km E of Ponta Delgada, July 1986, A. APTROOT 16205 (ABL); Sao Miguel, Agua de Pau, F. SCHUMM 10610 (Hb SCHUMM, ABL).

2. *Ramalina wirthii* APTROOT & SCHUMM spec. nov.

Ramalina saxicola, thallo laciniis dense ramosis, pseudocyphellatis, acidis salazinicis et saepe protocetraricis continens.

Type: Azores, Sao Miguel, Ponta da Ferraia, 1 m alt., 4 June 2003, F. SCHUMM 11114 (B–holotype; ABL, Hb SCHUMM–isotypes).

Thallus dull, shrubby, consisting of dense groups of branches rooting in a common base, up to 6 cm long, upright to hanging, greenish to yellowish grey, somewhat fragile, rather variable in branching pattern, but usually with many dense branches that become terete, and often very thin and somewhat curled towards the tips, with wrinkled surface, cartilaginous strands numerous, partly reaching the surface and forming dots or small lines of pseudocyphellae, branches mostly flattened, partly irregularly rounded, up to c. 2 mm diam, base usually much thinner, c. 1 mm diam; soredia absent; apothecia laminal, rare, not well developed, ascospores not seen; pycnidia laminal, pale, surrounded by thallus warts; medulla C–, K+red, P+red, P–, UV– (salazinic ± protocetraric acid); cortex with usnic acid.

Known only from coastal rock and on lava of walls along coastal fields on the Azores islands of Pico, Graciosa and Sao Miguel, where it is locally abundant. See the key for distinction from similar species.

This species is named in honour of our friendly colleague lichenologist Volkmar WIRTH.

Selected specimens: Pico, Madalena, July 1986, A. APTROOT 16480 (ABL); Graciosa, Lugar das Fontes, 8 June 2004, R. CUNHA (ABL); Graciosa, Saida do Tunez, 9 June 2004, R. CUNHA (ABL); Sao Miguel, Ponta da Ferraia, 4 June 2003, F. SCHUMM 11115 & 11118 (ABL, Hb SCHUMM).

Key to *Ramalina* species known from Atlantic islands

This key covers all accepted species known to occur on an Atlantic island; doubtful records are omitted and only a few synonyms are mentioned. The world distribution is indicated, with endemic signifying that it is not known outside the Atlantic islands. The distribution is specified for the following islands and island groups: Iceland (I), Great Britain (GB), Azores (Az), Madeira (M), Selvagem Islands (SI), Canary Islands (CI), Cape Verdes (CV), Ascension (As), St Helena (SH), South Georgia (SG), South Orkney Is (SO), South Sandwich Is (SS). No *Ramalina* species are known from the following islands within the same region: Saint Paul (SP), Tristan da Cunha (TC) and Gough (G). The key is largely based on morphological characters, but some indication of the habitat (saxicolous, corticolous or both) is indicated at every species by the codes sax and/or cort, as well as the main general medullary spot reactions and secondary metabolites.

1 Thallus sorediate, granular or isidiate (when in doubt, try this alternative first) 2
Thallus lacking soredia, preformed granules and isidia, sometimes with preformed terminal hooks or schizidia 17

2 Lobes hollow throughout, terete; soralia apical. W. European, GB, M, CI, sax, C–, K+r, P+r, UV– (salazinic). ..... ***R. portuensis*** SAMP.
Lobes at least mostly solid 3

3 Thallus locally hollow, breaking open to reveal soredia or granules 4
Thallus entirely solid 6

4 Thallus without preformed perforations; soredia fine. Nearly cosmopolitan, GB, Az, M, CI, CV, SH, cort (sax), C–, K–, P–, UV+w (divaricatic) ..... ***R. canariensis*** J. STEINER
Thallus with numerous preformed perforations; soredia granular to corticate 5

5 Perforations mainly through one cortex towards the interior. Endemic, CI, sax, C–, K+r, P+r, UV– (salazinic ± protocetraric) .... ***R. tortuosa*** KROG & ØSTH.
Perforations breaking through the whole thallus. (Sub)antarctic, SG, SO, SS, sax, C–, K–, P–, UV– (nil) ..... ***R. terebrata*** HOOK.F. & TAYLOR

6 Thallus with granular isidia following lines of pseudocyphellae. N. Hemispheric, GB, sax, C–, K–, P–, UV– (nil) ..... ***R. polymorpha*** (LILJ.) ACH.

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Soredia farinose to granular, or marginal if isidia-like 7

7 Soralia on ends of upright lobes, capitate. European, GB, M, CI, sax, C–, K–, P–, UV– (nil). ..... ***R. capitata*** (ACH.) NYL.
(incl. Macaronesian records of *R. polymorpha*)
Soralia laminal and/or marginal 8

8 Thallus flattened throughout 9
Thallus terete in parts, either near the basis and/or at the tips 14

9 Soredia in delimited, mostly marginal, soralia; medulla usually K+r, P+r 10
Soredia diffuse, laminal, marginal and/or near lobe tips; medulla K–, P– 12

10 Holdfast spreading, forming swards. W. European, I, GB, CI, sax, C–, K+y>r, P+r, UV– (norstictic, protocetraric and/or salazinic) ..... ***R. subfarinacea*** (NYL. ex CROMB.) NYL.
Holdfast single, forming discrete tufts or isolated thalli 11

11 Thallus without striations. N. Hemispheric, GB, Az, M, CI, CV, cort (sax), C–, K+r, K±or or K–, P+r or P–, UV+w or UV– (hypoprotocetraric, protocetraric, salazinic or nil) ..... ***R. farinacea*** (L.) ACH.
Thallus striate. Pantropical, As, SH, cort (sax), C–, K+ pink or K–, P–, UV+w (divaricatic) ..... ***R. nervulosa*** (MÜLL. ARG.) des Abb.

12 Lobes strap-like, up to 5 mm wide, shiny, lacking reticulations. N. Hemispheric, GB, sax/cort, C–, K–, P–, UV+w or UV– (evernic or nil) ..... ***R. pollinaria*** (WESTR.) ACH.
Lobes flabellate, at the basis often over 1 cm wide 13

13 Thallus soft, lobe tips broad or much divided into slender laciniae, reticulate ridged below. Nearly cosmopolitan, GB, Az, M, CI, CV, As, SH, cort (sax), C–, K–, P–, UV– (bourgeanic) ..... ***R. lacera*** (WITH.) J.R. LAUNDON *(= R. duriaei)*
Thallus firm, lobe tips broad, reticulate ridged above and below. African-Arabian, Az, CI, CV, sax, C–, K+y>r or K+r, P+r, UV– (bourgeanic and salazinic or norstictic) ..... ***R. maciformis*** (DELILE) BORY *(= R. evernioides)*

14 Thallus mostly terete to angular, also in parts that are over 1 mm thick. Endemic, SH, sax, C–, K+Y>r or K–, P+r, UV– (norstictic or protocetraric) ..... ***R. rigidella*** APTROOT
Thallus only terete in thinner parts 15

15 Thallus densely branched, laciniae generally tapering. Cosmopolitan, Az, M, CI, CV, As, SH, sax, cort, C–, K–, P–, UV– (sekikaic ± homosekikaic) ..... ***R. peruviana*** ACH.
Thallus sparingly and very irregularly branched 16

16 Soredia mostly in delimited soralia. Endemic, M, sax, C–, K–, P–, UV+w (divaricatic) ..... ***R. erosa*** KROG

Soredia irregularly formed, mostly marginal. Mediterranean, Az, M, CI, CV, sax, C–, K–, P–, UV+w (divaricatic)..... ***R. requienii*** (DE NOT.) JATTA

17 Thallus inflated and hollow (when in doubt, try this alternative first)..... 18
Thallus solid, if inflated than filled with medulla..... 25

18 Lobes with irregular, small blackened parts, without pseudocyphellae. W. European, Az, M, CI, CV, cort, C–, K+r or K–, P+r or P–, UV– (salazinic, divaricatic and/or sekikaic).....***R. pusilla*** LE PRÉV. ex DUBY
Lobes usually without irregular blackened parts, when blackened, also with pseudocyphellae 19

19 Lobes unevenly inflated; saxicolous species 20
Lobes of generally even width; corticolous species 23

20 Thallus rigid, with a distinct, delimited holdfast, in general upright. Endemic, Az, CI, CV, sax, C–, K–, P–, UV+w (divaricatic)..... ..... ***R. deminuta*** KROG & ØSTH.
Thallus soft, without a delimited holdfast, often creeping; pycnidia absent . 21

21 Thallus mostly becoming open at lower surface. Endemic, M, sax, C–, K–, P–, UV+w (divaricatic) .....***R. confertula*** KROG & ØSTH.
Thallus mostly closed below 22

22 Lobes perforated mainly at the tips; apothecia unknown. Endemic, CI, sax, C–, K–, P–, UV+w (divaricatic) .....***R. parva*** KROG & ØSTH.
Lobes irregularly perforate, becoming fenestrate; apothecia common. Endemic, CI, sax, C–, K+r or K–, P+r or P–, UV– (sekikaic ± salazinic)..... .....***R. pitardii*** HUE

23 Lobes mostly filled with arachnoid medulla, flabellate, usually over 3 mm wide. N. Hemispheric, GB, M, CI, cort, C–, K–, P–, UV– (evernic)..... ..... ***R. fastigiata*** (PERS.) ACH.
Lobes hollow, of generally even width, often under 3 mm wide 24

24 Thallus rather firm; lobe cavity partly closed. Possibly a chemical race of the next species. W. European, Az, M, CI, CV, cort, C–, K–, P–, UV+w (divaricatic; often salazinic or protocetraric in apothecium margin and there K+r, P+r) ..... ***R. subgeniculata*** NYL.
Thallus fragile; lobe cavity open, tube-like. Palaeotropical, Az, M, CI, CV, cort, C–, K+r, P+r, UV– (salazinic)..... ***R. subpusilla*** (NYL.) KROG & SWINSCOW

25 Thallus at least partly terete or angular 26
Thallus flattened throughout or irregularly inflated 34

26 Thallus densely striate, with linear pseudocyphellae and/or pale decolourations..... 27

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Thallus not striate; pseudocyphellae usually absent or sparse, if abundant, than not predominantly linear 29

27 Medulla without chondroid tissue. African-Arabian, M, CI, CV, As, SH, sax, cort, C–, K+y>r or K–, P+r or P–, UV– (norstictic or nil) ..... ***R. arabum*** (ACH.) MEYEN & FLOT. *(= R. rubrotincta)*
Medulla largely filled with chondroid tissue 28

28 Thallus without a delimited holdfast, mostly terete, up to 0.8 mm wide. Endemic, CI, sax, C–, K±or, P+r, UV– (protocetraric) ..... ***R. pluviariae*** KROG & ØSTH.
Thallus with a delimited holdfast, usually partly flattened and partly over 1 mm wide. Endemic, M, sax, C–, K+r or K±or, P+r, UV– (protocetraric or salazinic) ..... ***R. nematodes*** KROG & ØSTH.

29 Lobe tips mostly perpendicular, hook-shaped 30
Lobe tips not hook-shaped 32

30 Thallus mostly terete; pseudocyphellae absent or inconspicuous. W. European, GB, Az, M, CI, As, cort, sax, C–, K–, P–, UV+w or UV– (homosekikaic or nil) ..... ***R. chondrina*** J. STEINER
Thallus mostly angular; pseudocyphellae linear 31

31 Pycnidia absent; pseudocyphellae scarce. Endemic, CI, sax, C–, K+r, P+r, UV– (salazinic) ..... ***R. hamulosa*** KROG & ØSTH.
(this species belongs in the genus *Niebla* if the genus is accepted)
Pycnidia abundant, pale; pseudocyphellae abundant. Endemic, Az, sax, C–, K+r, P+r, UV– (salazinic ± protocetraric) ..... ***R. wirthii*** SCHUMM & APTROOT

32 Lobe tips very thin, irregularly constricted (nodulose). Endemic, CI, sax, C–, K–, P–, UV+w or UV– (sekikaic or divaricatic) ..... ***R. nodosa*** KROG & ØSTH.
Lobe tips not nodulose 33

33 Medulla largely filled with chondroid tissue; branches up to 0.8 mm wide. Endemic, M, sax, C–, K+r, P+r, UV+w (salazinic and divaricatic) ..... ***R. jamesii*** KROG
Medulla without strands of chondroid tissue; main branches generally over 0.8 mm wide. Endemic, M, sax, C–, K–, P–, UV+w (divaricatic) ..... ***R. timdaliana*** KROG

34 Thallus at least partly strongly canaliculated 35
Thallus not strongly canaliculated 37

35 Thallus pendulous, generally under 2 mm wide, branched in all directions. SW. European, CI, sax (cort), C–, K–, P–, UV– (nil) ..... ***R. hierrensis*** KROG & ØSTH.
Thallus not pendulous, branched in one plane 36

36 Thallus branches over 2 mm wide; pseudocyphellae laminal though indistinct. N. Hemispheric, GB, cort, C–, K–, P–, UV– (sekikaic or nil) .... ***R. calicaris*** (L.) FR.
Thallus branches generally under 2 mm wide; pseudocyphellae mostly marginal. SW. European, Az, CI, cort, C–, K+y>r, K+r, K±or or K–, P+r or P–, UV+w or UV– (hypoprotocetraric, protocetraric, salazinic, norstictic or nil) .... ***R. implectens*** NYL.

37 Lobes at least partly inflated, mostly filled with arachnoid medulla;. W. European, I, GB, sax, C–, K+r, K±or or K–, P+r or P–, UV+w or UV– (hypoprotocetraric, protocetraric, salazinic or nil) ..... ***R. siliquosa*** (HUDS.) A.L. SM.
Lobes flat 38

38 Thallus with laminal pseudocyphellae and/or linear striae 39
Thallus without laminal pseudocyphellae, not striate 45

39 Lobes reticulate-lacunose; pseudocyphellae round to oval. N. Hemispheric, GB, cort, C–, K–, P–, UV– (nil) ..... ***R. fraxinea*** (L.) ACH.
Lobes not lacunose; pseudocyphellae linear 40

40 Thallus very stiff; medulla with chondroid strands. Endemic, M, CI, CV, SH, sax, C+pink or C+or, K–, P–, UV– (lĕcanoric or 4-O-demethylbarbatic) .... ***R. maderensis*** MOTYKA
Thallus less stiff; chondroid strands only below the cortex 41

41 At least some lobes corkscrew-like contorted 42
Lobes not contorted 43

42 Laciniae richly branched and widening towards the tips after each branching. Endemic, SH, sax, C–, K+y>r or K–, P+r or P–, UV– (norstictic or nil) .... ***R. ketner-oostrae*** APTROOT
Laciniae little branched and not widening towards the tips after each branching. Endemic, Az, sax, C–, K–, P–, UV+w (divaricatic) .... ***R. azorica*** SCHUMM & APTROOT

43 Pseudocyphellae mostly in the basal parts of the thallus. Endemic, CI, CV, sax, C–, K+r or K±or, P+r, UV– (salazinic or protocetraric) .... ***R. decipiens*** MONT.
Pseudocyphellae covering most of the thallus 44

44 Thallus bent at an apothecium insertion; apothecia generally over 1 mm diam. Endemic, SH, sax, C–, K±or or K–, P+r or P–, UV– (boninic and protocetraric or nil) ..... ***R. geniculatella*** APTROOT
Thallus not bent at an apothecium insertion; apothecia generally under 1 mm diam. Endemic, SH, sax, C–, K±or or K–, P+r or P–, UV+ w or UV– (boninic and protocetraric or divaricatic or nil) ..... ***R. sanctae-helenae*** APTROOT

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45 Thallus papery thin and/or mostly rather soft, not conspicuously thickened in the basal part 46
Thallus relatively thick and stiff, especially towards the basal part, where it is less than 4 times as wide as thick 48

46 Thallus soft, flexuous, without chondroid strands, often reticulate. Mediterranean, CI, CV, sax, cort, C–, K–, P–, UV– (bourgeanic) ..... ***R. mollis*** KROG & ØSTH.
Thallus papery, but not flexuous, with chondroid strands, not reticulate 47

47 Thallus monophyllous, little branched, without overlapping lobes; apothecia terminal. Mediterranean, Az, cort, C–, K–, P–, UV+w or UV– (divaricatic or nil) ..... ***R. lusitanica*** H.MAGN.
Thallus polyphyllous from a common holdfast, branched with overlapping lobes; apothecia lateral or marginal. Endemic, CI, CV, cort, C–, K–, P–, UV+w or UV– (divaricatic or nil) ..... ***R. huei*** HARM.

48 Chondroid tissue adjourning the cortex, visible from the outside as nerve-like depressions in the cortex; thallus shiny, often only shallowly foveate-reticulate towards the base; thallus tips and margins partly black. Endemic, CI, sax, C–, K+r or K±or, P+r, UV– (salazinic or protocetraric) ..... ***R. subwebbiana*** (NYL.) HUE (= *Niebla subwebbiana)*
Chondroid tissue in the medulla; thallus usually dull, often strongly reticulate, without black tips 49

49 Laciniae richly branched and widening towards the tips after each branching. Endemic, M, CI, sax, C–, K+r or K–, P+r or P–, UV– (salazinic, protocetraric and/or bourgeanic) ..... ***R. crispatula*** DESPR. ex NYL. (= *Niebla crispatula)*
Laciniae little branched and not widening towards the tips after each branching 50

50 Lobes nearly linear, not or not strongly reticulate 51
Lobes cuneate or flabellate, at least partly strongly reticulate 53

51 Thallus bases usually shiny black; thallus mostly smooth. W. European, GB, sax, C–, K+y, K+y>r or K–, P+or, P+r or P–, UV– (norstictic, stictic or nil) ..... ***R. cuspidata*** (ACH.) NYL.
Thallus bases matt, not black; thallus somewhat ridged 52

52 Lobes reticulate; pseudocyphellae on the ridges. Endemic, M, sax, C–, K+r, P+r, UV– (salazinic) ..... ***R. portosantana*** KROG
(this species belongs in the genus *Niebla* if the genus is accepted)
Lobes transversely cracked only; pseudocyphellae marginal. Endemic, CI, sax, C–, K+r or K±or, P+r, UV– (protocetraric ± salazinic) ..... ***R. webbii*** MONT. (= *Niebla webbii)*

53 Lobes cuneate; apothecia mostly laminal. Possibly intergrading into the next species. Mediterranean-African, Az, M, CI, CV, sax, C–, K+r or K–, P+r or P–, UV– (salazinic and/or bourgeanic) ..... ***R. bourgaeana*** MONT. ex NYL. (= *Niebla bourgaeana;* not identical with the extra-limital (Mediterranean) *R. rosacea,* with which it is often synonymized and which is a further species that belongs in the genus *Niebla* if the genus is accepted)

Lobes flabellate; apothecia mostly apical. Endemic, Az, M, SI, CI, CV, sax, C–, K+y>r, K+r, K±or or K–, P+r or P–, UV+w or UV– (bourgeanic or norstictic ± bourgeanic or protocetraric or salazinic ± bourgeanic) .... ***R. cupularis*** KROG & P.JAMES (= *Niebla cupularis)*

Acknowledgements

Leo SPIER is warmly thanked for performing TLC on many specimens.

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Annex

Fig. 2 on page II

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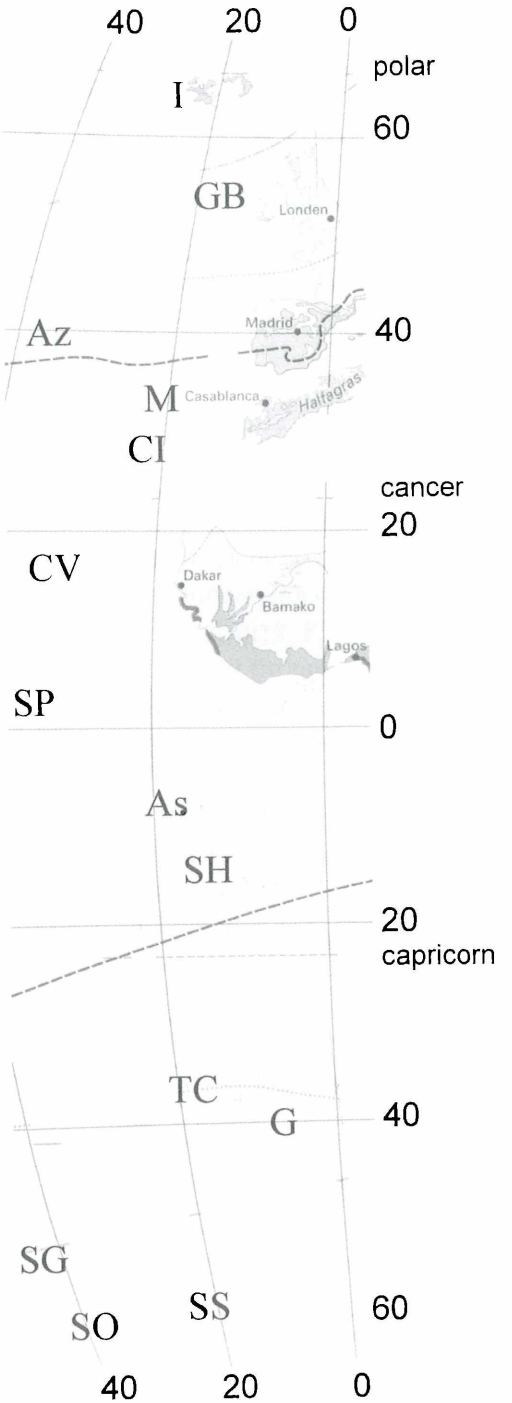

Fig. 1: Explanation of map

Islands: Iceland (I), Great Britain (GB), Azores (Az), Madeira (M), Selvagem Islands (SI), Canary Islands (CI), Cape Verdes (CV), Saint Paul (SP), Ascension (As), St Helena (SH), Tristan da Cunha (TC), Gough (G), South Georgia (SG), South Orkney Is (SO), South Sandwich Is (SS).

dashed line: palm limits

dotted line: wine limits

dot/dashed line: cereal limits

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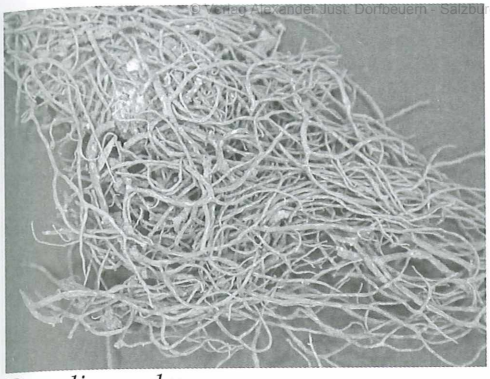
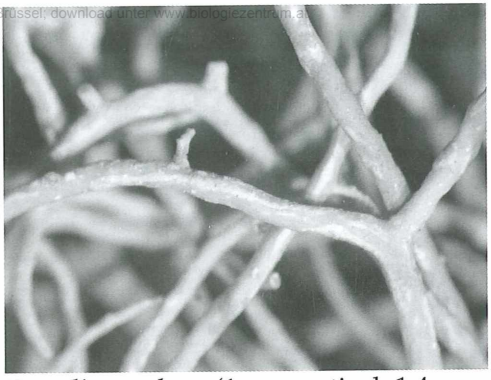
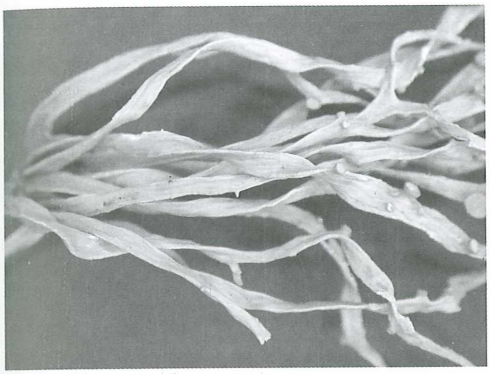


Ramalina arabum

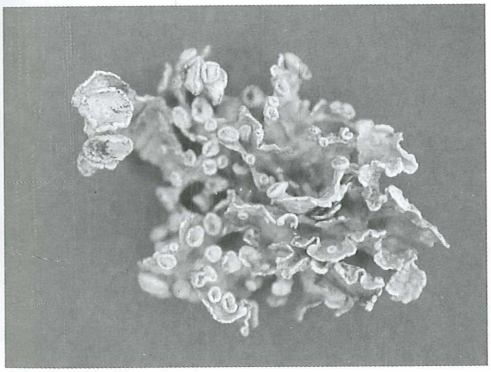


Ramalina arabum (1 cm vertical, 1.4 cm horizontal)



Ramalina azorica

Ramalina azorica (1 cm vertical, 1.4 cm horizontal)



Ramalina bourgaeana

Ramalina bourgaeana (1 cm vertical, 1.4 cm horizontal)

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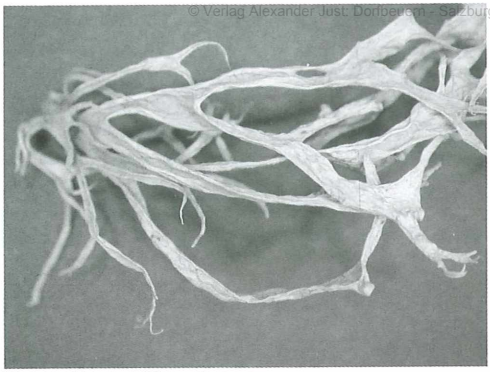
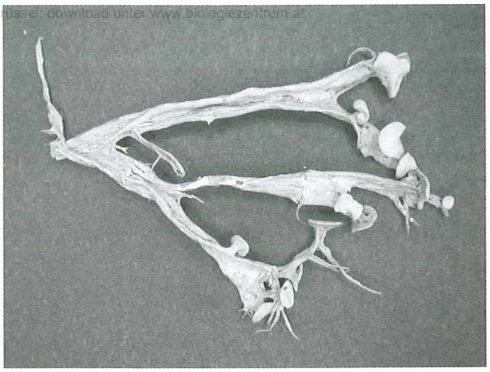
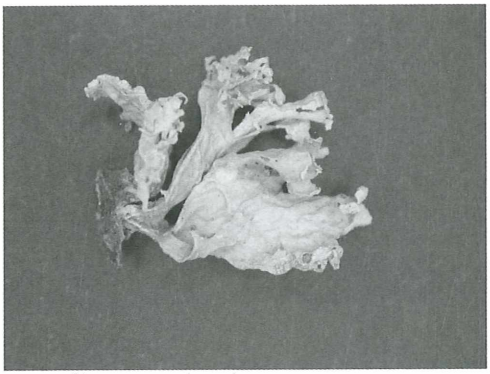


Ramalina calicaris

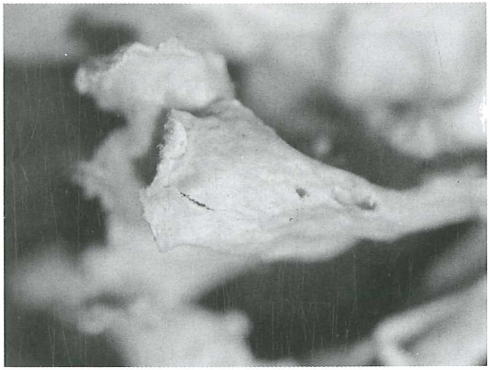


Ramalina calicaris

Ramalina calicaris (1 cm vertical, 1.4 cm horizontal)



Ramalina canariensis



Ramalina canariensis (1 cm vertical, 1.4 cm horizontal)

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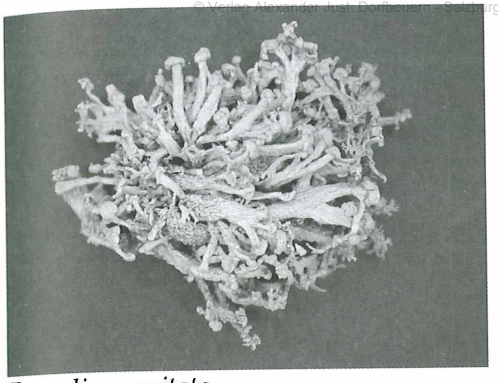
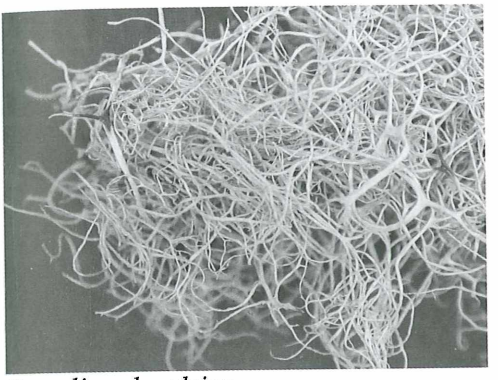


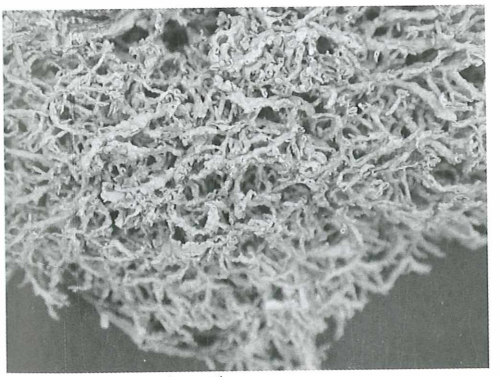
Ramalina capitata

Ramalina capitata (1 cm vertical, 1.4 cm horizontal)



Ramalina chondrina

Ramalina chondrina (1 cm vertical, 1.4 cm horizontal)



Ramalina confertula

Ramalina confertula (1 cm vertical, 1.4 cm horizontal)

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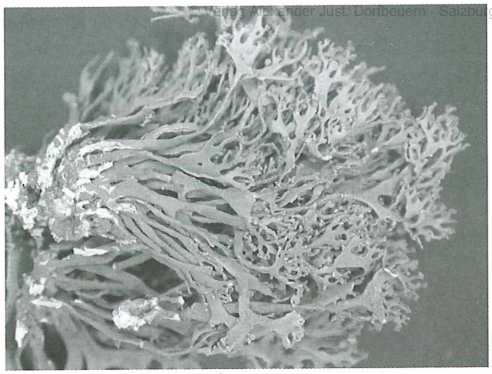
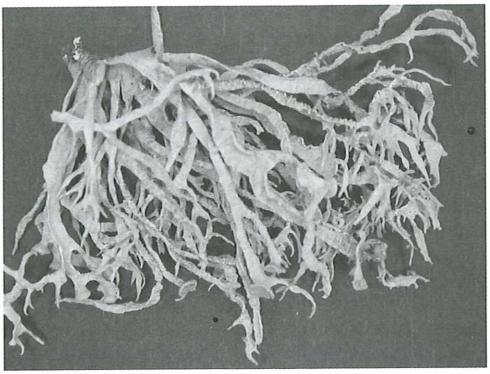
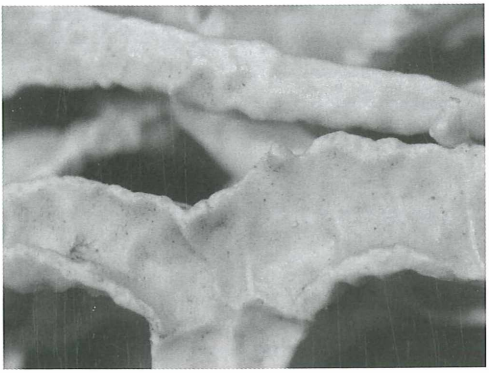


Ramalina crispatula

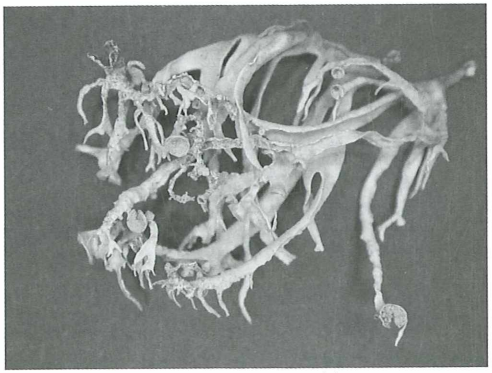
Ramalina crispatula (1 cm vertical, 1.4 cm horizontal)



Ramalina cupularis



Ramalina cupularis (1 cm vertical, 1.4 cm horizontal)



Ramalina cupularis (smooth)

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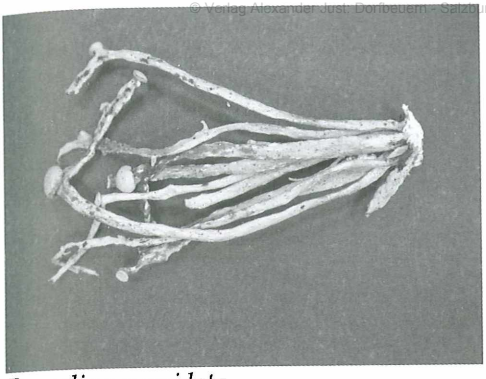
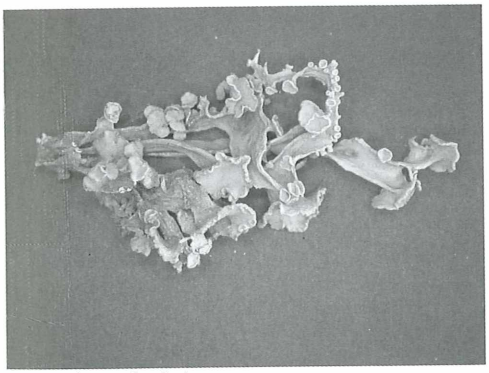


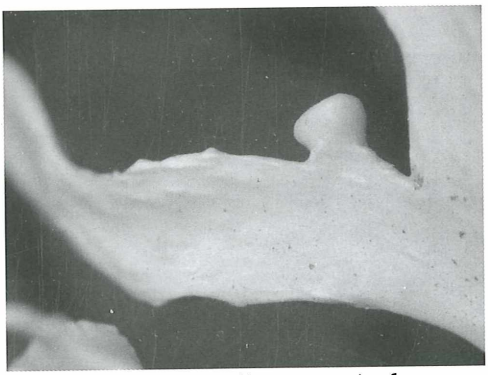
Ramalina cuspidata

Ramalina cuspidata (apothecium)

Ramalina cuspidate (tip)



Ramalina decipiens



Ramalina decipiens (1 cm vertical, 1.4 cm horizontal)

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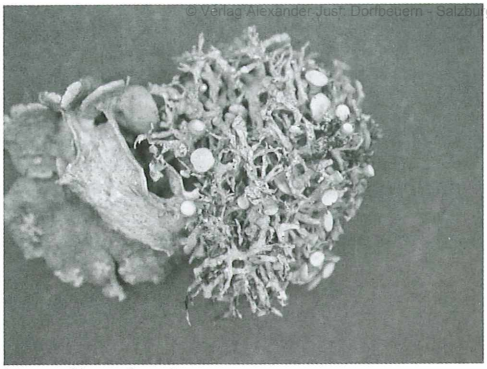
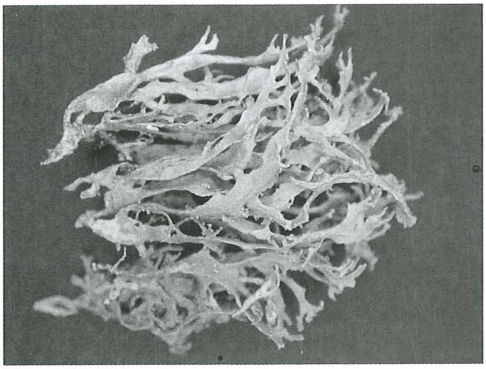
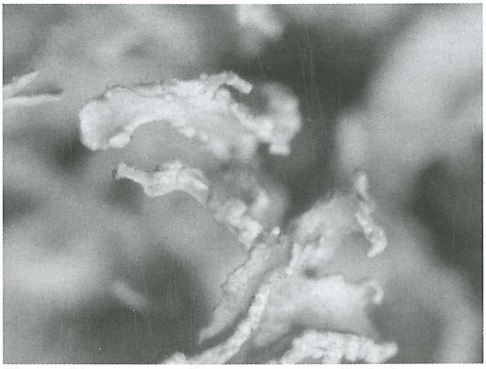


Ramalina deminuta

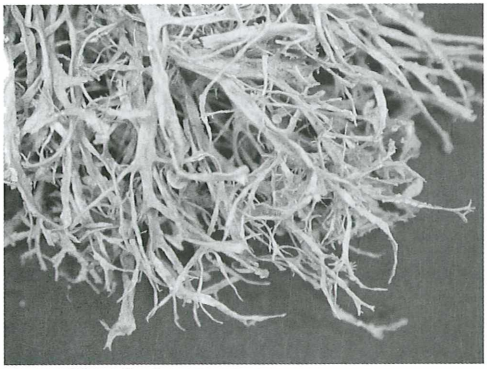
Ramalina deminuta (1 cm vertical, 1.4 cm horizontal)



Ramalina erosa



Ramalina erosa (1 cm vertical, 1.4 cm horizontal)



Ramalina farinacea

Ramalina farinacea (1 cm vertical, 1.4 cm horizontal)

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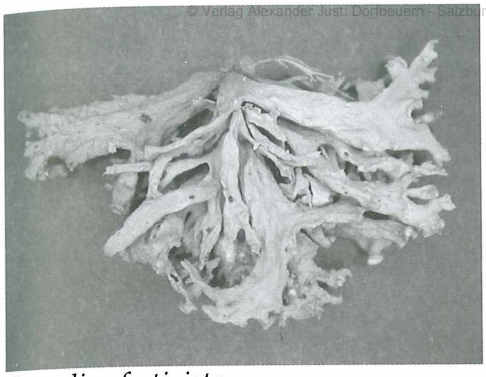
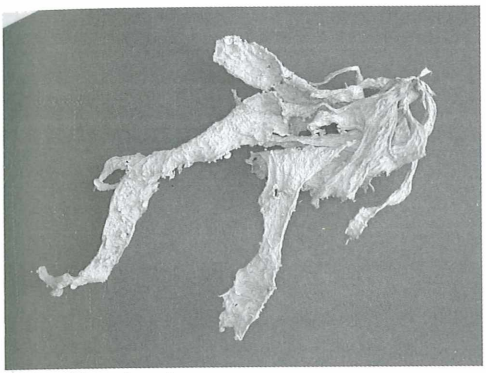


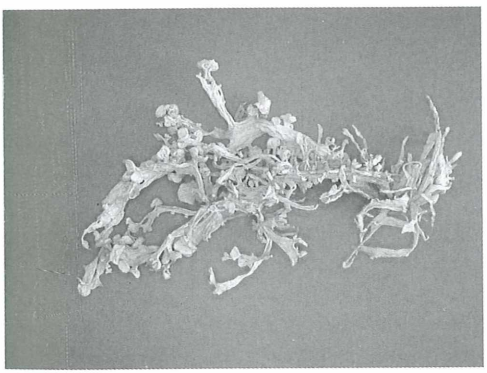
Ramalina fastigiata

Ramalina fastigiata (1 cm vertical, 1.4 cm horizontal)



Ramalina fraxinea

Ramalina fraxinea (1 cm vertical, 1.4 cm horizontal)



Ramalina fraxinea (slender)

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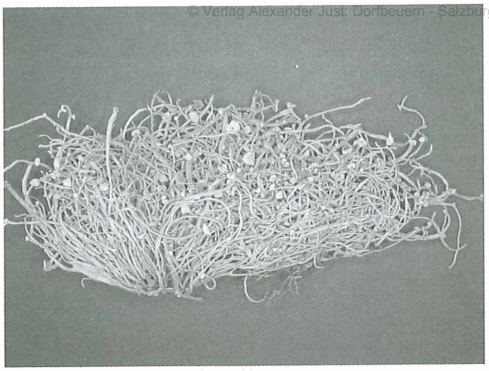
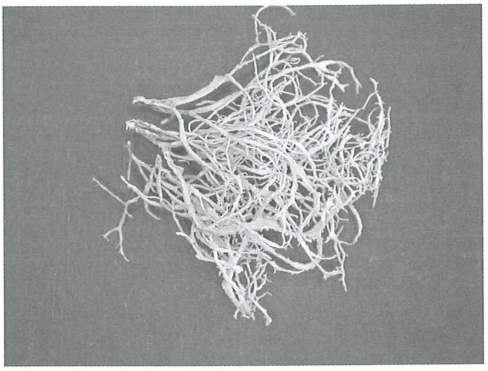


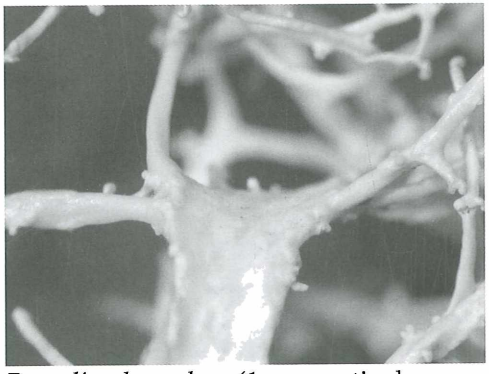
Ramalina geniculatella

Ramalina geniculatella (apothecium)

Ramalina geniculatella (1 cm vertical, 1.4 cm horizontal)



Ramalina hamulosa



Ramalina hamulosa (1 cm vertical, 1.4 cm horizontal)

Ramalina hamulosa (tip, 1 cm vertical, 1.4 cm horizontal)

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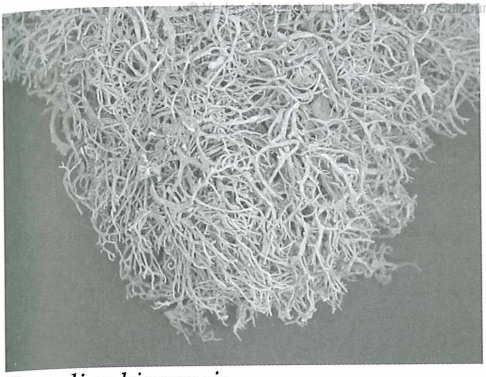
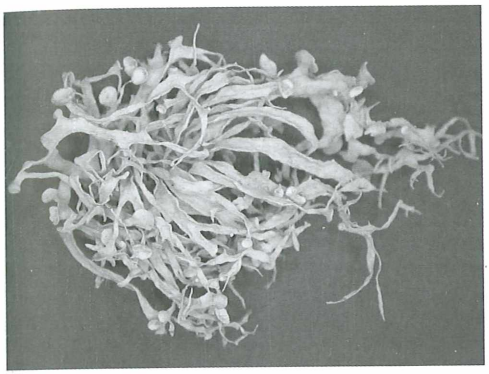


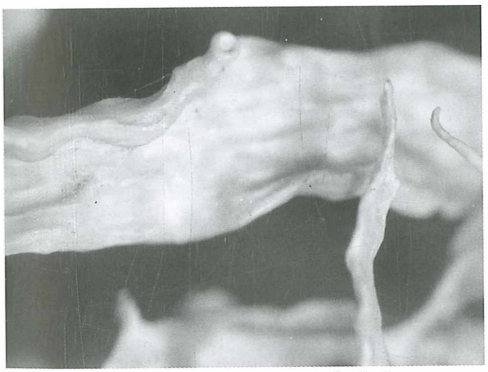
Ramalina hierrensis

Ramalina hierrensis (1 cm vertical, 1.4 cm horizontal)



Ramalina huei

Ramalina huei (apothecium, 1 cm vertical, 1.4 cm horizontal)



Ramalina huei (1 cm vertical, 1.4 cm horizontal)

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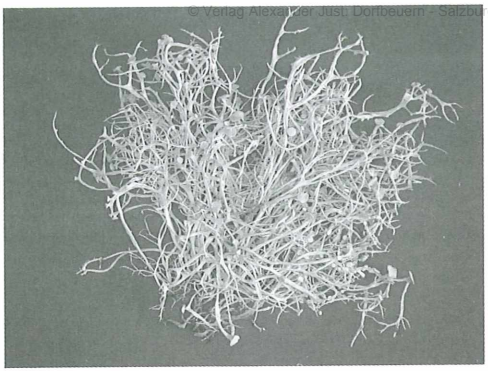
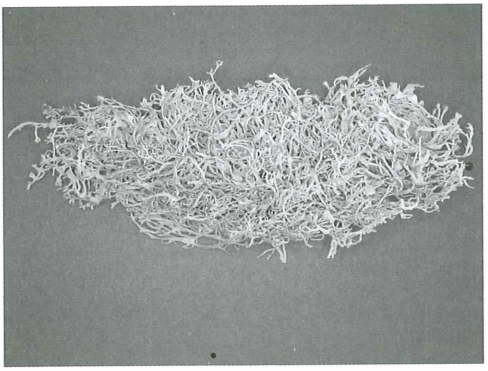


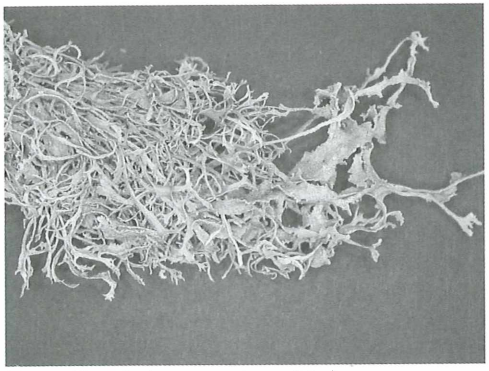
Ramalina implectens

Ramalina implectens (1 cm vertical, 1.4 cm horizontal)



Ramalina ketner-oostrae

Ramalina ketner-oostrae (1 cm vertical, 1.4 cm horizontal)



Ramalina ketner-oostrae (tip)

Ramalina ketner-oostrae (tip, 1 cm vertical, 1.4 cm horizontal)

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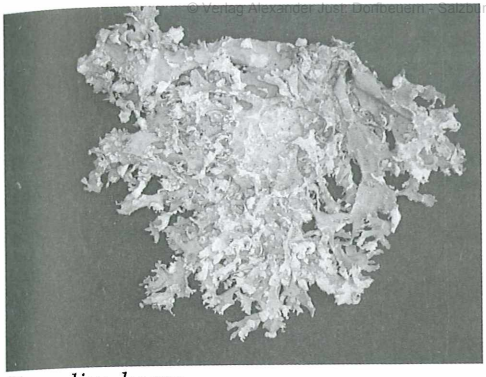
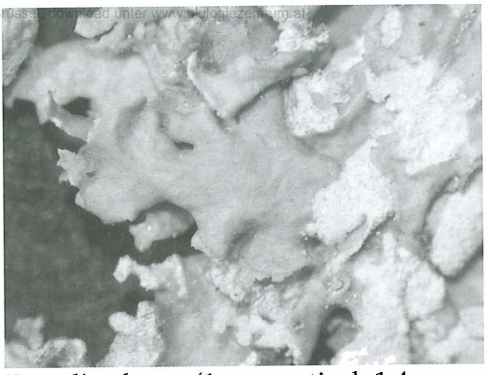
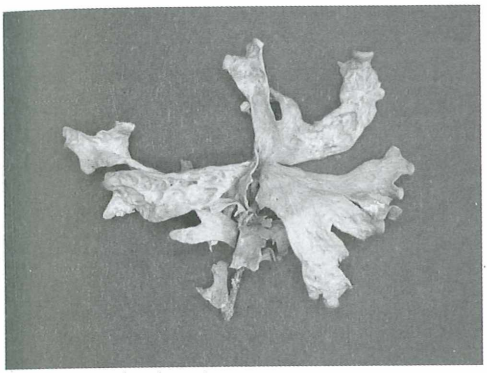


Ramalina lacera



Ramalina lacera (1 cm vertical, 1.4 cm horizontal)



Ramalina lusitanica

Ramalina lusitanica (apothecium, 1 cm vertical, 1.4 cm horizontal)

Ramalina lusitanica (1 cm vertical, 1.4 cm horizontal)

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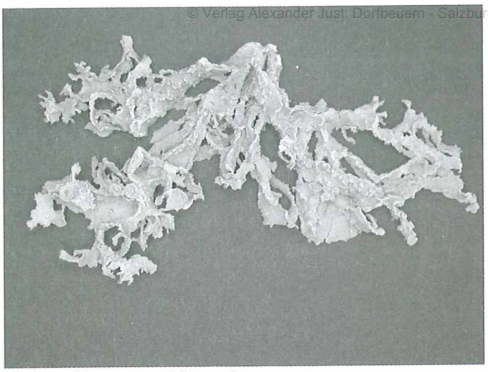
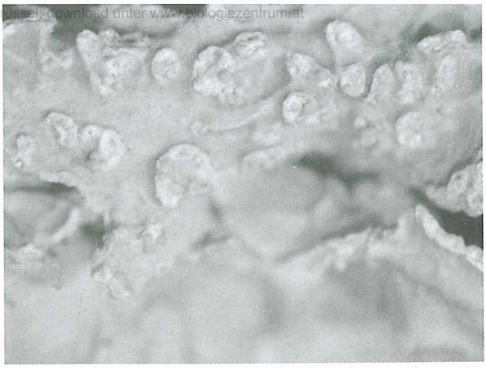
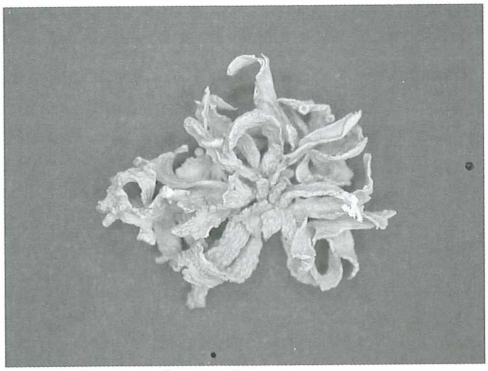


Ramalina maciformis

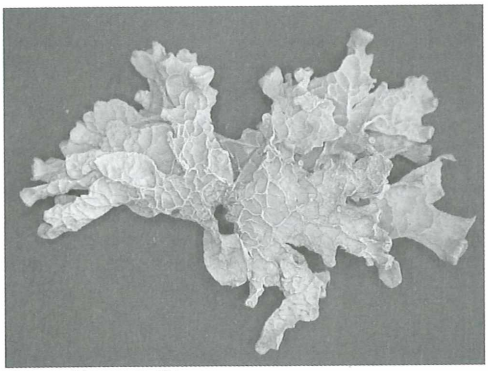


Ramalina maciformis (1 cm vertical, 1.4 cm horizontal)

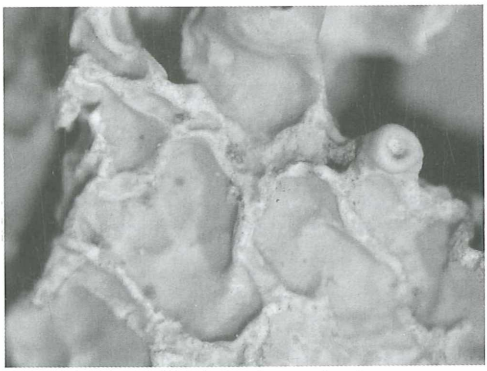


Ramalina maderensis

Ramalina maderensis (1 cm vertical, 1.4 cm horizontal)



Ramalina mollis



Ramalina mollis (1 cm vertical, 1.4 cm horizontal)

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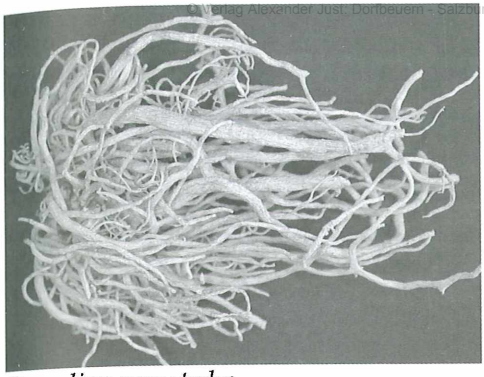
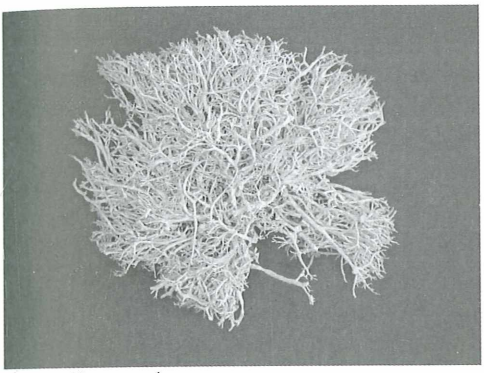


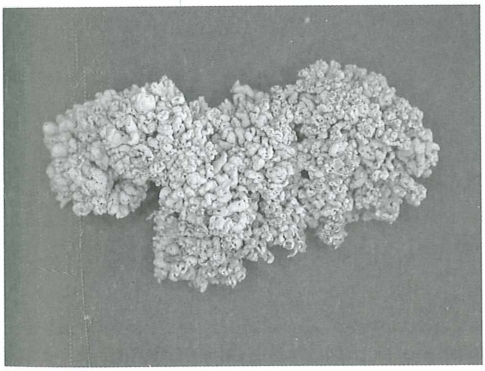
Ramalina nematodes

Ramalina nematodes (1 cm vertical, 1.4 cm horizontal)

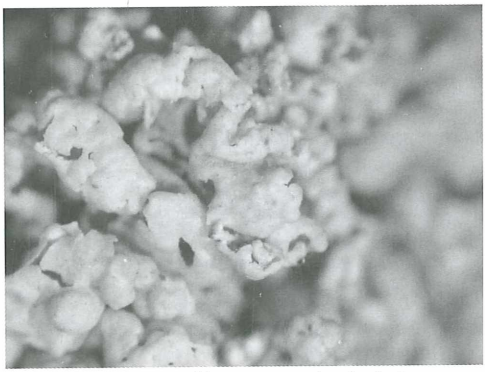


Ramalina nodosa

Ramalina nodosa (1 cm vertical, 1.4 cm horizontal)



Ramalina parva



Ramalina parva (1 cm vertical, 1.4 cm horizontal)

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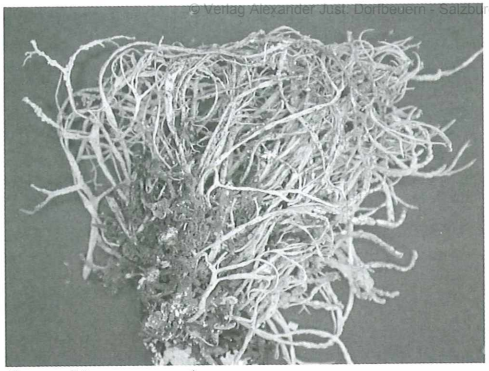
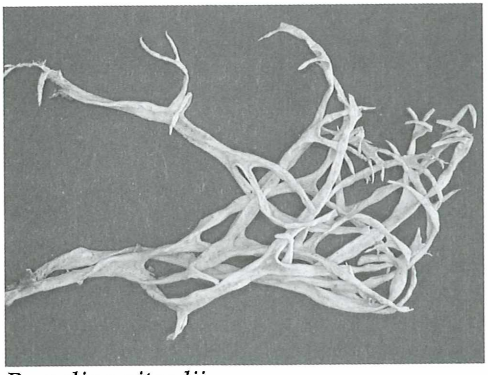


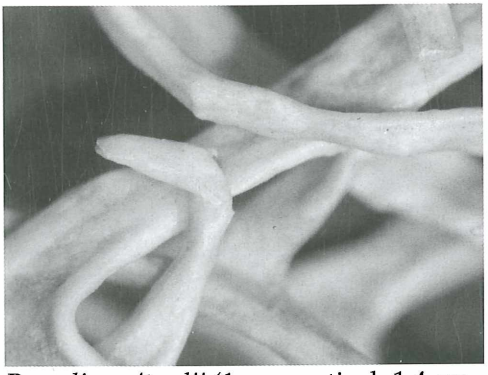
Ramalina peruviana

Ramalina peruviana (1 cm vertical, 1.4 cm horizontal)

Ramalina peruviana (tip, 1 cm vertical, 1.4 cm horizontal)



Ramalina pitardii



Ramalina pitardii (1 cm vertical, 1.4 cm horizontal)

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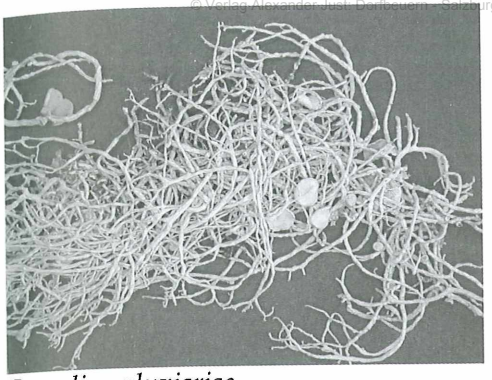
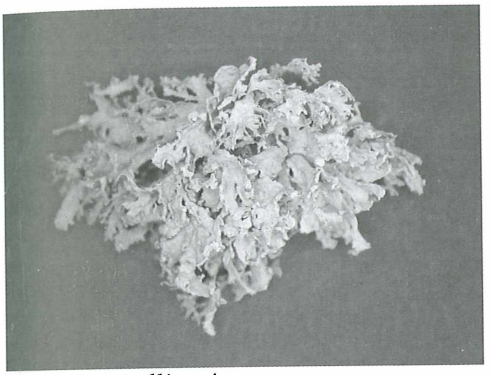
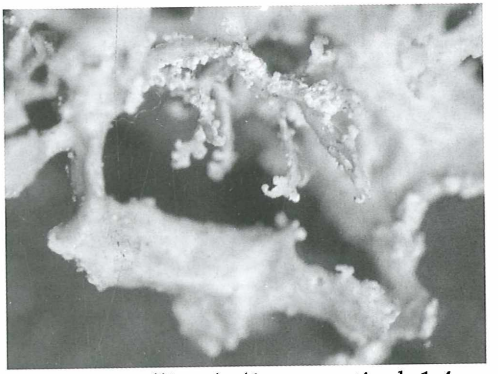


Ramalina pluviariae

Ramalina pluviariae (1 cm vertical, 1.4 cm horizontal)



Ramalina pollinaria



Ramalina pollinaria (1 cm vertical, 1.4 cm horizontal)

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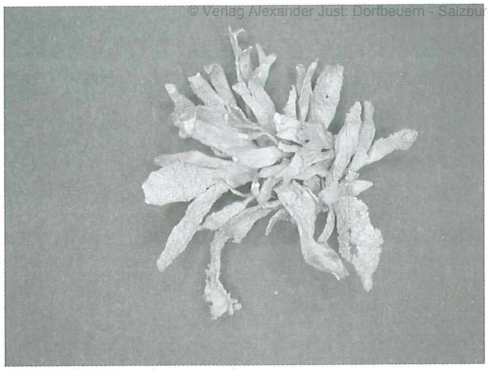
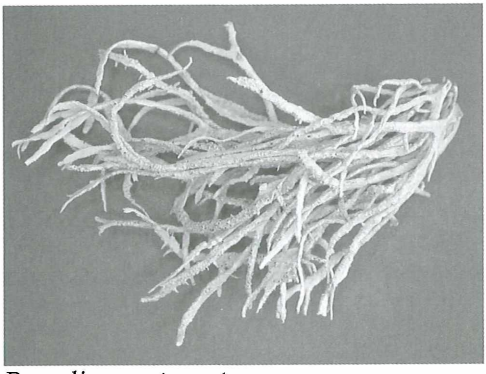


Ramalina polymorpha

Ramalina polymorpha (1 cm vertical, 1.4 cm horizontal)

Ramalina polymorpha (tip, 1 cm vertical, 1.4 cm horizontal)



Ramalina portosantana

Ramalina portosantana (1 cm vertical, 1.4 cm horizontal)

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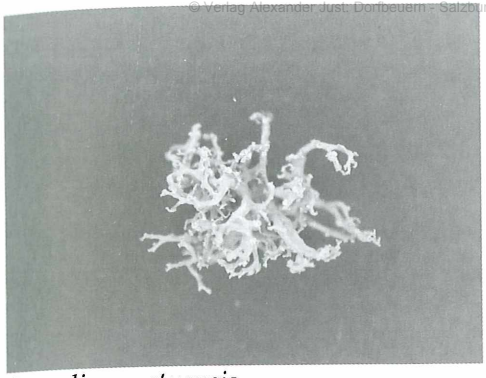
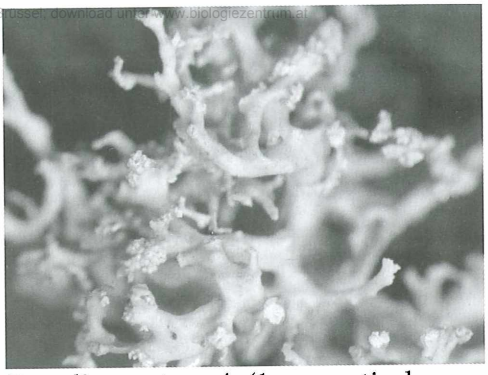
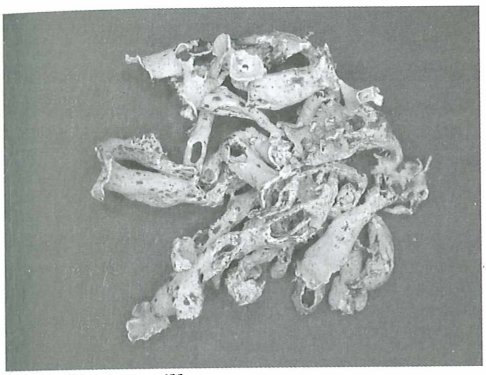


Ramalina portuensis

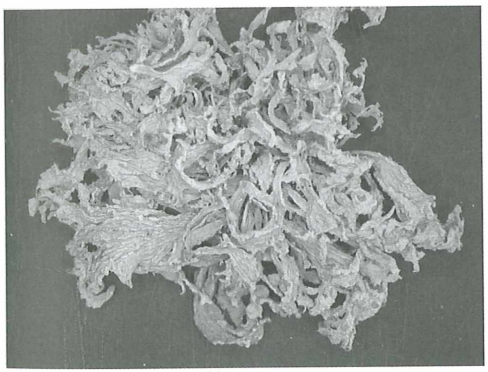


Ramalina portuensis (1 cm vertical, 1.4 cm horizontal)

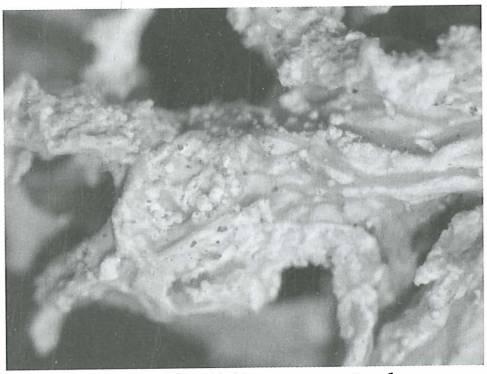


Ramalina pusilla

Ramalina pusilla (1 cm vertical, 1.4 cm horizontal)



Ramalina requienii



Ramalina requienii (1 cm vertical, 1.4 cm horizontal)

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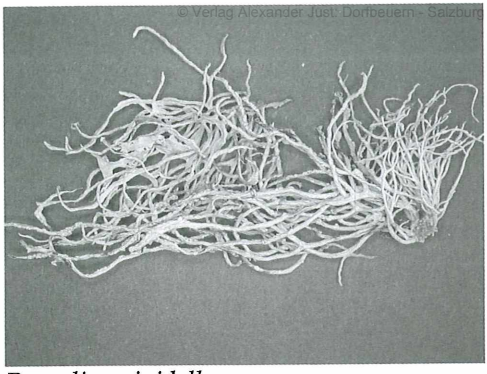
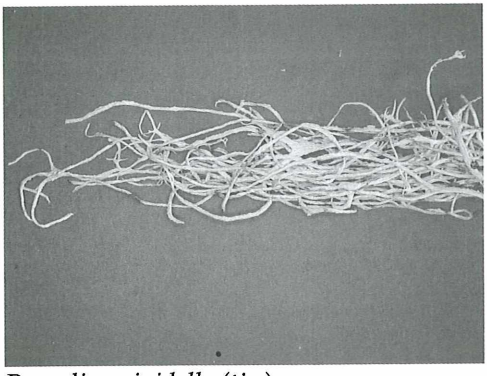
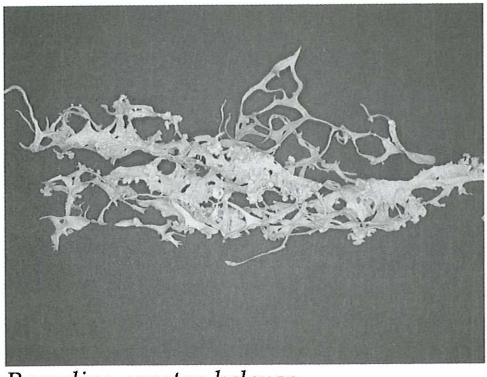


Ramalina rigidella

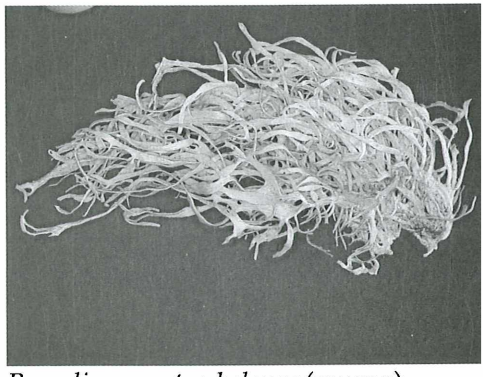
Ramalina rigidella (1 cm vertical, 1.4 cm horizontal)



Ramalina rigidella (tip)



Ramalina sanctae-helenae



Ramalina sanctae-helenae (young)

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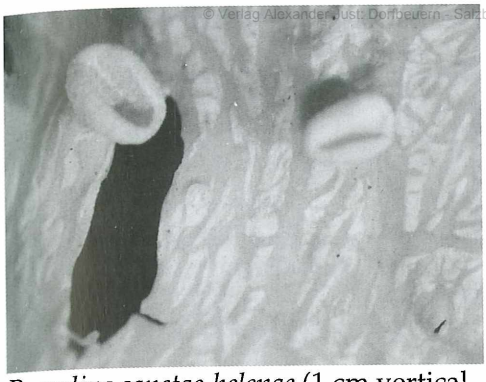
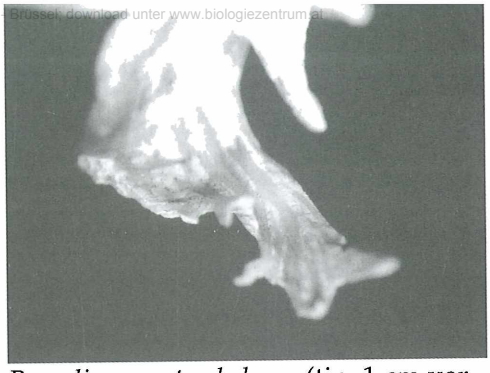
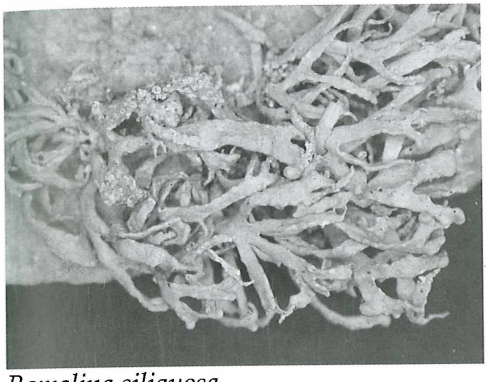


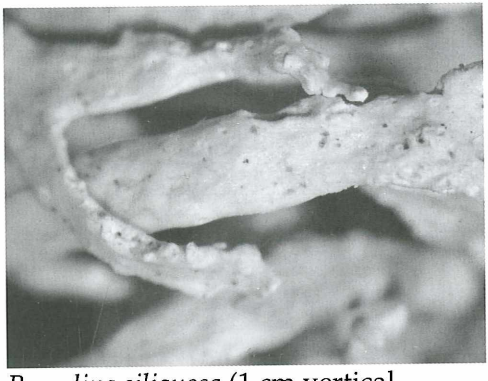
Ramalina sanctae-helenae (1 cm vertical, 1.4 cm horizontal)



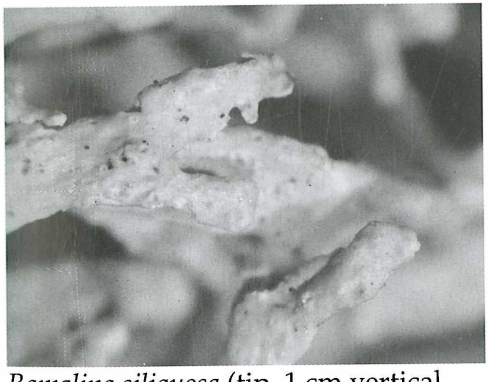
Ramalina sanctae-helenae (tip, 1 cm vertical, 1.4 cm horizontal)



Ramalina siliquosa



Ramalina siliquosa (1 cm vertical, 1.4 cm horizontal)



Ramalina siliquosa (tip, 1 cm vertical, 1.4 cm horizontal)

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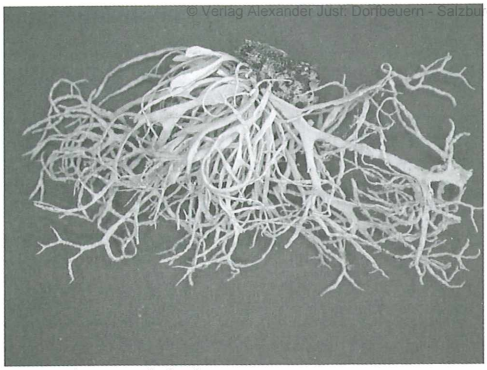
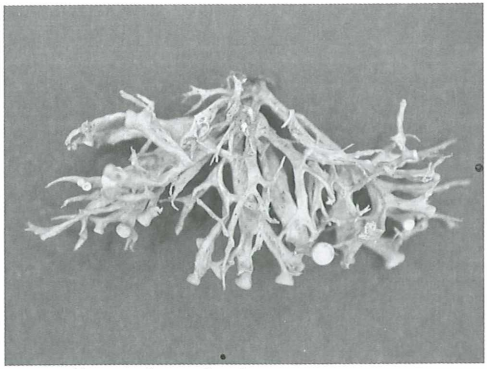


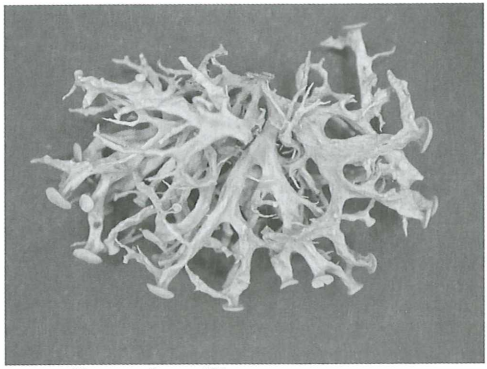
Ramalina subfarinacea

Ramalina subfarinacea (1 cm vertical, 1.4 cm horizontal)

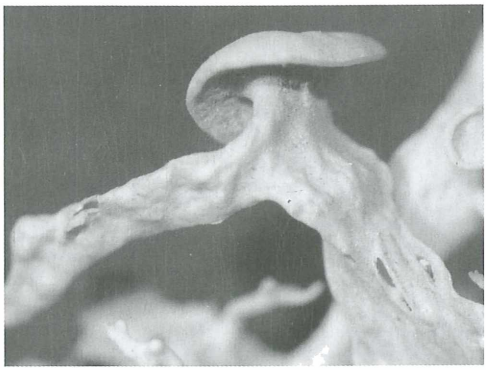


Ramalina subgeniculata

Ramalina subgeniculata (1 cm vertical, 1.4 cm horizontal)



Ramalina subpusilla



Ramalina subpusilla (1 cm vertical, 1.4 cm horizontal)

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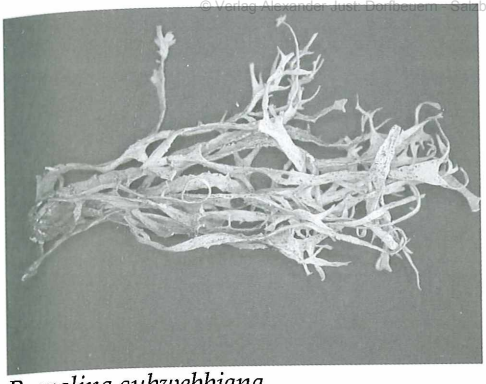
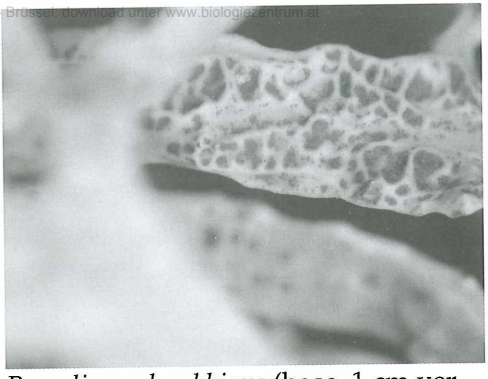
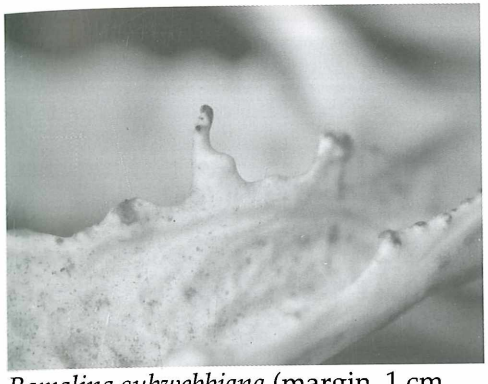


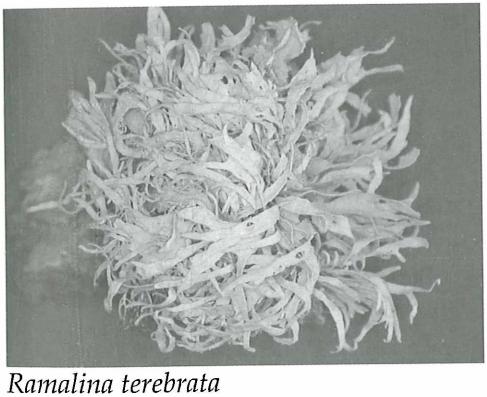
Ramalina subwebbiana



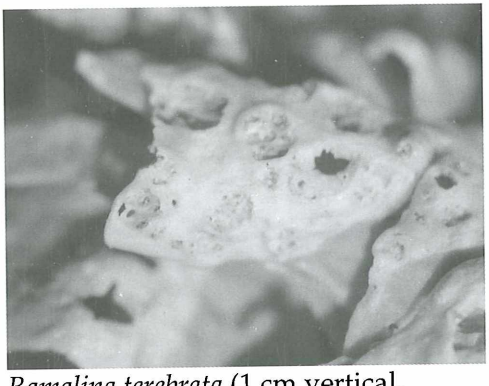
Ramalina subwebbiana (base, 1 cm vertical, 1.4 cm horizontal)



Ramalina subwebbiana (margin, 1 cm vertical, 1.4 cm horizontal)



Ramalina terebrata



Ramalina terebrata (1 cm vertical, 1.4 cm horizontal)

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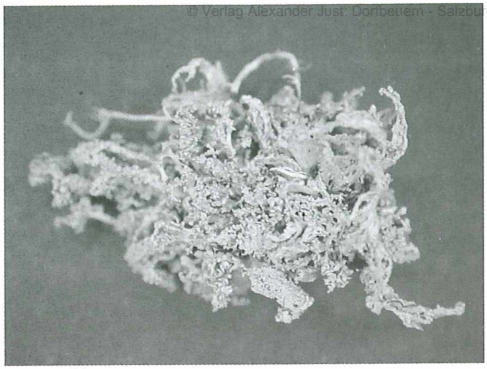
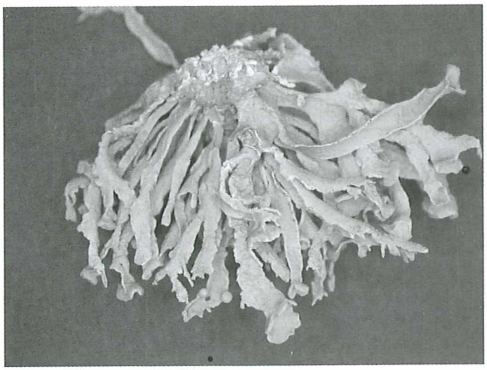
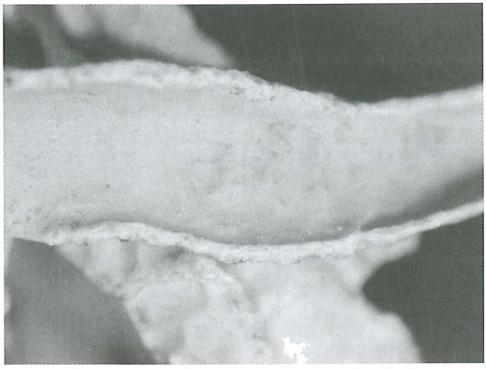


Ramalina tortuosa

Ramalina tortuosa (1 cm vertical, 1.4 cm horizontal)



Ramalina webbii



Ramalina webbii (1 cm vertical, 1.4 cm horizontal)

Ramalina webbii (tip, 1 cm vertical, 1.4 cm horizontal)

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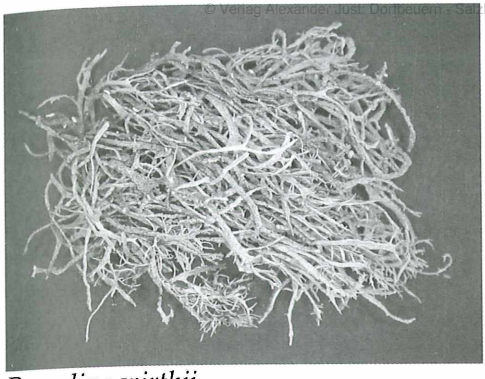
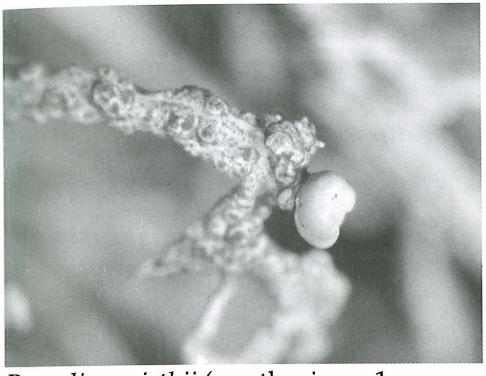


Ramalina wirthii

Ramalina wirthii (1 cm vertical, 1.4 cm horizontal)



Ramalina wirthii (apothecium, 1 cm vertical, 1.4 cm horizontal)

Ramalina wirthii (tip, 1 cm vertical, 1.4 cm horizontal)

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