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Hunting for *Cetrelia chicitae* (Lichenized Ascomycetes) in the Eastern European Alps

(Including an Attempt for a Morphological Characterization of All Taxa of the Genus *Cetrelia* in Central Europe)

By

Walter OBERMAYER*) and Helmut MAYRHOFER*)

With 51 Figures

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Summary

OBERMAYER W. & MAYRHOFER H. 2007. Hunting for *Cetrelia chicitae* (lichenized Ascomycetes) in the eastern European Alps (including an attempt for a morphological characterization of all taxa of the genus *Cetrelia* in Central Europe). – Phyton (Horn, Austria) 47(1–2): 231–290, with 51 figures. – English with German summary.

Six hundred and eighty one specimens of the lichen genus *Cetrelia* W.L.CULB. & C.F.CULB. (*Parmeliaceae*, lichenized Ascomycetes), collected mainly in the eastern European Alps (as well as some specimens from North America), have been studied by means of TLC (thin-layer chromatography). As many specimens were found to be heterogeneous, they were re-studied several times, resulting in a total of more than 1400 chemical analyses. Considering the collections from the south-eastern part of Central Europe (642 packets in total, 91 of which contained more than one taxon), 2 % (i.e. 15 specimens) were identified as *Cetrelia chicitae* (W.L.CULB.) W.L.CULB & C.F.CULB. (alectoronic acid / a-collatolic acid syndrome), 13 % as *Cetrelia olivetorum* (NYL.) W.L.CULB. & C.F.CULB s.str.. (olivetoric acid syndrome), 30 % as *C. cetrarioides* (DELISE ex DUBY) W.L.CULB. & C.F.CULB s.str. (perlatolic acid syndrome; ± traces of imbricaric acid) and 55 % as *C. monachorum* (ZAHLBR.) W.L.CULB. & C.F.CULB. (imbricaric acid syndrome [major] and perlatolic acid [minor]). No thalli were found to contain mixed or intermediate chemosyndromes.

*) Dr. Walter OBERMAYER and Dr. Helmut MAYRHOFER, Institut für Pflanzenwissenschaften, Karl-Franzens-Universität, Holteigasse 6, 8010 Graz, Austria, Europe; e-mail: walter.obermayer@uni-graz.at

Beside listing all diagnostic TLC characters, useful morphological features for separating the taxa have been evaluated and discussed. Densely developed, conspicuous pseudocyphellae on the lower surface of sterile thalli were found to be the most reliable morphological character for the delimitation of *Cetrelia cetrarioides* s.str. Three main types of pseudocyphellae could be distinguished on the upper side of the thallus. 'Type I' pseudocyphellae are rather large (when mature), with a homogeneously smooth and flat (not raised) surface, whereas the 'type II' pseudocyphellae comprise slightly convex structures, which may become agglomerated to form rather large, often elongated ridges with an heterogeneous punctuate centre. 'Type III' pseudocyphellae are rather small (difficult to see with the naked eye), flat or even slightly immersed in the thallus surface, and are commonly cracked in the centre. The latter type is frequently observed in *Cetrelia olivetorum* and *C. cetrarioides*. The rather large and usually well developed pseudocyphellae of 'type I' are typical for *Cetrelia chicitae*, where they commonly occur both at the margins and at the central parts of the thalli. Convex pseudocyphellae of 'type II' are characteristic of the most frequent morphotype of *C. monachorum*, but can also be found in other *Cetrelia* species. In addition, the size and shape of soredia and soralia respectively, are found to be helpful for separating the *Cetrelia* taxa. Freshly developed soredia of *Cetrelia cetrarioides* s.str. are in general smaller (25–35[40] µm) than in all other taxa treated ([35–]40–55 µm). Smooth, labriform (strongly convex) soralia are typical for *C. olivetorum* and (at least in part) for *C. cetrarioides*, whilst *C. monachorum* and *C. chicitae* have rather coarse soredia, exposed on more irregularly shaped soralia which – especially in *C. chicitae* – are developed on markedly undulate, contorted lobe margins, giving the lobe apices a somewhat nibbled appearance. – The slightly dumbbell-shaped (= weakly bifusiform) pycnospores (spermatia) of *Cetrelia chicitae*, the perforate apothecia of *C. cetrarioides* as well as the imperforate apothecia of both *C. cetrarioides* and *C. monachorum* are illustrated.

A statistical survey of the substrata for all taxa studied revealed the following frequency: *Acer pseudoplatanus* (34 %), *Fagus sylvatica* (14 %), *Alnus* (mostly *A. incana*, 13 %), *Quercus* sp. (8%), *Salix* sp. (6 %), *Fraxinus excelsior* (6 %). All other substrata ranged below 5 %.

Zusammenfassung

Obermayer W. & Mayrhofer H. 2007. Auf der Jagd nach *Cetrelia chicitae* (lichenisierte Ascomyceten) in den östlichen Teilen der europäischen Alpen (mit dem Versuch einer morphologischen Charakterisierung aller Taxa der Gattung *Cetrelia* in Mitteleuropa). – Phyton (Horn, Austria) 47(1–2): 231–290, mit 51 Abbildungen. – Englisch mit deutscher Zusammenfassung.

Sechshunderteinundachtzig Belege der Gattung *Cetrelia*, die hauptsächlich aus dem östlichen Teil der europäischen Alpen (inkl. einiger zusätzlicher Belege aus Nordamerika) stammen, wurden mittels Dünnschichtchromatographie (TLC) untersucht. Da sich der Inhalt zahlreicher Belege als heterogen herausstellte, wurden viele von ihnen mehrfach gescreent, was zu einer Gesamtzahl von über 1400 TLC-Untersuchungen führte. Betreffend die südöstlichen Teile von Mitteleuropa (mit 625 Belegen, 91 davon mit mehr als einem Taxon in der Kapsel) enthielten 2 % (15 Belege) *Cetrelia chicitae* (W.L.Culb.) W.L.Culb & C.F.Culb. (Alectoronsäure / a-Collatolsäure-Syndrom), 13 % *Cetrelia olivetorum* (Nyl.) W.L.Culb. & C.F.Culb s.str.

(Olivetorsäure-Syndrom), 30 % *C. cetrarioides* (DELISE ex DUBY) W.L.CULB. & C.F.CULB s.str. (Perlatolsäure-Syndrom; Spuren von Imbricarsäure sollen nach Literaturangaben auch vorkommen) und 55 % *C. monachorum* (ZAHLBR.) W.L.CULB. & C.F.CULB. (Imbricarsäure [Hauptinhaltsstoff] und Perlatolsäure [Nebeninhaltsstoff]). Thalli mit einem intermediären Chemosyndrom wurden nicht gefunden.

Neben einer Auflistung aller typischen TLC-Merkmale wurden einige, einer raschen Bestimmung dienende, morphologische Merkmale herausgearbeitet: Das Auftreten von dicht stehenden und auffälligen Pseudocyphellen auf der Unterseite steriler Thalli hat sich als ein verlässliches Merkmal für die Bestimmung von Cetrelia *cetrarioides* s.str. herausgestellt. In Bezug auf die Gestalt von Oberseiten-Pseudocyphellen kann man 3 Haupttypen unterscheiden. 'Typ I' zeigt (in voll entwickeltem Zustand) ziemlich große, nicht erhabene Durchbruchsstellen, mit einer homogenen, glatten und flachen Oberfläche. 'Typ II' lässt leicht konvexe Strukturen mit einer recht unregelmäßig gestalteten Oberfläche erkennen, die zu relativ großen rippigen, ungleichmäßig durchlöcherten Gebilden zusammenfließen können. 'Typ III' zeigt relativ kleine Pseudocyphellen (mit dem freien Auge kaum zu sehen), die flach oder sogar etwas in den Thallus eingesenkt sind und zentral (einen) Riss(e) aufweisen. Den letztgenannte Typ findet man häufig bei *Cetrelia olivetorum* und *C. cetrarioides*. Die vorher genannten, ziemlich großen und gut entwickelten Oberseiten-Pseudocyphellen vom 'Typ I' sind für *Cetrelia chicitae* kennzeichnend, wo sie gewöhnlich sowohl im Randbereich als auch im Thallus-Inneren vorkommen. Konvexe Pseudocyphellen vom 'Typ II' charakterisieren den häufigsten Morphotyp von *Cetrelia monachorum*. Auch die Beachtung von Größe und Gestalt von Soredien bzw. Soralen kann bei der Sippentrennung hilfreich sein. So sind frisch entwickelte Soredien bei *Cetrelia cetrarioides* deutlich kleiner (25–35[40] µm) als bei den restlichen Sippen ([35–]40–55 µm). Glatte, lippenförmige (meist deutlich wulstige) Sorale sind besonders für *Cetrelia olivetorum* und häufig auch für *C. cetrarioides* typisch, während die relativ großen Soredien von *C. monachorum* und *C. chicitae* auf eher unregelmäßigen und grobschlächtigen Soralen entwickelt werden. Besonders *C. chicitae* zeigt häufig Sorale, die auf engwellig verbogenen Lappenrändern stehen, die diesen bisweilen ein "angeknappertes" Aussehen verleihen. – Die typischen, schwach hantelförmigen Pycnosporen (= Spermatien) von *Cetrelia chicitae* sowie perforierte (von *C. cetrarioides*) und nicht perforierte (von *C. cetrarioides* und *C. monachorum*) Apothecien werden dargestellt.

Eine statistische Auswertung der von allen Cetrelien besiedelten Substrate ergibt folgende Reihenfolge: *Acer pseudoplatanus* (34 %), *Fagus sylvatica* (14 %), *Alnus* (meist *A. incana*, 13 %), *Quercus* spec. div. (8%), *Salix* spec. div. (6 %), *Fraxinus excelsior* (6 %). Alle anderen Substrate rangieren unter 5 %.

Content

1. Introduction

It was found that even in the field (armed with a hand lens) it was rather straight forward to recognize members of the lichenized fungal genus *Cetrelia* because of their distinctive morphological characters: the foliose thallus with greyish-green (sometimes slightly brownish) colour, the rounded marginal lobes, an upper surface with punctiform then irregular shaped pseudocyphellae (which often become elongated, branched or confluent), a lower surface which is blackish in the centre, but brownish, pinkish or even (especially when fertile) whitish at the margins, and simple, often sparse rhizines which are absent at the margins. All of the Central European taxa are additionally characterized by the presence of marginal soralia (sometimes accompanied by laminal, hemisphaeric soralia).

Depending on the authors' discretion, one, three or four species have been accepted in Europe. Some authors have only recognized *Cetrelia olivetorum* s.l. [or *C. cetrarioides* s.l.], and have included three chemotypes (see PURVIS 1992, CLERC 2004, BJELLAND & al. 1997), while other lichenologists have recognized three (or four) taxa (*C. olivetorum, C. chicitae, C. cetrarioides* [*C. monachorum*]) at species level (see e.g., WIRTH 1995: 277; RANDLANE & SAAG 1991: 119). Although at a first glance, all the above taxa seem to be rather morphologically uniform, from a chemical viewpoint

they are quite different. In addition to atranorin which is present in all taxa, one can observe olivetoric acid (→ *C. olivetorum* s.str.) or imbricaric and/or perlatolic acid (→ *C. cetrarioides* s.l.) or alectoronic and a-collatolic acid together with physodic acid and 4-O-methylphysodic acid (→ *C. chicitae*). Because of the variations in concentration of perlatolic acid and imbricaric acid in *Cetrelia cetrarioides* s.l., some authors have segregated this taxon into *C. cetrarioides* s.str. (with mainly perlatolic acid and only traces of imbricaric acid) and *C. monachorum* (with imbricaric acid as major and perlatolic acid as minor component). Both *C. cetrarioides* s.str. and *C. monachorum* appear to be quite common, whereas *Cetrelia olivetorum* appears less frequent, while *Cetrelia chicitae* seems extremely rare. Although the latter taxon was first described in 1965 (Culberson 1965: 95), it has yet to be reported for several European countries. Wherever it does occur, it is named in "red lists" as "being threatened with extinction".

The aim of the present study was the search for this endangered species (*C. chicitae*) in herbaria and nature. It has been reported from Austria only once (Poelt & Türk 1984; note, that the latter report of Türk & Wittmann 1987 is based on the same specimen). In addition, the data acquired will provide background information for an ongoing project dealing with *Cetrelia* in the Tibetan area by the first author. Given the high number of specimens studied chemically, it was possible to approximate the frequency and distribution of all the taxa present in the study area.

2. Material and Methods

Six hundred and eighty one specimens of the genus *Cetrelia* from the herbaria GJO, GZU, LI, LJU, and from the private herbaria of Franz Berger (Kopfing, Austria) and Ulrich Kirschbaum (Gießen, Germany) have been studied by means of thin layer chromatography (TLC). Many specimens were found to be heterogeneous and were analysed more than once. As a consequence, a total of more than 1400 analyses were undertaken. If not stated otherwise (where herbarium acronyms are given in square brackets), the specimens cited are housed in the herbarium of the Institute for Plant Sciences, University of Graz [GZU].

TLC analyses were carried out following the methods of Culberson & Ammann 1979 and Elix & al. 1987 respectively. For better separations (especially of imbricaric acid and perlatolic acid), the plates were run to a height of 15 cm. As all major substances clearly separated in solvent "C", in many cases only this solvent was used. In order to visualize fatty acids, the glass-plates were dipped into a water tank for several seconds.

Microcrystal tests, using the methodology of Yasuhiko Asahina (for a summary see Hale 1974), were performed in "GE" (glycerine : glacial acetic acid, 3:1).

As it proved to be very stable over several years, a commercial cleaner ('Dan-Klorix'; where the active component is sodium hypochlorite) was used as a spot test reagent for "C", "KC" and "CKC" respectively. The latter spot test gives a stronger orange reaction than by applying KC alone. A small piece of thallus is dipped into a

drop of 'C', then into 'K' and finally in 'C' (each for 10 seconds). In *C. chicitae*, the medulla of the thallus slowly turns orange and remains so.

Illustrations were made with a ZEISS Axioskop 50 and a LEICA Wild M3Z using a ZEISS Axiocam MRc5 camera (software: 'Carl Zeiss AxioVision Product Suite CD 29A').

3. Applied Taxonomical Concepts

As stated above, at first glance it seems rather difficult to separate the European taxa of *Cetrelia* morphologically, whereas it is very easy to segregate them by chemical means. Although some morphological features correlate well with chemical characters (e.g.„ finely granular soredia and striking pseudocyphellae on the lower side together with perlatolic acid [→ *C. cetrarioides*] or coarse soredia and raised pseudocyphellae of the upper surface together with imbricaric acid [→ *C. monachorum*], some thalli exhibit characters which do not appear to be correlated.

As has been done in some other cases of so called "chemotaxa" or "chemical strains" (e.g.„ in *Pseudevernia furfuracea* (L.) ZOPF, *Thamnolia vermicularis* (SW.) SCHAER., *Dimelaena oreina* (ACH.) NORMAN, *Sulcaria sulcata* (LÉV.) BYSTREK ex BRODO & D.HAWKSW., etc.), one can speculate whether it it is better to split or to unite such entities at the species level. There are several alternative possibilities to explain the close relationship between these taxa. In fertile specimens (note that roughly 5 % of the *Cetrelia* specimens studied show apothecia), each ascus could develop spores with different chemical abilities. Such taxa (still interbreeding but not yet 'sibling species') might exhibit different sensitivities to environmental conditions. By means of soredia, the better adapted "chemotypes" would be dispersed more rapidly and might explain the uneven frequency of the taxa. It is of interest that, despite of the large number of examined specimens (681), no single chemical chimera was found (note that such intermediates were found in *Pseudevernia furfuracea*; for relevant literature see OBERMAYER 1993: 135). Finally one should be aware that the age of thalli may influence the morphological (but most probably not the chemical) characters. Nevertheless, as the taxa treated can readily be separated by chemical means and as morphological and chemical characters correlate well with oneanother (at least for the most part), such a pragmatic segregation of the taxa was applied at the species level.

In his 'concept of species pairs', POELT 1970: 193 supposed that the closest relatives of each of the European 'secondary' (i.e. asexual reproductive) taxa of *Cetrelia* might be found among the 'primary' (i.e. sexual reproductive) species occurring in East Asia, but CULBERSON & CULBERSON 1976: 338 pointed out that at least the chemical relationship within the sorediate taxa *Cetrelia cetrarioides* and *C. monachorum* "... is better explained by chemical evolution through loss mutations from the morphologically identical 'secondary' species ...".

4. Useful Characters for Separating the Species

4.1. Pseudocyphellae on the Upper Surface of the Thallus

The size, shape and frequency of occurrence of pseudocyphellae of the upper surface provides a convenient means for determining the European species of *Cetrelia*. In general, mature pseudocyphellae are not punctiform as cited in several publications, but are usually rather irregular, ranging from linear, elongated forms to s-shaped or even slightly branched forms. Three main types of pseudocyphellae can be distinguished, but intermediate forms may occur more or less frequently.

a) 'Type I' pseudocyphellae on the upper surface.

When mature 'type I' pseudocyphellae are rather large and flat (not raised), and the penetration areas are relatively homogeneous, smooth and show a flat surface (Fig. 16, 46, 47). *Cetrelia chicitae* usually have 'type I' pseudocyphellae, which often extend over the whole thallus (including the centre of large thalli). Although in general, the other *Cetrelia* species have smaller pseudocyphellae (the smallest occurring in *C. olivetorum*, see 'type III' below), in some cases, they may become as large as those present in *C. chicitae* (e.g., *C. cetrarioides* collected near Lienz, leg. GANDER[?], III.1873 [GZU] with very large, partly concave pseudocyphellae).

b) 'Type II' pseudocyphellae on the upper surface.

'Type II' pseudocyphellae are initially flat, but then become slightly raised and convex and have a heterogeneous, riddled surface with one (or a few) crack(s) in the centre. They often appear to consist of several pseudocyphellae grouped together to form irregularly shaped, ring-like or even strongly elongated structures (Fig. 17a, 17b, 49). The occurrence of such pseudocyphellae together with rather coarse soredia are diagnostic for (a frequent morphotype of) *C. monachorum*.

c) 'Type III' pseudocyphellae on the upper surface.

'Type III' pseudocyphellae are flat to slightly concave, rather small (but also often cracked in the centre) and can be found in all the *Cetrelia* species studied, especially on the submarginal areas of *C. olivetorum* (and to a lesser extent in *C. cetrarioides*) (Fig. 18).

In *Cetrelia monachorum* (Fig. 48) and *C. cetrarioides* (and sometimes in *C. olivetorum*), pseudocyphellae may be absent from the upper surface, especially on older thalli or on pruinose lobes (HILLMANN 1936: 247 described a 'forma *pruinosa*').

In addition to the pseudocyphellae, white, irregularly shaped maculae (Fig. 16, arrow) may occur as algal-free zones, but are covered by the cortex and lack any cracks or pores.

4.2. Pseudocyphellae on the Lower Surface of the Thallus

Many sterile specimens of *C. cetrarioides* can readily be determined solely by the occurrence of well developed pseudocyphellae on (at least some parts of) the lower surface. If well developed, the striking pattern of the white, dot-like pseudocyphellae (embedded in the brown, blackish or sometimes pinkish matrix) can be seen with the naked eye (Fig. 19, 44).

Although pseudocyphellate lower cortices have been found in all the species studied, on sterile lobes they are by far most abundant in *C. cetrarioides* ('type I'; see below). *Cetrelia monachorum* may also develop pseudocyphellae, but they are considerably less frequent and have a different appearance ('type II'; see below). Whilst in *C. olivetorum* very small pseudocyphellae of "type II" may sometimes occur, they are very rare in *Cetrelia chicitae*. As in some other cetrarioid taxa, well developed and more densely grouped pseudocyphellae may be found on the lower surface of thalli with mature apothecia or apothecial initials (and thus may also be expected in fertile material of *C. chicitae*).

A more detailed overview of the morphology of pseudocyphellae on the lower surface revealed that there were two main types, both of which occur in *Cetrelia cetrarioides* and *C. monachorum* (but intermediate forms may occur in both taxa).

a) 'Type I' pseudocyphellae on the lower surface (usually on sterile lobes):

These pseudocyphellae consist of a homogenous, white or slightly brown (mostly irregular shaped) area punched into the brownish or blackish lower side (Fig. 19). Regarding the homogeneity of the penetration area, they look similar to 'type I' of the upper-side-pseudocyphellae. On older lobes, they can turn greyish-brownish and, in case of a rather pale coloured lower side, the surrounding cortex can form a darker coloured rim (regarding similar structures due to mechanically caused injuries see below).

b) 'Type II' pseudocyphellae on the lower surface (often on lobes with pycnidia, mature apothecia or with initials of apothecia).

Such pseudocyphellae appear as white or pale brown, ± shiny, irregularly shaped or elongated spots, surrounded by an unpigmented, but corticate, shiny ring-like region. The 'true' pseudocyphellate penetration, with its white, matt appearance, is located only in the very centre, and may exhibit (one or a few) elongated, slightly raised, ± branched or even ring-like fissures (Fig. 20). In *C. monachorum* (especially on lobes with initials of apothecia), such pseudocyphellae seem to stop developing at an early stage, but in *C. cetrarioides*, the penetration-area quickly develops into larger, flat structures.

It should be noted, that the frequency of occurrence of pseudocyphellae on the lower surface of *C. cetrarioides* can vary significantly within a single (sterile) thallus, and may range from being very abundant (with a strongly white dotted lower surface) to totally absent (with an almost uniform, brownish lower surface). On densely pseudocyphellate lobes, the lower surface is often contorted upwards, whereas adjoining, uncontorted lobes totally lack pseudocyphellae on the lower surface. One can speculate, whether the 180° contortion accelerates the development of pseudocyphellae, or vice versa, whether the production of pseudocyphellae causes contortion of the lobes.

Attention should be drawn to the white, pseudocyphellae-like wounds and scars, caused by abrasion of the rhizines (or their initials) on the lower surface. This may also produce perforations in the lower cortex exposing the white medulla. Lobes with a strongly reticulate lower surface may also become abraded along the ridges and thus appear pseudocyphellae-like. White flecked, shiny, unpenetrated areas of the lower surface (most commonly in *C. monachorum*) may also be mistaken for true pseudocyphellae.

4.3. Size of Soredia and Shape of Soralia

The size of soredia and the shape of soralia should be observed in the young stages as they tend to become darker coloured and subcorticate with age (sometimes forming coralloid pseudoisidia or even tiny-lobed structures).

Coarse soredia ([35–]40–55 μm), together with slightly raised pseudocyphellae of the upper surface (Fig. 17a, 17b) are observed in *Cetrelia monachorum*. Similar coarse soredia (Fig. 28) are observed in *Cetrelia chicitae*, where the sorediate, densely undulate, contorted margins of the thalli give the lobe-ends a somewhat nibbled appearance (Fig. 21); they often occur together with large, ± flat, pseudocyphellae on the upper surface (Fig. 16).

Comparatively fine soredia (25–35[–40] μm; Fig. 29) are observed in *Cetrelia cetrarioides*. This species and *C. olivetorum* (with slightly larger soredia) often develop rather smooth, strongly convex, labriform soralia (Fig. 23, 24).

Capitate (or sometimes even crater-like) soralia (usually with rather coarse soredia) can often be found on the upper surface of older thalli of all the species of *Cetrelia* studied (Fig. 25–27). Such soralia led to the description of infraspecific taxa by Laven 1941: 294 [as *Parmelia cetrarioides* f. *bisoralifera*] and by Poelt 1953: 327 [as *Parmelia cetrarioides* var. *cetrarioides* f. *bisoralifera*]. In fact, Poelt's name is a homonym of the older name proposed by Laven. Poelt (loc.cit.) presumed that the capitate soralia might be caused by exogenous factors. The development of such soralia is often initiated within pseudocyphellae of the upper surface and

might by caused by an ageing effect rather than a lichenicolous fungus. "Unusual" hemispherical soralia were also observed in some other (usually esorediate) lichens such as *Pseudevernia furfuracea* (a summary of literature concerning this phenomenon can be found in HAFELLNER & OBERMAYER 2004: 49).

Although atranorin is considered to be a cortical metabolite, it often occurs in much higher concentration in the ecorticate soredia than in the thick, thalline cortex (in all *Cetrelia* species studied) (Fig. 1, tracks 2, 4, 8, and 10).

4.4. Colour and Structure of the Lower Surface of the Thallus

The colour of the lower surface of the thallus varies from entirely black (particularly in the central parts) to ± shiny and brownish, or with a tinge of pink or pure white near or at the margins.. In general, all thalli with apothecia (or their initials) are almost always pale-coloured on the lower surface (Fig. 33).

A reticulate lower surface is most frequently developed in *Cetrelia olivetorum* (Fig. 30). In particular, ascending, contorted lobes show a relatively regular network of raised ridges. However, the degree of reticulation of the lower surface (seen in all other species, e.g., in *C. cetrarioides*, Fig. 31) seems to be caused by environmental factors (at least in part).

4.5. Apothecia and Pycnidia

As already stated under 'applied taxonomic concepts', apothecia were present in approximately 5% of the specimens examined. As most of the fertile material is present in relatively recent collections, one obtains the impression, that currently there is a 'retrogression' from (sorediate) 'secondary species' towards fertile 'primary species' (a similar situation has been observed in *Pseudevernia furfuracea* by OBERMAYER 2002: 9). All specimens with apothecia are marked with 'c.ap.' under the 'specimens examined' for each species. The percentage of fertile specimens (*Cetrelia monachorum* ca. 60%, *C. cetrarioides* ca. 30%, *C. olivetorum* ca. 10%) almost mirrors the percentage of specimens of each species of *Cetrelia* investigated (Fig. 7). In two specimens of *Cetrelia chicitae*, marginal, black, slightly white pruinose pycnidia (with weakly bifusiform pycnospores [= spermatia]) were found (Fig. 41–43), but no apothecia were developed. The pycnospores are (5.5–)6–6.5(–7) µm long, 1.1–1.3 µm wide (in the centre) and 1.5–1.7 µm wide (at both ends).

As in many other cetrarioid taxa, fertile lobes may appear quite different from sterile ones. The pseudocyphellae of the upper surface are always very well developed on fertile lobes, particularly near to and on the outer side of apothecia (Fig. 38, 40), where soralia may also occur (e.g., BREUSS 23270). In addition, pseudocyphellae are often developed on the

lower surface of fertile lobes in those taxa where they are usually absent (see above).

Although many authors regard the apothecial discs of *Cetrelias* to "usually be perforate" (e.g., Culberson & Culberson 1968: 490; Purvis 1992: 177 [but sub *C. olivetorum* as 'not perforate']; Wirth 1995: 277), the apothecia in the present material were often imperforate (Fig. 35–40). This may be a question of age, since some large apothecia ($\geqslant$ 8 mm diam.) were found with perforations (Fig. 32–34), but there are also some huge (old) imperforate apothecia (Fig. 40, right part of the image).

Densely and regularly brown-spotted areas may frequently be observed on the upper surface of young thalli (restricted to submarginal parts) (Fig. 26, 35, 50, 51). These structures are obviously initials of apothecia, so one can speculate that when one apothecium is 'fertilized', the others might be inhibited in their development and can be 'remodelled' into pseudocyphellae or even into laminal capitate or crater-like soralia (Fig. 26). As mentioned above, pseudocyphellae are more common on the lower surface of fertile lobes.

4.6. Spot Tests

By applying spot tests, *Cetrelia olivetorum* can readily be separated from mixed specimens. The "C-reaction" produces a strong sanguineous/red colour. Even traces of the reagent on the cutting edge of a razor blade yields a conspicuous result. The test should be applied to the freshly dissected white medulla or to the soralia. If the latter are overmature the reaction may be rather weak, so it is advisable to first abrade the soralia.

As species of the *C. cetrarioides-monachorum* complex often show a pale pinkish to slightly violet C-reaction, misdetermined specimens were found in all the herbaria cited (incorrectly identified as *Cetrelia olivetorum*). In some specimens of *C. cetrarioides* and *C. monachorum* the C-reaction may be rather strong, especially in those parts where the cortex has been abraded (e.g., by animals feeding). Culberson & Culberson 1968: 485 reported that the reaction must be due to an unidentified substance, since neither imbricaric nor perlatolic acid give a colour reaction. According to Jack Elix (in litt.) the colour reaction is caused by either anziaic and/or 4-*O*-demethylimbricaric acid.

The medulla of *C. chicitae* may react pale orange in C, but produces a (slowly intensifying) orange(-brownish) colour with CKC.

4.7. TLC Features and Microcrystal Tests

All TLC characters, used for the rapid determination of of *Cetrelia* species, are illustrated in Fig. 1–3. For the rapid screening of bulk specimens, it suffices to use solvent "C". Beside the cost and time advantages, the (sometimes very weak) atranorin spot does not overlap other sub-

stances and it is very easy to separate all four patterns of compounds. In *Cetrelia olivetorum*, a single strong spot (olivetoric acid) clearly appears below that of norstictic acid (present in the standard). In *C. chicitae*, two close moving spots (physodic and alectoronic acid) occur below, and two similar, faster moving spots (4-*O*-methylphysodic acid and α-collatolic acid) occur above norstictic acid. In *C. monachorum*, a double spot almost exactly halfway between norstictic acid and atranorin, is due to imbricaric acid (slower moving; present in higher concentration and thus larger) and perlatolic acid (faster). And finally, a single, strong spot of perlatolic acid (slightly faster moving than imbricaric acid in *C. monachorum*), distinguishes *C. cetrarioides*.

The latter two species (*C. monachorum, C. cetrarioides*) can readily be separated when run together on the same plate (with solvent front to 15 cm high). However, if only one of these two taxa is present, it is often difficult to distinguish them. In such cases, the following four additional TLC features (using solvent "C") may assist in their identification:

1.) In case of the imbricaric acid syndrome (*C. monachorum*), two close moving spots (anziaic acid above, 4-*O*-demethylimbricaric acid below; see references below) can be seen near the norstictic acid spot in solvent 'C'. *Cetrelia cetrarioides* s.str. lacks the lower spot (Fig. 1, tracks 3, 4, and 6).

2.) A very small (but sometimes intense), fatty acid-like spot can be seen in many specimens of *C. monachorum* in all three plates, with Rf classes 1(–2)/1(–2)/1(–2) (see arrows in Fig. 2 and Fig. 3). The occurrence of this substance is often associated with the presence of pseudocyphellae of "type II" on the upper surface. Note, that a similar (but generally weaker) spot can be observed in *C. olivetorum*, slightly below that of the corresponding substance present in *C. monachorum* (best seen in Fig. 2 [tracks 7 and 8] almost at the baseline).

3.) The perlatolic acid syndrome (in *C. cetrarioides*) always shows a small spot just below perlatolic acid which fluoresces blue-white under short (!) wave UV after treatment with sulphuric acid. According to Culberson & Culberson 1976: 328 and Randlane & Saag 1991: 123, this substance is most probably 4-*O*-methylolivetoric acid.

4.) Finally, the perlatolic acid and imbricaric acid spots behave differently when the plates slowly dry out after treatment with water. After drying for a few minutes, the imbricaric acid spot (and even more beautiful, the olivetoric acid spot) appears a homogeneous grey or as a white ring with a grey centre (best seen in reflected, visible light against a dark background (Fig. 2). By contrast, the perlatolic acid spot and the spots due to the alectoronic acid / a-collatolic acid syndrome, appear as homogeneous white spots. When transmitted light (strong light behind the plate) is applied, one can see an inverted colour effect (Fig. 3). This differential behaviour of the spots during drying of the plates persists for at least 30 min.

It is also possible to separate perlatolic acid and imbricaric acid by using microcrystal tests. The crystals of both substances have been illustrated by CULBERSON & CULBERSON 1966: 198 as well as in the present paper (Fig. 4–6). The needles of imbricaric acid (Fig. 4) are much longer and thinner than those of perlatolic acid. During recrystallisation perlatolic acid begins as small, boat-shaped crystals (Fig. 5, arrows) and finally form clustered and bushy structures (Fig. 6).

5. Statistical Evaluation of the Data

Five hundred and thirty seven specimens from Austria and 82 specimens from Slovenia have been examined. Further specimens were examined from U.S.A. (15), Germany (15), Italy (6), Canada (3), Romania (3), Switzerland (3), Slovakia (3), Czech Republic (2), France (2), Georgia (2), and from Great Britain, Norway, Portugal, Spain, Montenegro and Hungary (1 each). A total of 681 specimens were investigated.

5.1. Frequency of the Taxa in Central Europe

Six hundred and fourty two collections from Central Europe (89 of which comprised more than one taxon) resulting in a total of 731 'specimens' were studied (Fig. 7).

CULBERSON & CULBERSON 1978: 520 found that *C. cetrarioides* was much less common (15 %) than *C. monachorum* (85 %) in North America [based on a study of 110 specimens], but the two species showed similar frequencies in Europe (51 % vs. 49 %; based on 104 specimens). However, following our study of many more specimens (at least for south-eastern part of Central Europe), we found that *C. monachorum* (65 %) was significantly more common than *C. cetrarioides* (35 %). It is of particular interest, that *C. monachorum* (and *C. chicitae*) were not found in Norway (*fide* BJELLAND & al. 1997: 7) but *C. cetrarioides* (90%) and *C. olivetorum* (10%) were present. In the present study only one specimen from Norway was examined and it was found to be a mixture of *Cetrelia cetrarioides* and *C. monachorum*. An earlier study of *Cetrelia* in the Soviet Union (RANDLANE & SAAG 1991), recorded 51 specimens of *C. cetrarioides* compared with 29 specimens of *C. monachorum*. By contrast, BEGUINOT 1983: 12 found that *C. monachorum* and *C. chicitae* were almost equally common in the SW Burgundy region of France (using microcrystal tests), but no *C. cetrarioides* s.str. was observed.

5.2. Homogeneity of Specimens and the Number of Mixed Collections

As most of the specimens examined contained more than one thallus within the envelope, one should always be wary of mixed collections. More particularly, in those specimens where olivetoric acid was detected by TLC, all other (at least larger) thalli were subsequently 'spot-tested'. In

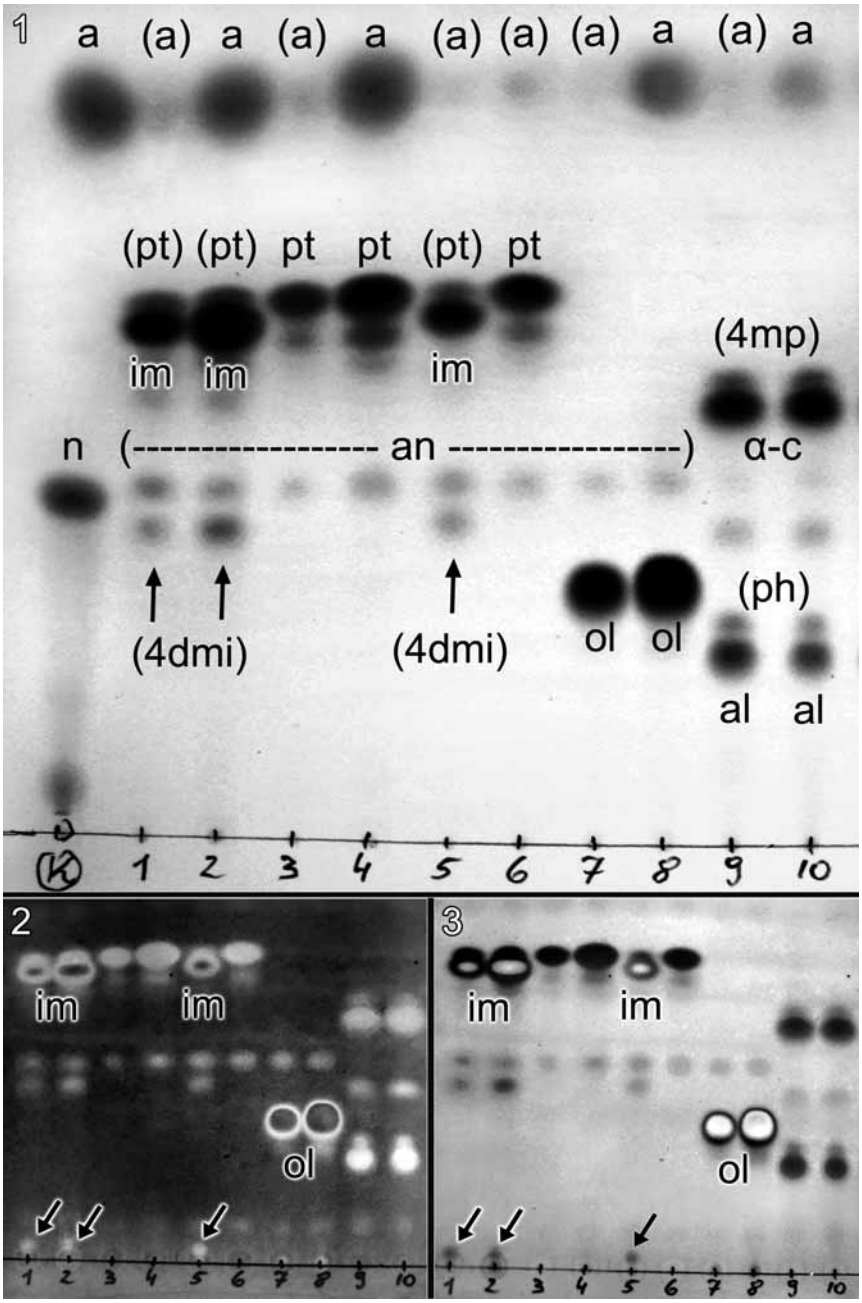

Fig. 1–3. Spot characters for species of Cetrelia run in TLC solvent 'C'. *Cetrelia monachorum* (tracks 1,2, and 5), *C. cetrarioides* (tracks 3,4, and 6), *C. olivetorum* (tracks 7 and 8), *C. chicitae* (tracks 9 and 10). K = control lichen (*Cladonia symphycarpa*). a = atranorin, al = alectoronic acid, an = anziaic acid, α-c = α-collatolic acid, im = imbricaric acid, n = norstictic acid, ol = olivetoric acid, ph = physodic acid, pt =

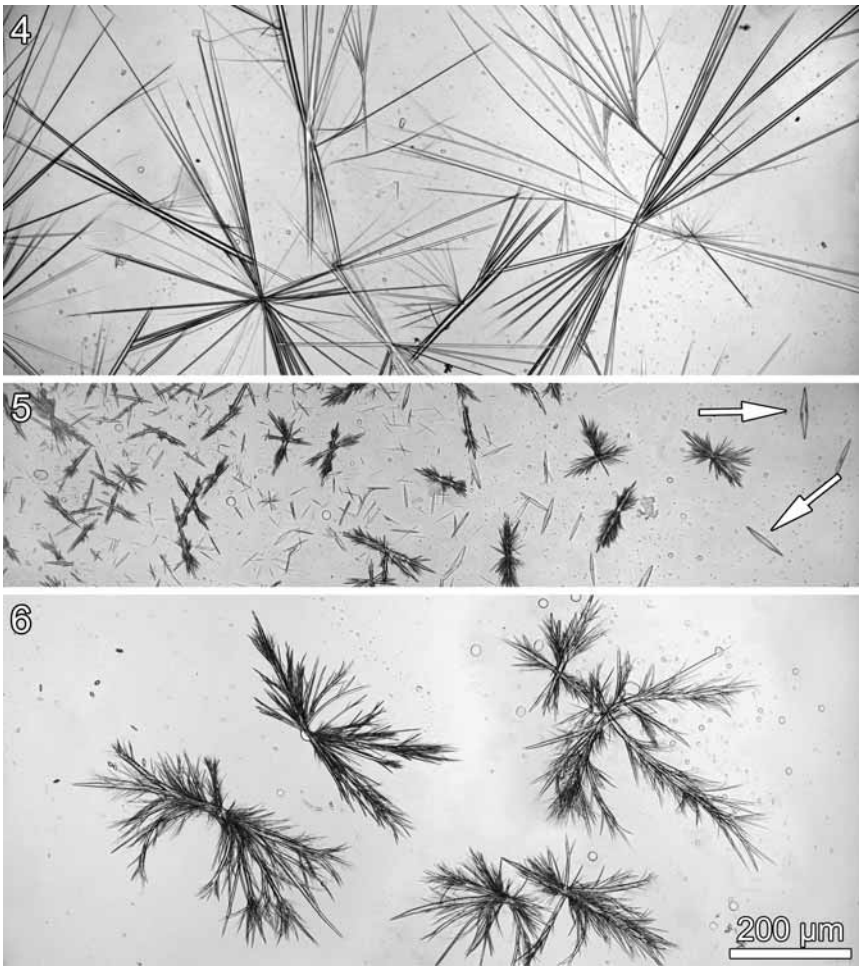

Fig. 4–6. Microcrystals recrystallized in "GE" derived from *Cetrelia monachorum* (Fig. 4) and *C. cetrarioides* (Fig. 5–6). – Fig. 4. Imbricaric acid (Türk 41747). – Fig. 5–6. Perlatolic acid (Obermayer 11393). – Fig. 5 shows early stages (several minutes after heating). Arrows point to very small, boat-shaped single crystals. Fig. 6 pictures typical bushy aggregates (30 min. after heating). – Scale applies to all figures.

perlatolic acid, 4dmi = 4-*O*-demethylimbricaric acid, 4mp = 4-*O*-methylphysodic acid. Substances in parenthesis refers to 'lower concentrations'. – Fig. 1. Plate (after running) photographed under UV-light. Arrows indicate 4-*O*-demethylimbricaric acid, present in *C. monachorum* but absent in *C. cetrarioides*. The spot just below perlatolic acid (tracks 3,4 and 6) may be 4-*O*-methylolivetoric acid (or glomelliferic acid), but is definitively not imbricaric acid. – Fig. 2. Wet plate (after treatment with water and left to dry for several minutes) photographed in reflected light. The spots of imbricaric acid and olivetoric acid appear as a dry ring which remains wet in the centre, whereas the spots of perlatolic acid and alectoronic / a-collatolic acid dry homogeneously from the centre. – Fig. 3. Similar to Fig. 2, but photographed in transmitted light. Arrows (in Fig. 2 and 3) indicate a fatty-acid like spot present in *C. monachorum*.

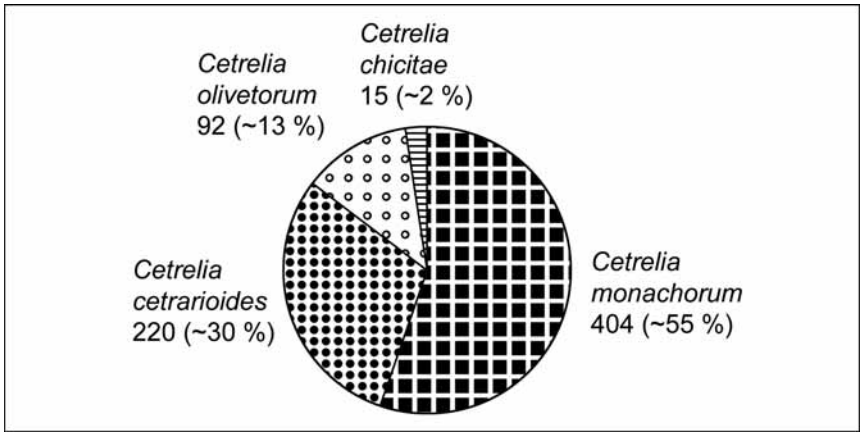

Fig. 7. Frequency of *Cetrelia* species in Central Europe (642 collections, 89 of which were mixed).

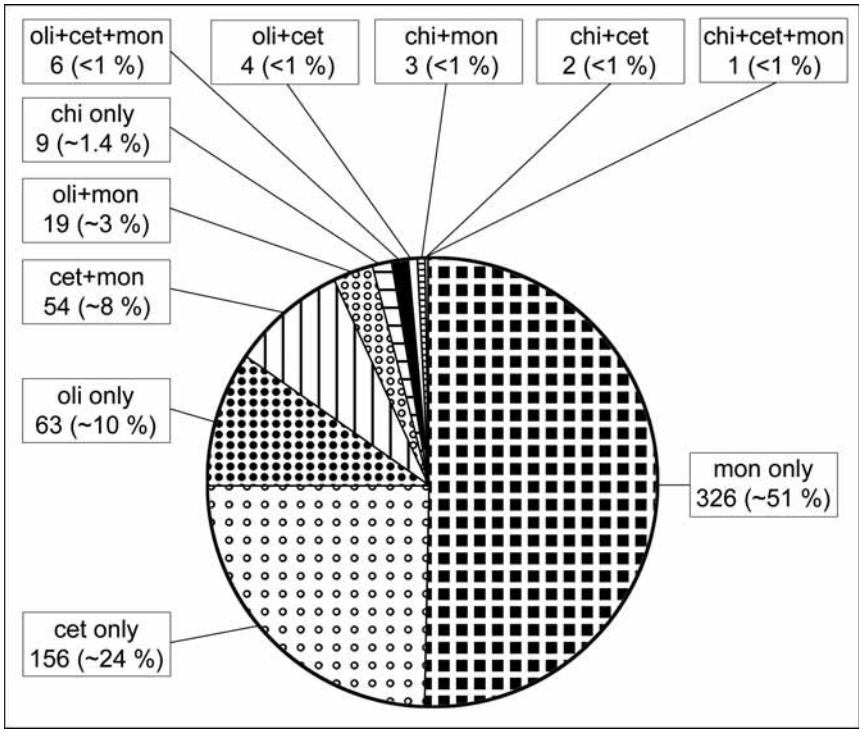

Fig. 8. Monospecific and mixed collections of *Cetrelia* species in Central Europe (number and %): cet=*cetrarioides*, chi=*chicitae*, mon=*monachorum*, oli=*olivetorum*.

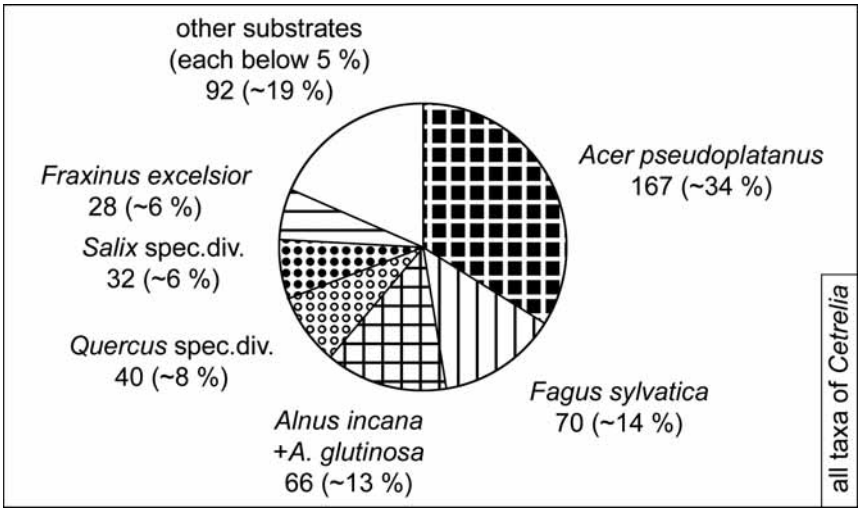

Fig. 9. Substrate preference of all species of *Cetrelia* in Central Europe (as determined for 495 specimens where substrate was stated).

addition, whenever numerous, striking pseudocyphellae were observed on the lower surface (*C. cetrarioides*), the specimens were subdivided for subsequent TLC investigation. Almost 13% of all collections from Central Europe were found to contain two (82 specimens) or even three (7 specimens) species.

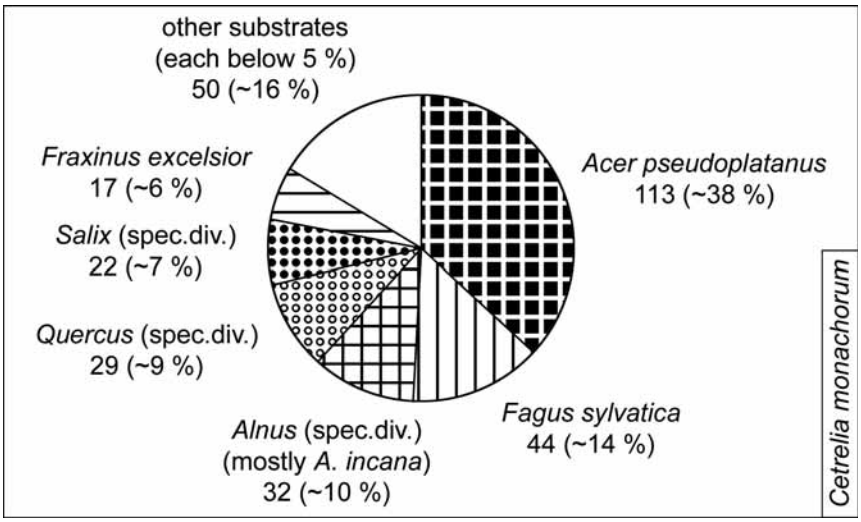

Fig. 10. Substrate preference of *C. monachorum* in Central Europe (as determined for 307 specimens where substrate was stated).

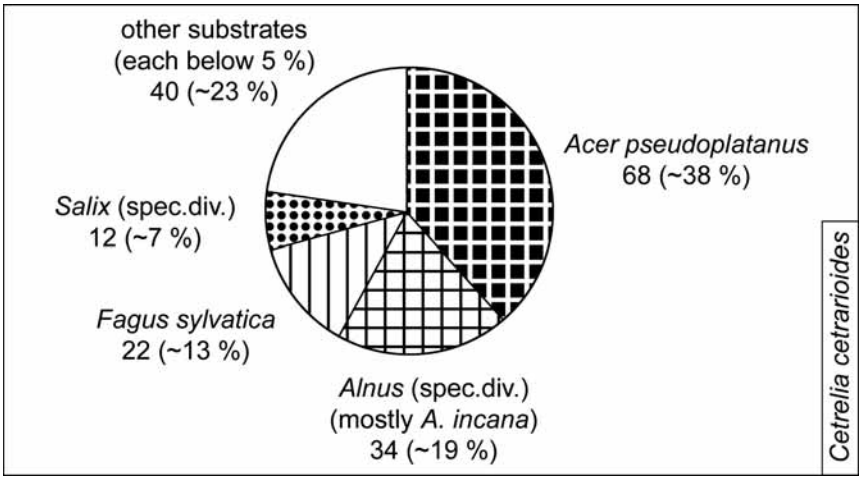

Fig. 11. Substrate preference of *C. cetrarioides* in Central Europe (as determined for 176 specimens where substrate was stated).

Mixtures of *Cetrelia monachorum* and *C. cetrarioides* were common (8% of collections; Fig. 8). In part this may be caused by 'careless collecting' (i.e. samples from different trees placed in the same paper bag), but many specimens clearly have several species intermixed on a single piece of bark. Interestingly, no mixed collections of *Cetrelia olivetorum* and *C. chicitae* were observed, although both species occur at lower altitudes (Fig. 14).

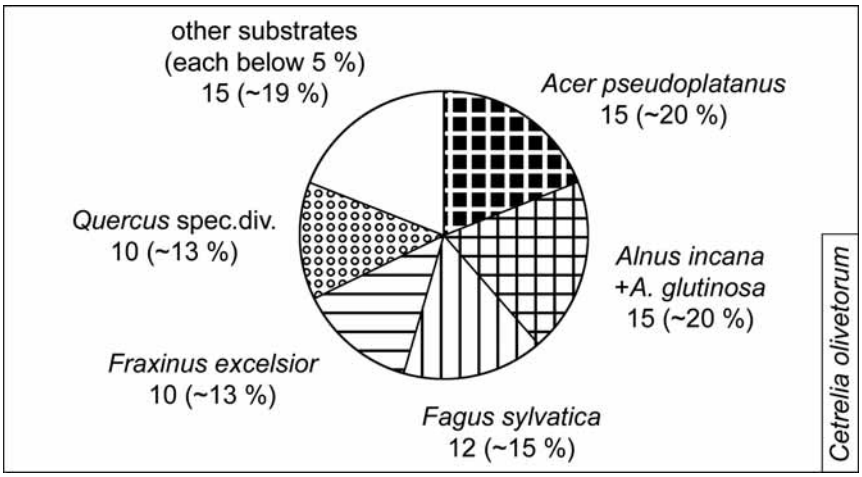

Fig. 12. Substrate preference of *C. olivetorum* in Central Europe (as determined for 77 specimens where substrate was stated).

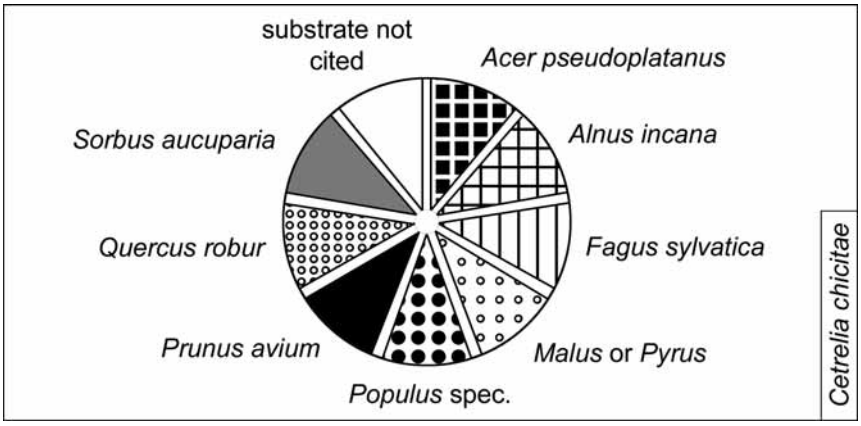

Fig. 13. Substrate preference of *C. chicitae* in Central Europe.

5.3. Substrate

Acer pseudoplatanus (34 %), *Fagus sylvatica* (14 %) and *Alnus* spec. (13 %) are the most common substrates for all four species of *Cetrelia*, but one should bear in mind that *Cetrelia* thalli often grow among or on corticolous bryophytes rather than directly on bark (the same is true for the few specimens collected from 'rocks'). One may get the impression that the lichen needs the bryophytes (or their fungal mycorrhiza-partner) to thrive. Both *C. monachorum* and *C. cetrarioides* ashow a marked preference for

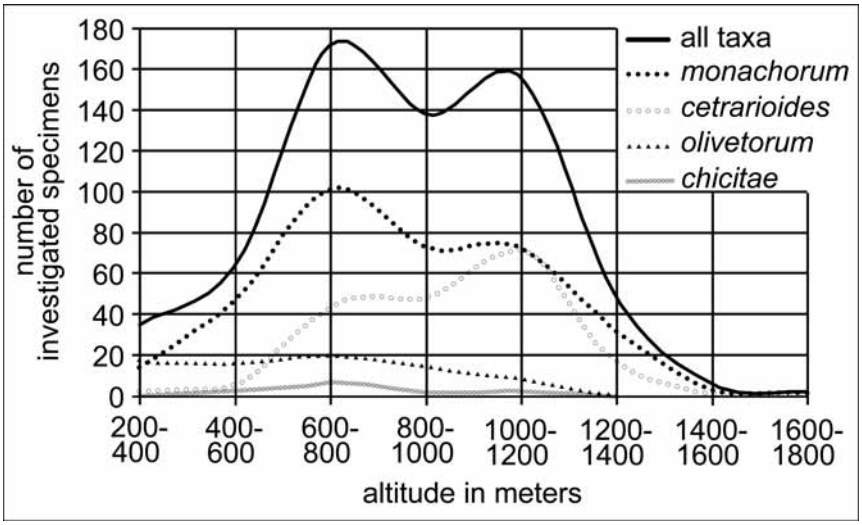

Fig. 14. Altitudinal distribution of the taxa of *Cetrelia* in Central Europe.

Acer pseudoplatanus (38%), whereas *C. olivetorum* exhibits similar preferences for *Acer pseudoplatanus, Alnus, Fagus, Fraxinus* and *Quercus*.

It is striking, that in Central Europe *C. chicitae* colonizes a diverse range of phorophytes (Fig. 13) whereas North American specimens (in GZU) were collected mainly from (mossy) rocks.

5.4. Altitudinal Distribution of *Cetrelia* in Central Europe

Figure 14 shows that in Central Europe, most of the *Cetrelia* specimens were collected between 600 and 1200 m alt. The curves indicate that *C. monachorum* is more common at lower altitudes (ca. 800 m) than *C. cetrarioides* (most common at 1000–1200 m). *Cetrelia olivetorum* (and probably *C. chicitae*) seem to prefer lower altitudes (as noted by BEGUINOT 1983: 16 in France).

6. Key to *Cetrelia* in Central Europe

Notes: The present key focuses on morphological and spot-tests characters, but for the unpractised eye TLC investigations are indispensable in many cases. Before applying the key, other genera with sorediate taxa such as *Parmotrema* A.MASSAL., *Punctelia* KROG and *Hypotrachyna* (VAIN.) HALE (or even isidiate *Platismatia* W.L.CULB. & C.F.CULB.) should be excluded. 'Sterile lobes' refers to lobes without marginal pycnidia or without laminal initials of apothecia (most common near the lobe-margins). The latter give the lobe apices a brownish, dotted appearance (see e.g., Fig. 50, 51).

1 Medulla and soralia C+ strongly sanguineous/red (olivetoric acid); soralia rather smooth; lower side of the thallus often regularly ridged ..... *C. olivetorum*

1* Medulla and soralia C- or C+ (pale) pinkish or slightly violet or pale orange..... 2

2 Lower surface of sterile lobes (at least of ascending, contorted lobes) with numerous, conspicuous white pseudocyphellae; perlatolic acid present..... *C. cetrarioides*

2* Lower surface of sterile lobes lacking pseudocyphellae (or sparse pseudocyphellae present in *C. monachorum*)'; perlatolic acid present or absent 3

3 Freshly developed soredia rather fine, 25–35[–40] µm; perlatolic acid present; soralia uniformly smooth and strongly convex..... *C. cetrarioides*

3* Freshly developed soredia rather coarse, [35–]40–55 µm; perlatolic acid absent or present in minor or traces quantities; soralia rather coarse and irregularly shaped..... 4

4 Pseudocyphellae on the upper surface often large and flat (frequently with a uniform, smooth surface); usually developed across the whole upper surface; medulla C- or slightly orange, KC and CKC + slowly (but then persistent) orange (alectoronic acid, a-collatolic acid present); soralia present on strongly distorted lobes giving the lobe-ends a somewhat nibbled appearance..... *C. chicitae*

4* Pseudocyphellae on the upper surface frequently somewhat raised, often appearing as accumulations of individuals to form a larger unit; pseudocyphellae very rare in older thalli (at least in the centre); medulla KC + pinkish or slightly brownish-reddish (imbricaric acid [major], perlatolic acid [minor]) ..... *C. monachorum*

7. *Cetrelia cetrarioides* (Delise ex Duby) W.L.Culb. & C.F.Culb.

7.1. Diagnostic Morphological Characters
(for further details see section 4)

Pseudocyphellae on the upper surface small to rather large, usually not raised ('type III') but sometimes slightly raised ('type II'), often lacking in central parts of the lobes. – Pseudocyphellae on the lower surface sometimes lacking, but frequently (at least on some ascending, contorted lobe apices) well developed, commonly of 'type I' (on sterile lobes), but also of 'type II' on lobes with pycnidia or initials of apothecia. – Soralia often very smooth and strongly convex. – Soredia small (25–35 [–40] µm).

Chemistry: atranorin (high concentrations in the soralia, low concentrations in the cortex), perlatolic acid (maj.; traces of imbricaric acid are reported to occur but cannot be detected on TLC plates), 4-*O*-methylolivetoric acid (UV+ blue-white, best seen under short-wave light; diagnostic for separating this species from *C. monachorum*), anziaic acid (tr.); according to Randlane & Saag 1991: 123 traces of olivetoric acid and glomelliferic acid may also be present. – Spot tests (medulla and soralia): C- or C+ slightly pinkish/violet, KC+ and CKC+ pinkish or pale brownish-reddish.

7.2. Specimens examined (228)

Notes: Due to the large number of specimens, the label text has been reduced to that data which is most important for reidentifying the specimens (the name of collector(s), unique specimen number [if given], substrate, abbreviated locality data). Information on the herbarium were the specimen is housed is given in square brackets, together with the number of samples separated for TLC investigations (including the number and abbreviations of intermixed taxa: chi = *Cetrelia chicitae*, cet = *C. cetrarioides*, mon = *C. monachorum*, oli = *C. olivetorum*), and on the occurence of apothecia ('c.ap.'). The following trees occur as substrata and are recorded by their generic names (note, that in many cases the trees are covered with bryophytes, on (or amongst) which the thalli of *Cetrelia* occur) : *Abies* = *A. alba, Acer* = *A. pseudoplatanus, Alnus* = *A. incana, Betula* = *B. pendula (or B. pubescens), Corylus* = *C. avellana, Fagus* = *F. sylvatica, Fraxinus* = *F. excelsior, Juglans* = *J. regia, Larix* = *L. decidua, Malus* = *M. domestica, Picea* = *P. abies, Prunus* = *P. avium, Pyrus* = *P. communis, Quercus* = *Q. robur or Q. petraea, Salix* = *Salix (spec. div.), Sorbus* = *S. aucuparia, Tilia* = *T. cordata or T. platyphyllos, Ulmus* = *U. glabra*. The specimens are arranged geographically after continents (UPPER CASE + LETTERSPACED, followed by a colon). Within each country (UPPER CASE + LETTERSPACED), the specimens are sorted by states (UPPER CASE), smaller political subregions or large mountain areas (letterspaced) and in addition, sometimes after valleys or smaller mountains. As regards Styria (where most specimens originate), the grouping of

landscape areas follows LIEB 1991, who subsumed the larger mountains areas within three main regions (i.e. STYRIA, 'NORDALPEN', STYRIA, 'VORLAND', and STYRIA, 'ZENTRALALPEN', given in UPPER CASE).

EUROPE:

AUSTRIA, CARINTHIA (= KÄRNTEN), Gurktaler Alpen, Severgraben, *Alnus*, C.Zeiner (664) E.Zeiner & J.Zeiner [3]. - ibid., *Alnus*, C.Zeiner (393). – ibid., *Alnus*, C.Zeiner (168) [2], H.Mayrhofer, J.Prügger & B.Pichorner [c.ap.]. – Hohe Tauern, Ankogel-Gruppe, Gößgraben, *Alnus*, R.Türk & J.Hafellner (22962) [3]. – ibid., J.Hafellner (33085). – Hohe Tauern, Reißeck-Gruppe, Umgebung der Unteren Thomanbauernhütte, H.Wittmann [LI] [2cet+1mon]. – Karawanken, im Bärental, W unter dem Gehöft Wretschek, *Alnus*, J.Hafellner (13551) [2oli+2-cetr+3mon]. – ibid., B.Auer (1672). – 6 km S von Feistritz im Rosental, Umgebung der Stouhütte, *Acer*, J.Hafellner (13494) [3]. – ibid., B.Auer (1514). – Obojnikbach Graben WSW von Eisenkappel, *Fagus*, J.Hafellner (26709) [2]. – Koschuta, im Taleinschnitt Huda jama, *Corylus*, B.Auer (1136). – Rosenbach, K.Klein [LI-292427]. – Karnische Alpen, Gailtal, Rudnig Alm, *Fagus*, M.&H.Mayrhofer [1cet+4mon]. – Wolayer Graben SW von Kötschach-Mauthen, *Fagus*, J.Hafellner (45738) [2cet+1-mon]. – 1.8 km SW of Mauthen, Mauthner Klamm, *Abies*, W.Obermayer (11398) [4chi+1cet]. – 3 km E of the pass area of 'Plöckenpass', valley of the brook 'Angerbach', *Salix*, W.Obermayer (11432) [2cet+2mon]. – ibid., *Alnus*, W.Obermayer (11428) [5]. – ibid., *Salix*, W.Obermayer (11425) [1cet+2mon]. – ibid., *Salix, Picea*, W.Obermayer (11426) [4cet,c.ap.+2mon]. – ibid., *Fagus*, W.Obermayer (11433) [2]. – ibid., H.Mayrhofer (16669) [2]. – 700 m S of Würmlach, NW of Dolling, *Sorbus*, W.Obermayer (11393) [5]. – Saualpe, Grünburger Graben E von Kitschdorf, J.Hafellner (14735) [2]. – ibid., *Acer*, S.Skant (1611) [2]. – Klieninger Graben, Abzweigung des Kuhgrabens, *Acer*, S.Skant (1712). – Steiner Alpen, Kotschnatal, *Acer*, J.Hafellner (26756) & W.Petutschnig [1cet+2mon]. – Vellacher Kotschna S von Bad Vellach, J.Poelt [6]. – LOWER AUSTRIA (= NIEDERÖSTERREICH), Göstlinger Alpen, Ybbssteinbach, Umgebung vom Jagdschloss, *Acer*, R.Türk (22009) [LI] [3oli+2-cet]. – Ötscher, Ötschergraben, O.Breuss (16750) [LI]. – Ötscherland, Weg zum Tirolerkogel, O.Breuss (16679) [LI] [4]. – Voralpen, Halbachtal, zwischen Roßbachklamm und Gasthof Kalte Kuchl, O.Breuss (20121) [LI] [3]. - SALZBURG, Flachgau, Schafbergmassiv S vom Mondsee, W vom Mittersee, *Acer*, R.Türk (37558). – Fuß des Untersberges, Umgebung des Kühlbaches, Veitlbruch, H.Wittmann [LI] [5cet+2mon]. – Ad truncus arborem am Untersberge, H.Hoppe (3962) [3]. – Tal des Steinbaches W der Henndorfer Berge, *Acer*, R.Türk (41683) [3cet+1mon+1oli]. – Lungau, Schladminger Tauern, Weißpriachtal, Gurpitschbach, *Alnus*, O.Breuss (2431) [LI]. – Pinzgau, Glocknergruppe, in der Seidlau, *Alnus*, R.Türk (37612) [1cet+1mon]. – Hohe Tauern, 400 m N der Talstation Kitzsteinhorn, H.Wittmann [LI-316685]. – ibid., H.Wittmann [LI-316686]. – Tal des Unkenbaches, Umgebung vom Wirtshaus Friedlwirt, H.Wittmann [LI] [1cet+1mon]. – Pongau, Hohe Tauern, Ankogelgruppe, Kötschachtal E von Badgastein, Weg in die Prossau, *Alnus*, R.Türk (38844). – Niedere Tauern, Radstädter Tauern, Kleinarltal, beim Jägersee, *Acer*, J.Hafellner (66892) & A.Hafellner [2cet+2mon]. – ibid., J.Hafellner (66893) & A.Hafellner [4cet+1mon]. – ibid., Salix, J.Hafellner (66895) & A.Hafellner. – Radstädter Tauern, Weg vom Jägersee zur Tappenkarseehütte, *Alnus*, R.Türk (39833). – STYRIA (= STEIERMARK), NORDALPEN, Dachsteingruppe, 0.5 km

N of the church of Ramsau-Ort, *Acer*, W.Obermayer (11338) [2]. – Eisenerzer Alpen, Puchgraben, *Fagus*, J.Hafellner (45352). – Sebringgraben, *Fagus*, J.Hafellner (42768) [1cet+2mon]. – NE vom Jagdhaus Don am Weg zur Achner Alm, *Acer*, J.Hafellner (40602) & J.Miadlikowska [3cet+1mon]. – Ennstaler Alpen, Haselkogel, *Acer*, J.Hafellner (60450). – Tamischbachturm-Massiv, Steig vom Tamischbachgraben zum Bärensattel, *Acer*, J.Hafellner (67425) [1cet+1mon]. – Gesäuseberge E von Admont, am Steig von Johnsbach zur Hess-Hütte, kurz W der unteren Koderalm, *Acer*, J.Hafellner (67482) [1cet+1mon]. – Haller Mauern, 3,4 km NE von Admont, Geiergraben, *Ulmus*, H.Matz. – Johnsbachtal, *Picea*, K.Schittengruber (912) [2oli+3cet+7mon]. – E der Bergkirche von Johnsbach, *Alnus*, H.Mayrhofer (16080) C.Hammer & C.Scheuer [5cet+1mon]. – ibid., *Alnus*, H.Mayrhofer (16081a) C.Hammer & C.Scheuer [2cet+3mon]. – ibid., *Alnus*, H.Mayrhofer (16082) C.Hammer & C.Scheuer [2cet+1mon]. – NE vom Buchauer Sattel, Bachlauf E der Haberlalm, *Fagus*, G.Böttger. – Grießbachgraben, *Salix*, G.Böttger & J.Kisovec [GJO]. – Weg vom Buchauer Sattel zum Grabneralmhaus, *Acer*, G.Böttger [3]. – Weg von Pölzau zur Seisenalm, *Acer*, G.Böttger [GJO]. – Spitzenbach-Graben, *Acer*, J.Poelt, W.Obermayer (2144) W.Petutschnig & M.Grube. – Hartelsgraben, *Acer*, W.Petutschnig [2]. – ibid., J.Steinová (003) & H.Mayrhofer [4]. – S von Unterlaussa, Breitau, Peterbauer, *Fagus*, G.Böttger & H.Mayrhofer [GJO]. – Mühlbachgraben, *Acer*, J.Poelt, J.Hafellner (25929) & E.Lopez de Silanes [1cet+1mon]. – ibid., *Salix*, J.Poelt, J.Hafellner & E.Lopez de Silanes. – Hochschwab-Gruppe, 3,3 km ENE of the Leopoldsteiner See, N of Eisenerz, path from Klamm to Hinterseeaugraben, *Acer*, W.Obermayer (10258) & J.Hafellner. – about 6.7 km E of Hieflau, Schwabeltal, close to the confluence of the brook Schwabelbach with a tributary brook, at the W-facing foot of the mountain Mitterkogel, *Acer*, W.Obermayer (10410a; Dupla Graec.Lich.342) [5]. – ibid., *Acer*, W.Obermayer (10410b) [1cet+4mon]. – Hinterseeau Graben, *Acer*, J.Hafellner (25080) & W.Obermayer [1cet+1mon]. – ibid., *Acer*, W.Obermayer (10286) & J.Hafellner. – Sackwaldboden, S unter dem Dippelkar, *Acer*, J.Hafellner (63006) [2]. – Marienklamm im Haring-Graben bei Tragöß-Oberdorf, *Picea*, H.Köckinger, H.Pittoni & J.Poelt (93/208). – 'Hochschwab', M.Heider [GJO]. – Totes Gebirge, path from Loser-Hütte to Blaa-Alm, *Acer*, W.Obermayer (11289) [12]. – Türnitzer Alpen, E von Mariazell, ENE von Halltal, Seitengraben des Kuhgrabens, *Alnus*, P.Bilovitz (2315) [1cet+1mon]. – ibid., *Alnus*, P.Bilovitz (2316) [2]. – ibid., *Fagus*, P.Bilovitz (2337) [1cet+1mon]. – ibid., *Salix*, P.Bilovitz (2354) [2]. – ibid., *Fraxinus*, P.Bilovitz (2304) [2]. – ibid., Haller Graben, *Salix*, P.Bilovitz (2383). – ibid., Finstergraben, *Acer*, P.Bilovitz (1897) [1cet+1mon]. – ibid., Sandiggraben, *Salix*, P.Bilovitz (2538). – Ybbstaler Alpen, N-Ufer der Salza an der Einmüdung des Prolesgrabens, *Acer*, H.Mayrhofer (14381). – Imbach Tal, Einmündung des Hebenstreit Baches, *Fagus*, J.Hafellner (24132) & A.Hafellner. – Ybbstaler Alpen, Rotmoos, an der Straße nach Dürradmer, *Acer*, J.Hafellner (15898) [3cet+1mon]. – STYRIA, VORLAND, Oststeirisches Riedelland (= O. Hügelland), NW von Feldbach, Kornberger Teiche, *Quercus*, B.Wieser (799). – Gleichenberger Kogel, Steinbruch, *Fraxinus*, B.Wieser (907) [4]. – Schützing, im Graben des Schützingbaches, *Quercus*, B.Wieser (801). – STYRIA, ZENTRALALPEN, Gleinalpe, Felskuppe in der Aufzweigung von Langensackgraben und Schrottgraben, 8,5 km SW von Rothleiten, *Acer*, J.Hafellner (52061) [2cet+2mon]. – Grazer Bergland, Haubenberger Graben SE von Neuhof, W von Übelbach, E-Abhänge des Köckkogels, J.Hafellner (3085). – 'Schöckl', J.Glowacki. –

Schöckl-Massiv, Hohenberg SE-Abhänge der Erharthöhe, J.POELT & J.HAFELLNER (9047) [3]. – Gurktaler Alpen, am Ufer des Laßnitzbaches an der Straße von Murau nach St.Lambrecht, kurz N der Einmündung des Auenbaches, *Alnus*, J.HAFELLNER (22519) & E.SCHREINER. – Paalgraben, 2 km N von Kaltwasser, *Acer*, J.HAFELLNER (22504) & E.SCHREINER. – Paal, Klausgraben, *Fagus*, D.SOUKUP (553) [2]. – ibid., nahe Stadlbauer, Moos, D.SOUKUP (397). – ibid., Peterbauer, *Betula*, D.SOUKUP (486). – ibid., Stöller, Leiminggraben, Gestein, D.SOUKUP (454) [3]. – ibid., Wallnergraben, nahe der Hube im Wald, *Prunus*, D.SOUKUP (338) [3]. – Predlitzwinkel S von Predlitz, 2 km N von Turrach, am Ufer der Turrach, *Alnus*, J.HAFELLNER (22358 + 22265) & E.SCHREINER. – Koralpe, Reinisch Kogel, Fallegg Bach, bei einer verfallenen Mühle, W.PONGRATZ (274). – Reinisch Kogel, W über dem Wh Klug, J.HAFELLNER & W.PONGRATZ (275) [6]. – Murberge, Wald bei Puxerloch, WEISBACH. – Hinterburggraben, *Alnus*, J.HAFELLNER (22479) & E.SCHREINER. – Niedere Tauern, Schladminger Tauern, Großsölktal, 0,5 km SW der Kirche von St.Nikolai, *Sorbus*, P.BILOVITZ (956) [3]. – Kleinsölktal, [Bereich zwischen Breitlahnhütte und Schwarzensee], *Alnus*, P.BILOVITZ (521) [1oli+1cet+4mon]. – ibid. *Abies*, P.BILOVITZ (589) & H.MAYRHOFER [GJO] [2cet+2mon]. – ibid., *Acer*, P.BILOVITZ (331) & H.MAYRHOFER [GJO] [1cet+1mon]. – ibid., *Acer*, (+Moose) P.BILOVITZ (361) & H.MAYRHOFER [GJO] [3]. – ibid., Alnus, H.MAYRHOFER (14061) [c.ap.]. – ibid., S der Breitlahnhütte, H.PITTONI. – E-Ufer des Schwarzensees, *Acer*, W.MAYER (1265) [5]. – Forststraße über der Kohlung, *Sorbus*, P.BILOVITZ (635) & H.MAYRHOFER [GJO]. – ibid., *Alnus*, H.MAYRHOFER (14066). – Kohlung am Eingang ins Obertal, *Sorbus*, H.MAYRHOFER (3982) [6]. – vom Jagdhaus Kohlung zur Anlaufjagdhütte, *Fagus*, H.MAYRHOFER (14517) & M.MAGNES [2cet+1mon]. – Gastingwald entlang der Forststraße, *Fagus*, P.BILOVITZ (85) & K.PEITLER. – unterste Abhänge der Großen Kesselspitze, *Alnus*, P.BILOVITZ (227 + 265) & H.MAYRHOFER [GJO]. – ibid., Bereich der Sacherseealm, *Acer*, P.BILOVITZ (124) & H.MAYRHOFER [GJO]. – ibid., unweit der Zaunerrinne, *Acer*, P.BILOVITZ (1127) & H.MAYRHOFER [GJO] – ibid., *Acer*, P.BILOVITZ (1170) & H.MAYRHOFER [GJO]. – ibid., *Betula*, P.BILOVITZ (1104) & H.MAYRHOFER [GJO] [3]. – ibid., *Abies*, P.BILOVITZ (1117) & H.MAYRHOFER [GJO] [3]. – ibid., H.MAYRHOFER, W.PUßWALD (s.n.) & K.ROPIN [2]. – unterste Abhänge der Kleinen Kesselspitze, Jägersteig unweit der Bärenrinne, *Fagus*, P.BILOVITZ (1195) [GJO]. – unterste Abhänge des Spatecks, über dem Tippl-Lehen, *Corylus*, H.MAYRHOFER (13956) & M.MAGNES [GJO]. – ibid., *Corylus*, P.BILOVITZ (675) & H.MAYRHOFER [3]. – unterste Abhänge der Lemperkarspitze, *Acer*, P.BILOVITZ (1604) & H.MAYRHOFER [GJO] [2]. – Sacherseealm, nahe der Haselrinne, H.MAYRHOFER, W.PUßWALD (6) & K.ROPIN. – ibid., unterste Abhänge der Großen Kesselspitze S der Kesselleitenrinne, *Fagus*, H.MAYRHOFER (14558) & M.MAGNES. – Stummeralmgraben, entlang der Forstraße, *Fagus*, H.MAYRHOFER (14087) & M.MAGNES. – Giglbach am Steig zur Lackneralm, R.TÜRK (32046) [1cet+1-mon]. – Druschalm gegenüber von den Riesachfällen, *Alnus*, J.HAFELLNER (13088) [6cet+1mon]. – Untere Gfölleralm, *Alnus*, R.TÜRK (32352) [2cet+5mon]. – Niedere Tauern, Seckauer Tauern, Triebental, nahe Eberl, *Acer*, H.KÖCKINGER (94–576). – Mautern, Hagenbachgraben, *Acer*, K.SCHITTENGRUBER (1390) [20mon+2cet]. – ibid., erste Brücke nach der Abzweigung zur Reicharthütte, *Betula*, K.SCHITTENGRUBER (1260) [3]. – Niedere Tauern, Wölzer Tauern, Großsölktal, Wanderweg Nr.12 (Strupp-Kleinsölk), morscher Baumstamm, P.&E.BILOVITZ (859). – bei Donnersbach, *Acer*, K.SCHITTENGRUBER (1908) [5]. – Seetaler Alpen, Schrattenberg bei Teufenbach, WEISBACH. – 0.7 km SSW of St.Wolfgang, along the rivulet 'Gra-

nitzenbach', *Alnus*, W.OBERMAYER (11388) [2]. – TIROL, Kitzbühler Alpen, Kelchsau, Lange Grund-Ache, *Alnus*, R.TÜRK (808) [LI] [c.ap.]. – Kelchsau, Kurze Grund-Ache, *Acer*, R.TÜRK (4781) [LI]. – ibid., Umgebung der Wegscheider Hütte, *Acer*, R.TÜRK (8867) [LI] [2cet+1mon]. – ibid., *Acer*, R.TÜRK (8867-dupl.) [LI] [1cet+4-mon]. – ibid., *Acer*, R.TÜRK (8868) [LI] [1cet,c.ap.+1mon]. – Wildschönau, Umgebung von Niederau, O.BREUSS (5110) [LI]. – Ötztaler Alpen, 3 km SE von Pfunds, Pfundser Tscheybach, *Alnus*, W.OBERMAYER (02283) [2cet+1mon]. – Tannheimer Berge, NW-Tannheimer Tal, bei Rauth, Birkental, *Fagus*, U.KIRSCHBAUM (3712) [KIRSCHBAUM] [1cet+1mon]. ibid., *Acer*, U.KIRSCHBAUM (5444) [KIRSCHBAUM]. – ibid., *Fagus*, U.KIRSCHBAUM (3505) [KIRSCHBAUM] [5cet+2mon]. – ?Lermoos bei Reutte, Laubbäume E[?].R[?] [LI-289736] [2cet+1mon] – Osttirol, Lienz, zwischen Thurn und Oberdrum, Mauer, H.GANDER [3]. – Zillertaler Alpen, Stilluptal, neben der Ache, *Alnus*, R.TÜRK (804) [LI]. – ibid., S vom Speicher, *Alnus*, R.TÜRK (810) [LI] [1cet+1mon]. – UPPER AUSTRIA (= OBERÖSTERREICH), Böhmische Masse, Mühlkreis, Altenhof, H.HASLINGER (266) [LI]. – Rannatal, Talgrund SW Schloss Altenhof, *Acer*, F.BERGER (21326) [BERGER] [1cet+1mon]. – SE von Eschelberg, W von St.Gotthard im Mühlkreis, Baumstämme, E.SCHINNINGER (831) [LI]. – Dachstein-Krippenstein-Gebiet, Gosau-Lacke, *Acer*, F.GRIMS [LI-413771] [1oli+4-cet+2mon]. – Vorderer Gosausee, Westufer, *Acer*, R.TÜRK (41790) [1cet+2mon]. – Hinterer Gosausee, *Acer*, F.GRIMS [LI] [4cet+1mon]. – Obertraun, Koppenwinkelalm, *Salix*, R.TÜRK (18258) & M.C.MOLINA [LI] [1cet+1mon, c.ap.]. – Ennstaler Alpen, Haller Mauern, Laussabauernalm SE vom Hengstpaß, *Acer*, S.WAGNER (ex herb. TÜRK 29275) [LI]. – Höllengebirge, Vorderer Langbathsee, *Acer*, R.TÜRK (40408). – Höllbachtal, *Acer*, F.GRIMS [LI] [4oli+2cet]. – Pyhrn-Eisenwurzen, Unteres Stodertal nach dem Stromboding-Fall, O.BREUSS (23270) [LI] [1oli-c.ap.+1cet]. – Reichraminger Hintergebirge, Holzgraben, O.BREUSS (23671) [LI] [2, c.ap.]. – ibid., O.BREUSS (23672) [LI]. – Salzkammergut, Schwarzensee NE von St.Wolfgang, *Acer*, R.TÜRK (40103). – Strobl am Wolfgangsee, Bürglstein, *Tilia*, R.TÜRK (33157) [LI]. – [17 km ENE von Bad Ischl], Offensee, 'Kastanie' B.WEINMEISTER (LI-300374) [LI] [3]. – Goiserer Hütte, nahe Bad Goisern, *Salix*, R.TÜRK (4730) [LI]. – Totes Gebirge, Almsee, H.FORSTINGER [LI-042432]. – ibid., *Fagus*, F.BERGER (21320) & R.TÜRK. – ibid., O.BREUSS (3430) & R.TÜRK [LI]. – Dietlgut bei Hinterstoder, R.TÜRK & J.HAFELLNER (11668) [4cet+4mon]. – Hinterstoder, *Acer*, R.TÜRK (422) [LI]. – Ostufer des Offensees, *Acer*, R.TÜRK (11218) [LI]. – Vorderstoder, Stodereck, *Juglans*, H.HASLINGER (602) [LI]. – Vorderstoder, Vordertambergau, *Prunus*, H.HASLINGER (603) [LI-299532] [1oli+1cet+1mon]. – Steyrtal, Weg von Hinterstoder zur Polsterlucke, *Salix*, R.TÜRK (5188) & J.POELT [LI] [1cet+3mon]. – Traunstein, Mair-Alm S vom Traunstein, *Fagus*, R.TÜRK (21144) [LI] [1cet+1mon, c.ap.]. – VORARLBERG, Allgäuer Alpen, Kleines Walsertal, Bärguntbach-Tal, J.HAFELLNER (4833) [3]. – Rätikon, Gamperdona-Tal, über Kühbruck, M.&H.MAYRHOFER (7073) [1chi+1-cet+2mon]. - ibid., J.POELT [1cet+2mon].

FRANCE, Massif Central, Auvergne, Dépt.Cantal, 15 km WSW von Murat, Col du Perthus, O.BREUSS (15066) [LI] [3].

GERMANY, BADEN WÜRTTEMBERG, Stetten im Remstal, Haldenbachtal, *Fagus*, [?]. – BAVARIA (= BAYERN), Berchtesgadener Land, Ramsau, Hintersee, *Acer*, R.TÜRK (37654). – ibid., J.POELT (361). – ibid., J.POELT (444) [2]. – ibid., J.POELT (503) [2cet+1mon,c.ap.].

ITALY, Karnische Alpen, Prov. Belluno, an der Straße von Sauris di Sopra zur Casera Razzo, *Salix*, J.Hafellner (32637) [2]. – Ortler-Gruppe, Südtirol, Martell-Tal, Gneisfelsen, R.Türk (1193) [LI].

MONTENEGRO, Bjelasica, Biogradsko jezero, 42°53'35"N, 019°36'15"E, 1100 m alt., *Alnus*, 31.III.2004, H.Mayrhofer (17587), B.Nedović & D.Vincek.

NORWAY, OPPLAND, Gudbrandsdalen, Sjoa, mossy rocks, G.Degelius (Magn.Lich.Sel.Scand.Exs. 183) [2cet+1mon].

PORTUGAL, MADEIRA, Poiso, unter der Straße kurz S von Casa do Poiso, *Quercus*, J.Hafellner (41617) & A.Hafellner [20].

SLOVENIA, Javorniki, 1.5 km SW von Otok (Cerkniško jezero), NE von Sovinšček, *Acer*, J.Prügger (SN067.1/1) & H.Mayrhofer [2]. – ibid., *Acer*, J.Prügger (SN067.63/1) & H.Mayrhofer [LJU-6849]. – ibid., *Acer*, J.Prügger (SN067.48/1) & H.Mayrhofer [LJU-6845] [1cet+1mon]. – Julian Alps, Koritnica valley NE of the village Log pod Mangartom, *Picea*, H.Mayrhofer (16032a), M.Jensen & M.Trembley [11, c.ap.]. – ibid., *Picea*, H.Mayrhofer (16032b + 16032c), M.Jensen & M.Trembley. – ibid., *Salix*, H.Mayrhofer (16033a + 16033b), M.Jensen & M.Trembley [2]. – Trenta, Lepena, *Picea*, F.Batič [LJU-2575] [4]. – Kamniško-Savinjske Alpe, Logarska dolina, bei km 1.5 an der Straße von Solšava zur Hütte Koča pod slapom Rinka, *Acer*, H.Mayrhofer (16640) [1cet+2mon]. – Notranjski Snežnik, Črni dol, 2 km W von Sviščaki, *Sorbus*, J.Prügger (SN077.13/1) & B.Surina [2]. – 2.5 km SE von Leskova dolina, Lepi dol, *Ulmus*, J.Prügger (SN062.30/1) H.Mayrhofer & F.Batič [LJU-7719] [2]. – Pohorje, Graben des Črni-Baches SW von Ribnica na Pohorju, Anwesen 'Blazovnik', *Acer*, M.Koch & H.Mayrhofer [LJU-415] [3]. – Mislinski Graben, 1 km JV od domačije Pusto, *Acer*, M.Koch, H.Mayrhofer & F.Batič [LJU-450] [2]. – Vuhreščica-Graben, 0.5 km NW von Hudi kot, *Tilia*, M.Koch [GJO] [2]. – W Seitengraben des Črni-Baches SW von Sv.Bolfenk, *Acer*, M.Koch & H.Mayrhofer [GJO] [3]. – Trnovski gozd, an der Straße 312/1063 von Mala Lazna nach Predmeja, bei km 4.0, *Acer*, J.Prügger (643), H.Mayrhofer & F.Batič [2]. – bei km 5.2 an der Straße 312/1064 von Predmeja nach Mala Lazna, *Acer*, J.Prügger (66112) & F.Batič [LJU-5763 + LJU-5765] [2]. – S von V.Golak, *Acer*, J.Prügger (65727) & H.Mayrhofer [LJU-5772] [3]. – Smrečje, *Fagus*, J.Prügger (66002) & H.Mayrhofer [LJU-5765]. – Ternovaner Wald, J.Glowacki [2].

SWITZERLAND, [KANTON BERN], Berner Oberland, 11 km SSE von Meiringen], Guttannen, *Picea*, K.Schittengruber (1210) [12]. – [KANTON GLARUS], Glarner Land, W von Elm bei Güetli, *Acer*, U.Kirschbaum (2471) [Kirschbaum].

UNITED KINGDOM, ENGLAND, Devon, Dartmoor, 0.5 km NE of Two Bridges, mossy granite boulder in small wood T.D.V.Swinscow [2].

8. *Cetrelia chicitae* (W.L.Culb.) W.L.Culb. & C.F.Culb.

8.1. Diagnostic Morphological Characters
(for further details see section 4)

Pseudocyphellae on the upper surface (at least in part) rather large, smooth, and not raised ('type I'), often also developed in the older (central) parts of the thallus. – Pseudocyphellae on the lower surface of sterile lobes ± not developed (seen only on thalli with pycnidia). –

Soralia coarse, often present on strongly twisted lobes giving the lobe-ends a somewhat nibbled appearance. – Soredia coarse, [35–]40–55 µm.

Chemistry: atranorin (high concentrations in the soralia, low concentrations in the cortex), alectoronic acid and a-collatolic acid syndrome (including physodic acid and 4-*O*-methylphysodic acid) in the medulla. At least two further substances were found to occur in traces. – Spot tests (medulla and soralia): C- or (+) faintly orange, KC and CKC slowly (but then persistent) orange.

8.2. Distribution and Frequency in Austria and other Parts of Europe:

When describing *Cetrelia chicitae*, Culberson 1965: 97 cited only one specimen from Europe (France, Vosges) and considered this species to be rare on the continent. However, some years later Culberson & Culberson 1978: 521 supposed that *C. chicitae* "... may actually be rather common in central Europe...". Our investigations has shown, that Culberson's initial report remains true, although more detailed chemical analyses of the genus in various European countries of Europe have revealed further new localities. The species obviously shows a decreasing frequency of occurrence from south-western to north-eastern Europe. Whereas 8.5 % of all *Cetrelias* present in the northern part of the Iberian Peninsula are reported to belong to *C. chicitae* (fide Barbero & al. 1995: 29), and studies from the French départements of Burgundy and Jura revealed a high percentage of specimens of *C. chicitae* (almost 50 % reported by Beguinot 1982: 9; and ca. 20 % reported by Beguinot 1984: 22), the taxon has only been found once, or is stated as being 'very rare' or 'in danger of extinction' in several countries/regions of central Europe (Germany: Wirth & al. 1996: 331, Cezanne & al. 2002; Switzerland: Scheidegger & Clerc 2002: 44+59; Slovenia: Mrak & al. 2004: 115; northern Italy [Friuli-Venetia Giulia]: Nimis 2007), north-western Europe (Great Britain: Purvis 1992: 177), and eastern Europe (Ukraine: Randlane & al. 1991). *Cetrelia chicitae* has yet to be found in Fennoscandia (fide Santesson & al. 2004: 84) and is not cited e.g., in the checklists of Denmark (Søchting & Alstrup 2002), of Belgium and Luxembourg (Diederich & al. 2007), or of Hungary (Verseghy 1994).

All previous citations of *Cetrelia chicitae* in Austria refer to a single record in Poelt & Türk 1984. The identity of this specimen could not be clarified definitively, but there is one specimen in GZU, which has the same locality data, collectors and date as given in Poelt & Türk 1984: 434, i.e. Gurpitschbach, leg. Mayrhofer, Poelt & Türk, 21.VII.1981. Nevertheless, duplicate chemical analyses of that specimen revealed it to be *Cetrelia monachorum*. (Note, that this taxon has not been listed in the "red list of endangered lichens in Austria" [see Türk & Hafellner 1999]).

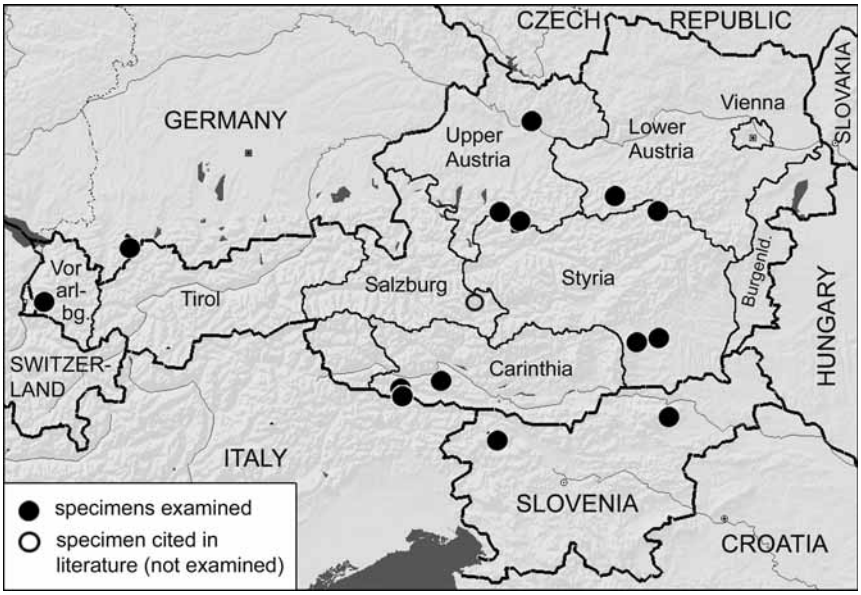

Fig. 15. Previously known distribution of *Cetrelia chicitae* in the Bundesländer of Austria and in Slovenia.

8.3. Specimens examined (19):

Note: Contrary to the other three taxa of *Cetrelia*, the label-text on the specimens is given in full. If the exact coordinates were not recorded on the labels, they were subsequently determined and are given square brackets (for abbreviations see notes under *Cetrelia cetrarioides* sub 'specimens examined', chapter 7.2.).

EUROPE:

AUSTRIA, KÄRNTEN (= CARINTHIA), Gailtaler Alpen, Weißenseegebiet, SE von Naggl, Tal des Almbaches, [46°41'30"N, 013°21'35"E], 1000–1100 m, *Alnus*, 25.VII.1994, O.Breuss (10410) [LI]. – Karnische Alpen, Oberes Gailtal, 1.8 km SW of Mauthen, Mauthner Klamm, 46°39'15"N, 012°59'05"E, MTB 9343/2, 740 m, rocky gorge area with limestone cliffs, *Alnus* (shady conditions), 18.VII.2007, W.Obermayer (11398) [4chi+1cet]. – 7.2 km SSW of the railwaystation of Kötschach-Mauthen, 3 km E of the pass area of 'Plöckenpass', valley of the brook 'Angerbach', 46°36'25-30"N, 012°58'50-59"E, MTB 9343/4, 1300-1350 m alt., mixed forest with mainly *Fagus sylvatica, Alnus*, 31.VIII.2007, W.Obermayer (11429) [2chi+2cet]. – NIEDERÖSTERREICH (= LOWER AUSTRIA), Lunz, [47°51'N, 015°02'E], [620 m], VII.1950, K.Schittengruber (735) [4]. – OBERÖSTERREICH (= UPPER AUSTRIA), Koglerau bei Linz, [48°20'50"N, 014°14'30"E], [MTB 7651/1], [580 m], Obstbäume, 9.VI.1940, H.Haslinger [LI-299538] [3chi+2mon]. – Totes Gebirge, Almsee, [47°45'N, 013°57'E], 590–650 m, 16.X.1983, R.Türk & O.Breuss (3449[b]) [LI-276649]. – Polsterlucke bei Hinterstoder, [47°41'30"N, 014°07'50"N], [610 m], VIII.1986, F.Speta [LI-862088]. – 'Vorderstoder' [but probably 4 km SW of Hinterstoder], Nickerbauerngut,

[47°40'40"N, 014°06'50"E], [650 m], *Prunus*, 20.VIII.1948, H.HASLINGER [LI-299535]. – STEIERMARK (= STYRIA), NORDALPEN, Türnitzer Alpen, E von Mariazell, ENE von Halltal, Seitengraben des Kuhgrabens, 47°46'31"N, 015°26'19"E, MTB 8258/2, 940 m, bachnahe Gehölze, *Sorbus*, 31.VII.2003, P.BILOVITZ (2300) [2chi+1mon]. – STYRIA, VORLAND, Weststeirisches Riedelland (= W. Hügelland), Kaiserwald 10 km SW von Graz, 2 km S von Unterpremstätten, 46°56'50"N, 015°24'E, MTB 9058/1, 350 m, Stieleichen-Föhrenwald, *Quercus*, 15.XI.1997, J.HAFELLNER (44092) [4chi+1mon]. – STYRIA, ZENTRALALPEN, Koralpe, Reinisch Kogel NW von Stainz, am linken Ufer des Stainz-Baches kurz hinter dem Wirtshaus Sauerbrunn, [46°55'10"N, 015°11'45"E], 460 m, *Fagus*, 22.V.1984, J.HAFELLNER & W.PONGRATZ (249) [2]. – TIROL, Tannheimer Berge, Tannheimer Tal, bei Schattwald, Vilstal bei Rehbach, [47°32'20"N, 010°27'25"E], Auenwald, 1000 m, *Populus*, 6.I.2003, U.KIRSCHBAUM (5468) [KIRSCHBAUM]. – VORARLBERG, Rätikon, Gamperdona-Tal SSW von Nenzing, über Kühbruck, [47°08'50"N, 009°41'30"], 1000–1240 m, 28.VII.1986, M.&H.MAYRHOFER (7073) [1chi+1cet+2mon]

SLOVENIA, Smrecno na Pohorju, [46°27'14"N, 015°29'21"E], MTB 9558, 988 m, *Acer*, 13.XII.1989, F.BATIČ [2] [LJU-998]. – Triglav National Park, Bohinj area, Voje valley, 3,5 km N of Stara Fužina, 46°19'N, 13°53'10"E, MTB 9649/3, 680 m, forest, *Fagus*, 19.VI.2002, F.BATIČ & T.MRAK (0469) [LJU-6084].

NORTH AMERICA:

CANADA, ONTARIO, Algoma district, Lake Superior Provincial Park, Lake Superior, including part of an ancient lake beach, 47°45'N, 084°50'W, mossy partially shades boulder, 7.IX.1965, I.M.BRODO (7029) [2].

U.S.A., MICHIGAN, Keweenaw County, Isle Royale National Park, Conglomerate Bay near Saginaw Mine, 48°04'31"N, 088°34'34"W, 190 m, rocky shore of bay, rock cliff, 13.VII.1959, C.M.WETMORE (5121A; Lich.Exs. Univ.Minesota 137) [2]. – MINNESOTA, Cook County, Superior National Forest, W of Greenwood Lake on USFS 144, 27.5 km NNE of Grand Marais, 48°00'02"N, 090°14'33"W, 610 m, steep W-facing cliffs (with *Populus tremuloides* and *Betula papyrifera*), 18.VIII.1999, C.M.WETMORE (83736; WETMORE, Lich.Exs.Univ.Minesota 102) [2]. – NORTH CAROLINA, Transylvania county, Blue Ridge Parkway lookout over John Rock south of intersection with U.S.Highway 276, 1620 m, moist oak woods,28.V.1967, R.C.HARRIS (3342-A) [2chi+1oli].

9. *Cetrelia monachorum* (ZAHLBR.) W.L.CULB. & C.F.CULB.

9.1. Diagnostic Morphological Characters

(for further details see section 4)

Pseudocyphellae on the upper surface frequently developed as somewhat raised structures ('type II'), often appearing as accumulations of individuals to form a larger unit; flat pseudocyphellae of "type I" and "type III" may occur, older (often strongly convex and contorted) thalli often lacking pseudocyphellae (at least in the thallus centre). – Pseudocyphellae on the lower surface usually absent, but sometimes sparingly developed ('type II'). – Soralia often rather coarse and irregularly shaped. – Soredia coarse, [35-]40–55 µm.

Chemistry: atranorin (high concentrations in the soralia, low concentrations in the cortex), imbricaric acid (major), perlatolic acid (always minor), 4-*O*-demethylimbricaric acid (min./tr.), anziaic acid (tr.). According to RANDLANE & SAAG (1991: 123), traces of glomelliferic acid, loxodellic acid and divaricatic acid may also occur. A fatty acid-like substance (1[-2]/1[-2]/1[-2]) frequently present. – Spot tests (medulla and soralia): C- or C+ slightly pinkish/violet, KC+ and CKC+ (due to 4-*O*-demethylimbricaric and anziaic acids) pinkish or pale brownish-reddish.

Note 1: *Cetrelia alaskana*, which occurs in Alaska and in the Chukotka region (Russian Far East), could be regarded as a soil-inhabiting, esorediate morphotype of *C. monachorum*.

Note 2: *Cetrelia monachorum* was first cited for Austria by CULBERSON & CULBERSON 1978: 522 and not by HAFELLNER & al. 2005: 57 as the latter authors stated.

9.2. Specimens examined (423)
(for abbreviations see notes under *Cetrelia cetrarioides* sub 'specimens examined', chapter 7.2.)

ASIA:

GEORGIA, Caucasus occidentalis, distr. Gulripshi, in vicinitate pagi Saken, V.VAŠÁK.

EUROPE:

AUSTRIA, BURGENLAND, Südburgenland, Fidischer Wald E von Kirchfidisch, *Quercus*, W.MAURER (402) [3]. – Günser Gebirge, Große Plische bei Oberpodgoria, W.MAURER (406) [1oli+1mon]. – ibid., W.MAURER (408). – ibid., W.MAURER (400) [3]. – NW von Güssing, bei Sulz, *Quercus*, W.MAURER (410) [3]. – NW von Güssing, Natzwald zwischen Hasendorf und Krottendorf, *Quercus*, W.MAURER (398) [2]. – NW von Salmannsdorf, SW-Hang zur Güns, *Quercus*, (Basis) W.MAURER (407) [2]. – SE von Großpetersdorf, Nordhang des Eisenberges, *Quercus*, W.MAURER (401). – ibid., S von Badersdorf, *Quercus*, W.MAURER (403) [2]. – SE von Großpetersdorf zwischen Kohfidisch und Kleintschaterberg, *Quercus*, W.MAURER (409). – SE von Güssing, SE von Großmürbisch, *Quercus*, W.MAURER (397). – SW von Jennersdorf, Zotterberg W von Tauka, *Quercus*, W.MAURER (396) [2]. – ibid., Tostlereck N von Mühlgraben, *Quercus*, W.MAURER (404) [4]. – Bernsteiner Gebirge, 1 km E von Heanzenstein, *Quercus*, J.HAFELLNER (31519) & W.MAURER. – CARINTHIA (= KÄRNTEN), Gailtaler Alpen, E-Ende des Weißensees, Großer Silbergraben, Einmündung des Kleinen Silbergrabens, *Salix*, J.HAFELLNER (24054) [2]. – SE-Ufer des Weißensees, N-Fuß des Berges Laka, Umgebung des Ghf. Dolomitenblick, *Alnus*, J.HAFELLNER (22987) [1cet+1mon]. – Weißensee-Gebiet, Tal des Almbaches, O.BREUSS [LI-164124]. – Tuffbad, Weg zur Wieser Alm, *Alnus*, R.TÜRK (38781) [3]. – unterste Hänge des Dobratsch, am Gailsteig zwischen Tscheltschnigkogel und Pungart, J.HAFELLNER (310). – ibid., J.POELT. – Aufstieg von Weißbriach zur Hochwarter Höhe, *Fagus*, O.BREUSS (10135) [LI]. – Gurktaler Alpen, Severgraben, E von Gnesau, SE der Gurk, Totholz, C.ZEINER (94). – Nationalpark Nockberge, Langalmtal, *Salix*, W.PETUTSCHNIG [2]. – Hohe Tauern, Reißeck-Gruppe, N vom Reißeck, Göß-

graben (westliches Seitental des Maltatales), Umgebung der Unteren Thomanbauernhütte, H.WITTMANN [LI] [2cet+1mon]. – Radlbachgraben [SW von Gmünd], oberhalb Rubenthaler Alm, *Alnus*, W.REPETZKY (415) [LI]. – Karawanken, Ferlach, Zell-Oberwinkel, Ortsteil Winkel, Umgebung des Gehöftes Franzibauer, *Juglans*, B.AUER (1767). – Ferlach, Waidisch, Weg Nr. 603 auf das Ferlacher Horn, *Fagus*, B.AUER (2064). – Bärental, W unter dem Gehöft Wretschek, *Alnus*, J.HAFELLNER (13551) [2oli+2cetr+3mon]. – ibid. *Alnus*, B.AUER (1673) [2]. – ibid., S der letzten Wohnhäuser, *Juglans*, B.AUER (1445). – Koschutabach Graben SW der Trögener Klamm, 1,5 km W des Gehöftes Franzl, *Fagus*, J.HAFELLNER (26690) [4]. – Zell-Schaida, Straße zum Meleschnik-Sattel, in der Kehre oberhalb des Hofes Meleschnik, *Fraxinus*, B.AUER (1196) [1oli+3mon]. – Karnische Alpen, Gailtal, Rudnig Alm S von Rattendorf, E-exponierte Abhänge des Zuckerhütl, *Fagus*, M.&H.MAYRHOFER [1cet+4mon]. – Plöckenpassgebiet, Obere Valentin-Alm, O.BREUSS (7761) [LI]. – ibid., unterhalb der Unteren Valentin Alm, R.TÜRK & O.BREUSS (7842) [LI]. – 3 km E of the pass area of 'Plöckenpass', valley of the brook 'Angerbach', *Salix*, W.OBERMAYER (11432) [2cet+2mon]. – ibid., *Fagus*, W.OBERMAYER (11430) [5]. – ibid., *Salix*, W.OBERMAYER (11425) [1cet+2mon]. – ibid., *Salix, Picea*, W.OBERMAYER (11426) [4cet+2mon]. – ibid., *Salix*, W.OBERMAYER (11427) [2]. – ibid., *Fagus*, W.OBERMAYER (11434) [2]. – ibid., *Salix*, H.MAYRHOFER (16670) [3]. – Wolayer Graben, SW ober der Unteren Wolayer Alm, *Fagus*, J.HAFELLNER (45738) [2cet+1mon]. – 1.8 km SW of Mauthen, Mauthner Klamm, *Abies*, W.OBERMAYER (11397) [5]. – ibid., *Fagus*, W.OBERMAYER (11396). – 700 m S of Würmlach, NW of Dolling, *Prunus*, W.OBERMAYER (11394) [2]. – 3.1 km E of Plöckenpass, 'Angerbach' to 'Heldenfriedhof', *Fagus*, W.OBERMAYER (11395) [3]. – Garnitzenklamm, *Fagus*, W.OBERMAYER (11423). – ibid., *Acer*, W.OBERMAYER (11424) [4]. – Sattnitz, Hänge am Südufer des Hafnersees, N ober dem Abfluss des Plankensees, *Fagus*, J.HAFELLNER (16052) [2]. – Seetaler Alpen, Saualpe, zwischen Lading und der Gießlhütte, 2 km W von Lading, *Acer*, S.SKANT (1125). – Steiner Alpen, Kotschnatal S von Eisenkappel, NE vom Gehöft Offner, *Acer*, J.HAFELLNER (26756) & W.PETUTSCHNIG [1cet+2mon]. – LOWER AUSTRIA (= NIEDERÖSTERREICH), Böhmische Masse, Ysperklamm, *Acer*, R.TÜRK (22038) [LI]. – Nördliche Kalkalpen, Göller-Gruppe, Südhänge der Weißmauer E vom Lahnsattel, *Fagus*, J.HAFELLNER (45277) [2]. – Seetal, kurz S hinter dem Mittersee, J.HAFELLNER (9206) [2]. – Lunz, Mitterseeboden, *Acer*, M.STEINER [6]. – Steinbachgraben W des Erlaufsees, O.BREUSS (18435) [LI] [1oli+1mon]. – ibid., O.BREUSS (18453) [LI] [1oli+2mon]. – ibid., *Acer*, R.TÜRK (19910) [LI]. – Ybbstaler Alpen, Großer Urwald Rothwald, 16 km W von Mariazell, R.TURK & O.BREUSS [LI]. – ibid., bei Lunz am See, O.BREUSS (495[b]) [4]. – ibid., O.BREUSS (495) [LI]. – Kalkvoralpen, Tal des Högerbaches zwischen Furthof und Dachsgraben, O.BREUSS (22413) [LI]. – Dachsbachgraben, O.BREUSS (17844) [LI]. – ibid., O.BREUSS (17802) [LI] – Kleinzeller Hinteralm, *Tilia*, O.BREUSS (15605) [LI]. – Rehbauerkogel gegen Lappental, O.BREUSS (20071) [LI]. – ibid. O.BREUSS (20076) [LI]. – Aufstieg vom Halbachtal (Kumpfmühle) zur Brennalm, O.BREUSS (18013) [LI]. – Unterberg, Blochboden, O.BREUSS & R.TÜRK [LI]. – Steinparztal bei Hohenberg, O.BREUSS (20317) [LI] [5]. – SALZBURG, Flachgau, Henndorfer Wald, Kolomannsberg, Stögerbrücke, *Acer*, R.TÜRK (25238) [LI]. – Neumarkt am Wallersee, Tal des Steinbaches, SE von Haslach, *Fraxinus*, R.TÜRK (41531) [2]. – ibid., W der Henndorfer Berge, *Acer*, R.TÜRK (41683) [3cet+1-mon+1oli]. – Salzachtal, Acharting, Salzachaue, *Fraxinus*, R.TÜRK (33787) [LI]. – Salzburg-Stadtbereich, Hellbrunner Park, *Quercus*, R.TÜRK (38354). – Schafberg,

beim Mittersee, *Acer*, R.TÜRK (34814). – ibid., W vom Mittersee, *Acer*, R.TÜRK (37559). – SW der Stadt Salzburg, Fuß des Untersberges, an der Straße zwischen Fürstenbrunn und Großgmain, Umgebung des Kühlbaches, Veitlbruch, H.WITTMANN [LI] [5cet+2mon]. – SE der Stadt Salzburg, Glasenbachklamm, *Quercus*, E.SCHINNINGER (95) [LI]. – Weg vom Krottensee zum Almkogel, bei Steingartenhütte, *Acer*, R.TÜRK (26096) [LI]. – ibid., *Acer*, R.TÜRK (26095) [LI] [5oli+1mon]. – Bleckwand im Postalmgebiet, *Fagus*, F.GRIMS [LI]. – Weg von Fürberg nach Ried am Wolfgangsee, *Acer*, R.TÜRK (41738) [3]. – Lungau, Schladminger Tauern, Weißpriachtal, Gurpitschbach, H.MAYRHOFER, J.POELT & R.TÜRK [2]. – ibid., *Alnus*, O.BREUSS (2441) [LI] [2]. – ibid., *Alnus*, O.BREUSS (2441-dupl.) [LI] [2]. – Pinzgau, Glockner-Gruppe, Kaprunertal, Ebenwald? bei Kaprun, J.GLOWACKI [c.ap.]. – Tal der Seidlwinkelache, SW von Worth, in der Seidlau, *Alnus*, R.TÜRK (37612) [1cet+1mon]. – ibid., *Acer*, R.TÜRK (37614) [2]. – Pinzgau, Loferer + Leoganger Steinberge, Weg zur Vorderkaserklamm, *Salix*, R.TÜRK (17536 + 17537) [LI] [c.ap.]. – St.Martin bei Lofer, Maria Kirchental, *Acer*, R.TÜRK (34882) [c.ap.]. – Pinzgau, Chiemgauer Alpen, Tal des Unkenbaches, Umgebung vom Wirtshaus Friedlwirt, H.WITTMANN [LI] [1cet+1mon]. – Pongau, Radstädter Tauern, Kleinarltal, beim Jägersee, 5 km S von Kleinarl, entlang der Straße am Ostufer des Sees, *Acer*, J.HAFELLNER (66892) & A.HAFELLNER [2cet+2mon]. – ibid., *Acer*, J.HAFELLNER (66893) & A.HAFELLNER [4cet+1mon]. – ibid., *Acer*, J.HAFELLNER (66894) & A.HAFELLNER [2-c.ap.]. – Kleinarltal, Rund um den Jägersee, *Acer*, R.TÜRK (21968) [LI]. – Tennengau, Kuchl, Gasteig, *Acer*, R.TÜRK (24986) [LI]. – ibid., *Acer*, R.TÜRK (24993) [LI]. – 5 km E von Kuchl, Zimmereckwald, H.WITTMANN [LI]. – 6 km ENE von Kuchl, zwischen Pernegg und Vordertrattbergalm, Umgebung vom Weiler Brücklreit, H.WITTMANN [LI]. – Bluntautal W von Golling, beim Bärenwirt, *Acer*, R.TÜRK (33690) [LI]. – ibid., Weg zur Joch-Alm, *Acer*, R.TÜRK (41751) [2]. – ibid., *Acer*, R.TÜRK (41747) [2, c.ap.]. – ibid., *Acer*, R.TÜRK (41748) [2, c.ap.]. – 3 km E von Kuchl, zwischen Strubau und Wegscheid, knapp N vom Pfenningpoint, H.WITTMANN [LI]. – Grenzbereich zwischen Zillertaler Alpen und Hohe Tauern, Krimmler Wasserfallweg, *Alnus*, H.MAYRHOFER (16668) [2]. – STYRIA (= STEIERMARK), NORDALPEN, Dachstein-Gruppe, Ramsau, 0,5 km N of the church of Ramsau-Ort, *Acer*, (NW-exposed sides) W.OBERMAYER (11322) [2]. – ibid., W.OBERMAYER (11323) [3]. – Vordere Ramsau, Silberkar, H.MAYRHOFER (7023) [2]. – Eisenerzer Alpen, Flitzenschlucht, unweit vom Goldloch, *Fagus*, J.HAFELLNER (45139) [2]. – Sebringgraben S von Johnsbach, im untersten Talabschnitt, *Fagus*, J.HAFELLNER (42768) [1cet+2mon]. – Zeiritzkampel N von Kalwang, NE vom Jagdhaus Don am Weg zur Achner Alm, *Acer*, J.HAFELLNER (40602) & J.MIADLIKOWSKA [3cet+1mon]. – Ennstaler Alpen, Buchauer Sattel, Auf der Lahn, *Ulmus*, G.BÖTTGER [3]. – ibid., SW vom Gehöft Radmerer, *Acer*, H.MAYRHOFER & G.BÖTTGER [GJO]. – Grießbachgraben, Weg zum Kleinen Buchstein, *Acer*, J.POELT, G.BÖTTGER & H.MAYRHOFER [GJO]. – ibid., *Acer*, G.BÖTTGER. – Haller Mauern, Simandlalm, G.BÖTTGER & H.MAYRHOFER. – Haselkogel, 9 km S von Hieflau, S-Hänge am Steig von Radmer an der Hasel ins Haselkar, *Fagus*, J.HAFELLNER (60447). – Hundsgraben S von Unterlaussa, *Prunus*, G.BÖTTGER & H.MAYRHOFER [GJO]. – Mühlbachgraben, 3 km W von Großreifling, *Acer*, J.POELT, J.HAFELLNER (25929) & E.LOPEZ DE SILANES [1cet+1mon]. – Oberreith, Weißenbach nahe Lindenhof, *Fraxinus*, G.BÖTTGER, H.MAYRHOFER & B.WIESER [GJO]. – Pölzalmbachgraben, *Salix*, G.BÖTTGER, J.PRÜGGER, G.KANTVILAS & H.MAYRHOFER [3, c.ap.]. – ibid., *Salix*, H.MAYRHOFER & G.BÖTTGER [GJO]. – Scheiblingbachgraben, *Acer*, G.BÖTTGER [GJO]. – ibid., *Fraxinus*, G.BÖTTGER [2]. –

Schindlgraben SE von St.Gallen, *Acer*, G.Böttger & H.Mayrhofer [3]. – Spitzenbach-Graben, *Acer*, J.Poelt, W.Obermayer (2157) W.Petutschnig & M.Grube [3]. – Tamischbachturm-Massiv, Steig vom Tamischbachgraben zum Bärensattel, *Acer*, J.Hafellner (67425) [1cet+1mon]. – ibid., *Acer*, J.Hafellner (67443) [2]. – Tamischbachgraben, *Acer*, H.Mayrhofer & G.Böttger [GJO]. – ibid., *Acer*, H.Mayrhofer (17147) & C.Scheuer [3]. – Gesäuse-Berge, Hinterwinkel N von Gstatterboden, *Acer*, H.Mayrhofer (17104 + 17105), C.Hammer & C.Scheuer [1+2]. – E der Bergkirche von Johnsbach, *Alnus*, H.Mayrhofer (16080), C.Hammer & C.Scheuer [5cet+1mon]. – ibid., *Alnus*, H.Mayrhofer (16081a), C.Hammer & C.Scheuer [2cet+3mon]. – ibid., *Alnus*, H.Mayrhofer (16081b), C.Hammer & C.Scheuer [3, c.ap.]. – ibid., *Alnus*, H.Mayrhofer (16082), C.Hammer & C.Scheuer [2cet+1mon]. – ibid., *Alnus*, H.Mayrhofer (17072), C.Hammer & C.Scheuer. – Gesäuseberge E von Admont, am Steig von Johnsbach zur Hess-Hütte, kurz W der unteren Koderalm, *Acer*, J.Hafellner (67482) [1cet+1mon]. – Johnsbachgraben, *Acer*, F.Widder. – Johnsbachtal, *Picea*, K.Schittengruber (912) [2oli+3cet+7mon]. – Hartelsgraben 3 km W von Hieflau, kurz vor der zweiten Brücke, *Acer*, J.Hafellner (60643) & J.Miadlikowska. – ibid., *Alnus*, J.Hafellner (60666) & J.Miadlikowska. – Hochschwab-Gruppe, Fölzalm, Gasthof Schwabenbartl, *Fagus*, S.Sitzwohl (82). – Fölzgraben NW von Aflenz, J.Poelt [3]. – Grüner See, *Larix*, S.Sitzwohl (594). – Leopoldsteiner See, *Larix*, S.Sitzwohl (378). – Rötzgraben, kurz vor dem Forsthaus Lahnhube, *Acer*, J.Hafellner (11047). – Endriegelgraben NE des Schwabenbartl, *Salix*, J.Poelt (93/80) [2]. – Schwabeltal, surrounding area ot the waterfall, *Fraxinus*, W.Obermayer (10323) [2]. – Schwabeltal, kurz W der Einmündung des Schwarzenbaches, *Acer*, J.Hafellner (63516). – Schwabeltal, W-facing foot of the mountain Mitterkogel, *Acer*, W.Obermayer (10351) [4]. – Kaltmauer, north of the valley Wurmgraben, *Acer*, W.Obermayer (10400) [3]. – Hackentörl SW ober Seewiesen, Moose (über Rinde) J.Hafellner (63321) [3]. – Leopoldsteiner See, Eingang des Hinterseeau Grabens, *Acer*, J.Hafellner (25080) & W.Obermayer [1cet+1mon]. – Hinterseeaugraben, near the confluence of the brooks Geharts Bach and Seeau Bach, *Acer*, W.Obermayer (10283) & J.Hafellner. – S von Hinterwildalpen, *Salix*, J.Poelt. – 2.5 km S von Wildalpen, 'Siebensee-Hochmoor', *Betula*, H.Mayrhofer (16667) [3]. – Mürzsteger Alpen, Greithgraben N von Turnau, Umgebung vom Barbarakreuz, *Acer*, J.Hafellner (67532) & L.Muggia [9]. – W der Schneealpe, Hinteralm, W der Wiener-Lehrer-Hütte, *Acer*, P.Bilovitz (3591) & H.Mayrhofer. – Totes Gebirge, bei Bad Mitterndorf, Riesenbachgraben, *Acer*, W.Maurer (207). – S-exponierte Hänge N ober Gößl am Grundlsee, *Acer*, J.Hafellner (50602), E.Schreiner & A.Hafellner [3]. – Ausseer Becken, Umgebung von Bad Aussee, Waldparzelle zwischen Gallhof und Zlaim, *Acer*, J.Hafellner (50575) & E.Schreiner. – N-Ufer des Altausseer Sees, E von Fischerndorf, *Fraxinus*, H.Mayrhofer (10110) [2]. – Türnitzer Alpen, Seitengraben des Kuhgrabens, *Alnus*, P.Bilovitz (2315) [1cet+1mon]. – ibid., *Fagus*, P.Bilovitz (2337) [1cet+1mon]. – SE des Franz-Josef-Denkmals im Rechengraben, Finstergraben, *Fagus*, P.Bilovitz (1878) [1oli+1mon]. – ibid., *Acer*, P.Bilovitz (1897) [1cet+1mon]. – Salzatal, Wanderweg durch die Salzaklamm, *Acer*, H.Mayrhofer (14305) [3]. – ENE von Halltal, Seitengraben des Kuhgrabens, *Sorbus*, P.Bilovitz (2300) [2chi+1mon]. – Ybbstaler Alpen, Vordere Eßling bei Altenmarkt bei St.Gallen, Weg zum Bärenkopf, O.Breuss (22752) [LI]. – hinterster Teil des Hopfgartentales N von Wildalpen, *Fagus*, J.Hafellner (24167) & A.Hafellner [2]. – Grünau, 5 km W von Mariazell, beim Marienwasserfall, O.Breuss (18877) [LI]. – ibid.,

H.MAYRHOFER (16666) [2]. – Rotmoos, an der Straße nach Dürradmer, 2 km N des Forsthauses, *Acer*, J.HAFELLNER (15898) [3cet+1mon]. – STYRIA, VORLAND, Oststeirisches Riedelland (= O. Hügelland), bei Eggersdorf, *Quercus*, W.MAURER [GJO]. – ibid., H.MAYRHOFER (8123) [2]. – Straße von Weiz nach Anger, 1 km S von Oberfeistritz, *Alnus*, J.HAFELLNER (22157) & A.HAFELLNER [1oli+1mon]. – 5 km SE von Fehring, Schüttlgreut, Sandgrube an der Grenze zum Burgenland, *Quercus*, B.WIESER (1228) [2]. – Haselbachgraben, 3 km W von Paldau/Saatzal, Umgebung einer Lehmgrube, *Quercus*, B.WIESER (908) [2]. – Raabtal, Katzlergraben, *Alnus*, B.WIESER (899) [GJO]. – Gleichenberger Kogel, Gossendorfer Trassbergbau N unterhalb vom Bschaidkogel, Umgebung des Steinbruches, *Quercus*, B.WIESER (906). – 2 km S von Tieschen, nahe Jörgen, J.POELT. – Weststeirisches Riedelland (= W. Hügelland), Kaiserwald 10 km SW von Graz, 2 km S von Unterpremstätten, *Quercus*, J.HAFELLNER (44092) & A.HAFELLNER [4chi+1mon]. – ibid., 0.5 km SW of the pond 'Neuteich', W.OBERMAYER (11375 + 11376) [2]. – zwischen Deutschlandsberg und Schwanberg, Allee W der Bahnstation Hollenegg, *Quercus*, J.HAFELLNER (26037) & E.LOPEZ DE SILANES [3]. – S von Deutschlandsberg, lichter Wald kurz E unterhalb von Schloß Hollenegg, J.POELT. – Sausal-Gebirge, SW unterhalb von Kitzeck, J.POELT. – STYRIA, ZENTRALALPEN, Gleinalpe, Großgößgraben, Übergang zum Kleingößgraben, *Acer*, K.SCHITTENGRUBER (1369) [3]. – Felskuppe in der Aufzweigung von Langensackgraben und Schrottgraben, *Acer*, J.HAFELLNER (52061) [2cet+2mon]. – Pöllaugraben, kurz W hinter der Jordankreuz-Kapelle, *Fraxinus*, J.HAFELLNER (52006) [2]. – Grazer Bergland, Frohnleiten, am Waldweg in die Gams, *Fagus*, K.SCHITTENGRUBER (734) [1oli+1mon]. – Stadtgebiet von Graz, Hauenstein, *Sorbus aria* [?]. – Raabklamm, ESE von Arzberg, halb des Weges nach Haselbach, *Fraxinus*, J.POELT [2]. – Mühlbachgraben bei Stift Rein, J.POELT (11037) [c.ap.]. – ibid., *Fraxinus*, J.POELT [3]. – Gurktaler Alpen, Stadl an der Mur, Paal, Berglergraben, *Picea*, D.SOUKUP (359) [2]. – ibid., Klausgraben, *Betula*, D.SOUKUP (559) [2]. – Koralpe, 2 km nach der Abzweigung von Rassach in Richtung Gams, W.PONGRATZ (776) [2]. – Teigitschgraben W von Edelschrott, H.MAYRHOFER (14005), J.BLAHA & C.EDLER [3]. – W von Schwanberg, Sulmufer bei der Mühle des Bauern Müllerbauer, *Alnus*, W.PONGRATZ (965) [3]. – Niedere Tauern, Schladminger Tauern, Kleinsölktal, Breitlahnalm, 0,9 km S der Breitlahnhütte, *Alnus*, P.BILOVITZ (539) [GJO]. – ibid., *Alnus*, P.BILOVITZ (521) [1oli+1cet+4mon]. – 0,5 km NE der Breitlahnhütte, *Acer*, P.BILOVITZ (248) & H.MAYRHOFER [GJO]. – 1,2 km S der Breitlahnhütte, *Abies*, P.BILOVITZ (589) & H.MAYRHOFER [GJO] [2cet+2mon]. – 0,3 km NE der Breitlahnhütte, *Acer*, P.BILOVITZ (331) & H.MAYRHOFER [GJO] [1cet+1mon]. – Breitlahnalm, *Alnus*, H.MAYRHOFER (11113) [1oli+3mon, c.ap..]. – Kohlung-Brücke, *Salix*, P.BILOVITZ (615) & H.MAYRHOFER [GJO]. – Sacherseealm, 0,25 km SW der Kohlung-Brücke, *Acer*, P.BILOVITZ (1210) [GJO]. – ibid., Haselrinne, über dem Schwarzenseebach, *Acer*, H.MAYRHOFER (13911) [GJO] [2]. – Steig vom Jagdhaus Kohlung zur Anlaufjagdhütte und Hopfgarteneben, *Fagus*, H.MAYRHOFER (14517) & M.MAGNES [2cet+1mon]. – ibid., *Fagus*, H.MAYRHOFER (14551) & M.MAGNES [3]. – Schwarzensee, S-Ufer, *Acer*, P.BILOVITZ (1637) & H.MAYRHOFER [3]. – Kapelle am Schwarzensee, *Acer*, P.BILOVITZ (436) [GJO]. – ibid., SW-shore of Schwarzensee, *Sorbus*, W.OBERMAYER (11421) [2]. – unweit der Zaunerrinne, *Picea*, P.BILOVITZ (1097) & H.MAYRHOFER [GJO]. – über dem Tippl-Lehen, *Ulmus*, P.BILOVITZ (684) & H.MAYRHOFER [GJO]. – Weg zur Putzenalm, *Acer*, P.BILOVITZ (1462) [3]. – unterste Abhänger der Lemperkarspitze, *Acer*, P.BILOVITZ (1433) [GJO]. – ibid., *Acer*, P.BILOVITZ (1605) & H.MAYRHOFER [GJO]. – zwischen

Zauner- und Geißlochrinne, *Ulmus*, P.Bilovitz (166) & H.Mayrhofer [3]. – ibid., *Acer*, (+Moose) P.Bilovitz (217) & H.Mayrhofer [GJO]. – Gehweg zwischen der Ofenstegbrücke und dem Gasthof Mössner, *Fagus*, H.Mayrhofer. – Stummeralmgraben, entlang der Forstraße, *Fagus*, H.Mayrhofer & P.Bilovitz (11) [GJO]. – ibid., *Acer*, H.Mayrhofer & P.Bilovitz (40) [GJO]. – Obertal, Tal des Giglbaches am Steig zur Lackneralm, R.Türk (32046) [1cet+1mon]. – Untertal, M.Heider [GJO]. – Druschalm gegenüber von den Riesachfällen, *Alnus*, J.Hafellner (13088) [6cet+1mon]. – Untere Gfölleralm, *Alnus*, R.Türk (32352) [2cet+5mon]. – Niedere Tauern, Seckauer Tauern, Feistritzgraben N von Knittelfeld, 5.5 km N von Wasserleith, bei der Abzweigung des Weges zur Floneralm, *Salix*, J.Hafellner (51643). – Mautern, Hagenbachgraben, *Acer*, K.Schittengruber (1390) [20mon+2cet]. – Hagenbachgraben bei Liesingau (Weg zum Hochreichhart), *Acer*, W.Möschl [2]. – Niedere Tauern, Triebener Tauern, Großer Geißstein, S ober dem Bildstock beim Gehöft Eberl, *Acer*, J.Hafellner (52216) [3]. – Niedere Tauern, Wölzer Tauern, Trieben, Sunk, M.Heider [GJO, 2 specimens]. – Seetaler Alpen, Schrattenberg bei Teufenbach, Weisbach. – Steinberg bei Teufenbach, Erde, Weisbach. – Stubalpe, Teigitschgraben, S von Voitsberg, 2,5 km NE der Langmannsperre, Fels, H.Mayrhofer (13571) [3]. – ibid., Bürgermeister-Gruber-Brücke, 3 km SW vom Kraftwerk Arnstein, *Betula*, H.Mayrhofer & E.Unger [2]. – ibid., Langmann Stausee, S von St.Martin am Wöllmißberg, *Acer*, H.Mayrhofer & E.Unger [2]. – Teigitschgraben, Felsabbrüche SE der Hirzmann Sperre am Weg zum Kraftwerk St.Martin, Moose über Gestein, H.Mayrhofer (12367) [2]. – TIROL, Ammergauer Alpen, Weg von Plansee nach Neidernach, A.Schröppel [2]. – Brandenberger Alpen (= Rofangebirge), Brandenberger Ache, Weg vom Kaiserhaus zum Trauersteg, *Salix*, R.Türk (22719) [LI] [c.ap.]. – Karwendel Gebirge, Stallental bei Schwaz, Hänge unterhalb St.Georgenberg, *Acer*, J.Poelt [2oli+2mon]. – Kitzbühler Alpen, Kelchsau, Kurzer Grund, Umgebung der Wegscheider Hütte, *Acer*, R.Türk (8867) [LI] [2cet+1mon]. – ibid. *Acer*, R.Türk (8867-dupl.) [LI] [1cet+4mon]. – ibid., *Acer*, R.Türk (8868) [LI] [1cet,c.ap.+1mon]. – Ötztaler Alpen, 3 km SE von Pfunds, Pfundser Tscheybach, *Alnus*, W.Obermayer (02283) [2cet+1mon]. – Tannheimer Berge, bei Grän (Enge), *Acer*, U.Kirschbaum (3671) [Kirschbaum] [3]. – ibid., bei Rauth, *Fagus*, U.Kirschbaum (3670) [Kirschbaum] [2]. – ibid., *Fagus*, U.Kirschbaum (3505) [Kirschbaum] [5cet+2mon], – Birkental, *Fagus*, U.Kirschbaum (3712) [Kirschbaum] [1cet+1mon]. – ibid., im Birkental beim Wasserfall, *Acer*, U.Kirschbaum (3714) [Kirschbaum] [2]. – ibid., bei Tannheim-Schmieden, am westlichen Dorfrand (Weg zur Hubertushütte), *Fraxinus*, U.Kirschbaum (4786) [Kirschbaum] [3]. – ?Lermoos bei Reutte, Laubbäume, E[?].R[?], [LI-289736] [2cet+1mon] – Vilser Alpe, A.Schröppel [3, c.ap.]. – Zillertaler Alpen, Stilluptal, S vom Speicher, *Alnus*, R.Türk (810) [LI] [1cet+1mon]. – UPPER AUSTRIA (= OBERÖSTERREICH), Koglerau bei Linz, Obstbäume, H.Haslinger [LI-299538] [3chi+2mon]. – Kremsmünster, Schachenwald, *Quercus*, R.Türk (17604) [LI]. – Oberer Weilhardtforst bei Burghausen, Laubbäume, W.Repetzky (349) [LI]. – ibid., W.Repetzky (349[b]) [LI] [1oli+2mon]. – Steyrtal, bei Klaus, *Fagus*, K.Schittengruber (732) [5]. – Attersee-Gebiet, Kulmgraben bei Oberwang, H.Becker [LI]. – Weg von Weißenbach am Attersee über die Madlschneid zur Brennerin, *Fagus*, R.Türk (8405) [LI]. – Rossmoos ENE von Oberwand, H.Becker [LI]. – Unterach am Attersee, *Quercus*, R.Türk (25867) [LI]. – Böhmische Masse, Rannatal, Talgrund SW Schloss Altenhof, *Acer*, F.Berger (21326) [Berger] [1cet+1-mon]. – Rottenegg, unterhalb der Ruine, Fels, H.Haslinger (260) [LI]. – W von Hel-

fenberg, Straße nach St.Stefan, H.WITTMANN & R.TÜRK (4435) [LI]. – Donautal oberhalb von [Ober-]Landshaag bei Aschach, Granitfelsen, F.GRIMS [LI]. – Böhmische Masse, Sauwald, 'Mäuern' am Haugstein, *Acer*, F.GRIMS [LI-831765] [1oli+3mon]. – ibid., *Acer*, F.GRIMS [LI] [4]. – ibid., *Acer*, F.GRIMS [LI] [2]. – Schlagberg bei Linz, Granit, H.HASLINGER (264) [LI]. – Dachstein-Krippenstein-Gebiet, Gosau-Lacke, *Acer*, F.GRIMS [LI-413771] [1oli+4cet+2mon]. – Vorderer Gosausee, Westufer, *Acer*, R.TÜRK (41790) [1cet+2mon]. – ibid., Ostufer *Acer*, R.TÜRK (41794) [2, c.ap.]. – Weg von Obertraun auf den Hohen Krippenstein, *Acer*, R.TÜRK (4351) [LI] [c.ap.]. – ibid., *Acer*, R.TÜRK (4351-dupl.) [LI]. – Obertraun, Koppenwinkelalm, *Salix*, R.TÜRK (18258) & M.C.MOLINA [LI] [1cet+1mon, c.ap.]. – Hinterer Gosausee, *Acer*, F.GRIMS [LI] [4cet+1mon]. – Hausruck, NNE von Frankenburg, *Quercus*, H.BECKER [LI-866689] [2oli+1mon]. – Höllengebirge, Höllbachtal, morscher Baum, F.GRIMS [LI-830965] [3oli+15mon]. – Höllengebirge, *Salix*, F.GRIMS [LI]. – Kobernaußer Wald, Holzwiesental, *Quercus*, R.TÜRK (27525) & O.STÖHR [LI] [2]. – Pyhrn-Eisenwurzen, 7 km S von Großraming, Tal des Brunnbaches, O.BREUSS (20460) [LI]. – ibid., O.BREUSS (20468) [LI] [1oli+1mon]. – ibid., O.BREUSS (20485) [LI]. – Stodertal, Schiederweiher bei Hinterstoder, O.BREUSS (23201 + 23202 + 23215) [LI]. – ibid., nach dem Stromboding-Fall, O.BREUSS (23268) [LI] [c.ap.]. – Reichraminger Hintergebirge, beim Schleierfall, O.BREUSS (23757) [LI]. – Holzgraben, O.BREUSS (23673) [LI]. – Tal des Schwarzen Bachs, zwischen Biwak Weißwasser und Schleierfall, O.BREUSS (23762) [LI] [4oli+2mon]. – Taleinschnitt NNW der Mooshöhe gegen Weißwasser, O.BREUSS (23688) [LI]. – Weißwasser, Weg zwischen Hirschkogelkreuzung und Biwak Weißwasser, O.BREUSS (23749) [LI]. – Zöbelboden, *Fagus*, R.TÜRK (27787) [LI] [2]. – ibid., *Acer*, R.TÜRK (28131) [LI]. – ibid., unterhalb des Stefflkogels, *Acer*, R.TÜRK (30655 + 39357) [LI]. – ibid., Zöbelgraben, *Fagus*, R.TÜRK (39571) & W.MAYER. – ibid., *Acer*, R.TÜRK (39274 + 39275) & W.MAYER [2+2]. – NW von Altenmarkt bei St.Gallen, Aufstieg auf das Bodenwies, O.BREUSS (22844) [LI]. – Salzkammergut, Schafberg, Schwarzensee am Schafberg, *Fagus*, F.GRIMS [LI]. – Totes Gebirge, Almsee, R.TÜRK & O.BREUSS (3449) [LI]. – ibid., *Alnus*, F.GRIMS [LI]. – ibid., *Picea*, R.TÜRK (41399). – ibid., *Alnus*, R.TÜRK (40838 + 40840) – ibid., *Picea*, R.TÜRK (41406) [3]. – ibid., *Salix*, R.TÜRK (39974) [c.ap.]. – ibid., *Salix*, R.TÜRK (25588) & T.TØNSBERG [1oli+(1mon, c.ap.)]. – ibid., *Picea*, R.TÜRK (34595) [2, c.ap.]. – ibid., *Salix*, R.TÜRK (34594) [c.ap.]. – ibid., Weg vom Seehaus zur Klause, *Fagus*, R.TÜRK (21036) [LI] [1oli+1mon, c.ap.]. – Almtal, bei Längau, *Aesculus hippocastanum*, R.TÜRK (21772) [LI]. – Dietlgut bei Hinterstoder, R.TÜRK & J.HAFELLNER (11668) [4cet+4mon]. – Stodertal, Baumschlagerreith, *Fagus*, R.TÜRK (21561) [LI] [7]. – um den Schiederweiher W von Hinterstoder, J.POELT. – Wanderweg von Hinterstoder zum Schiederweiher, *Acer*, M.MATZER (120) & B.PELZMANN. – Weg von Hinterstoder zur Polsterlucke, *Salix*, R.TÜRK (5188) & J.POELT [LI] [1cet+3mon]. – Steyrtal, Steyrling, Brunnental, *Salix*, R.TÜRK [LI]. – Vorderstoder, 2. Bauernhaus vom [?]Hickerbauern nach Vorderstoder, H.HASLINGER (839) [LI]. – Vorderstoder, Vordertambergau, *Prunus*, H.HASLINGER (603) [LI-299532] [1oli+1cet+1mon]. – Gemeinde Roßleithen, Pießling-Ursprung, O.BREUSS [LI]. – ibid., O.BREUSS (23395) [LI]. – Rettenbachtal E von Bad Ischl, *Acer*, R.TÜRK (10572) [LI] [c.ap.]. – Traunstein-Gebiet, Lainaubach, bei der Moar-Alm, *Fagus*, R.TÜRK (21459) [LI]. – Mair-Alm S vom Traunstein, *Fagus*, R.TÜRK (21144) [LI] [1cet+1mon, c.ap.]. – Ybbstaler Alpen, Frenz, 3 km N von Altenmarkt, *Salix*, R.TÜRK & E.WESELY [LI]. – VORARLBERG, Rätikon, Gamperdona-Tal SSW von Nenzing, Kühbruck, M.&H.MAYRHOFER (7066). – ibid.,

M.&H.MAYRHOFER (7073) [1chi+1cet+2mon]. – ibid., J.POELT [1cet+2mon]. – ibid., J.POELT.

CZECH REPUBLIC, [Moravia], Gesenke, Felswände (freistehend, bemoost), F.SCHENK [2].

FRANCE, DÉPT. PYRÉNÉES-ATLANTIQUES, 50 km SW von Pau, Ravin d'Arpidia, SE von Ste.-Engrâce, O.BREUSS [LI].

GERMANY, BADEN WÜRTTEMBERG, Schwarzwald, Weg von Schönau (Kreis Lörrach) gegen Holzinshaus, Fels, J.POELT (4631). – Schwarzwald, Zastlertal, *Quercus*, U.KIRSCHBAUM (4107) [KIRSCHBAUM]. – ibid., *Fagus*, A.LÖSCH (Migula, Krypt. Germ.Austr.Helv.exs.90) [2]. – BAYERN, Berchtesgadener Land, E vom Hintersee, Ramsau, Antenbichl, WNW der Mündung des Lattenbaches in die Ramsauer Ache, H.WITTMANN (181634) [LI]. – Au südlich des Hintersees in der Ramsau, J.POELT (503) [2cet+1mon,c.ap.]. – Tal der Königssee Ache knapp S vom Wirthaus Mühlleigen (Schusterstein), H.WITTMANN [LI]. – Bayerisch-Böhmischer Wald, Kohlschachten E über Buchenau, Kreis Regen, J.POELT (10704). – NNE von Grainet, Kreis Wolfstein, J.POELT (10690) [2]. – Wald an der Hochstraße am Südhang des Dreisesselzuges, *Fagus*, J.POELT. – Dreisesselberg, *Fagus*, H.HASLINGER (259) [LI].

ITALY, FRIULI-VENEZIA, Julische Alpen, N des M.Mangart, Laghi di Fusine (Mangartsky jezera), oberer See, O.BREUSS (23006) [LI]. – SOUTH TYROL (= Südtirol, = Alto Adige) Tirolia australis, ad rupes umbrosas argillaceo-schistosas pinetorum supra pagum Ehrenburg in valle Pusterthal, KERNSTOCK (Flora Exs. Austro-Hung.3117) [5]. – ibid., (Flora Exs.Austro-Hung.3117) [3]. – [Italy ?/Slovenia?], Görz, J.GLOWACKI.

MONTENEGRO, Bjelasica, National Park Biogradska Gora, along the delta of Biogradska rijeka, S of Biogradsko jezero, 42°53'35"N, 19°36'15"E, 1105 m alt., *Alnus*, 19.VII.2005, H.MAYRHOFER (17655) & B.KNEŽEVIĆ [2, c.ap.].

NORWAY, OPPLAND, Gudbrandsdalen, Sjoa, mossy rocks, G.DEGELIUS (MAGNUSSON, Lich.Sel.Scand.Exs. 183) [2cet+1mon].

ROMANIA, DISTR. PRAHOVA, in montibus Ciucaș, ad pedem mont. Zăganul, *Fagus*, P.CRETZIOU (Lich.Rom.Exs. 28) [1oli+1mon]. – SSW von Brasov, bei Zarnesti (Pestera), am Königstein, *Fagus*, U.KIRSCHBAUM (5408) [KIRSCHBAUM]. – SSW von Brasov, E von Zarnesti (Bucegi-Gebirge), *Acer*, U.KIRSCHBAUM (5436) [KIRSCHBAUM].

SLOVAKIA, [Karparten], Vihorlat, Strypa, J.NÁDVORNÍK. – Belianske Tatry, Medzisteny, *Fagus*, (mossy bark of stump) Z.KYSELOVÁ (4301-dupl.1) [3]. – ibid., Z.KYSELOVÁ (4301-dupl.2) [3].

SLOVENIA, Gorianci, Krakovo, pragozd, blizu Kostanjevice na Krki, 150 m, *Quercus*, 15.VII.1976, F.BATIČ [LJU-1880] [1oli+1mon]. – [Goteniški Snežnik], Medvedjekov Gozd, E von Gotinška Gora, W von Grčarice, W von Kočevje, *Acer*, H.MAYRHOFER (12531), F.BATIČ, M.GRUBE & U.SUPPAN [LJU-2174] [1oli+1mon]. – Javorniki, 1,5 km SW von Otok (Cerkniško jezero), NE von Sovinšček, *Acer*, J.PRÜGGER (SN067.48/1) & H.MAYRHOFER [LJU-6845] [1cet+1mon]. – Julian Alps, Koritnica valley NE of the village Log pod Mangartom, *Salix*, H.MAYRHOFER (16033b), M.JENSEN & M.TREMBLEY [2cet+2mon]. – Bohinj area, near the waterfall of Suha, by the local road from Stara Fužina to Planina Blato, *Fagus*, T.MRAK (0465) [LJU-6082] [2]. – Bohinj area, Planina Blato, near parking place, *Fagus*, H.MAYRHOFER, T.MRAK (0210) H.POLICNIK & R.MEŠL [LJU-5945] [3]. – Bohinj area, Žagarjev graben 1.5 km W of Ski Center Vogel above Bohinjsko jezero, *Acer*, T.MRAK (0202) [LJU-5943] [2]. Spodnji del doline Voje, 750 m S od Koče na Vojah,

Salix, F.Batič (0237) & T.Mrak [LJU-5956] [3]. – Ukanc, okolica Koče pri Savici, *Salix*, T.Mrak [LJU-6146] [2]. – ibid., *Acer*, T.Mrak [LJU-6144] [2]. – Spodnja Bohinjska dolina, levi breg Save Bohinjke pri Laškem Rovtu, nad kolovozom, *Quercus*, T.Mrak [LJU-6079] [4]. – Šentviška planota, *Malus*, K.Primožič [LJU-2737]. – Krma-Tal E der Triglav-Gruppe, S von Mojstrana, *Fagus*, J.Hafellner (3084) [2]. – Kamniško-Savinjske Alpe, Logarska dolina, bei km 1.5 an der Straße von Solšava zur Hütte Koča pod slapom Rinka, *Acer*, H.Mayrhofer (16639) [2]. – ibid., *Acer*, H.Mayrhofer (16640) [1cet+2mon]. – Notranjski Snežnik, 1,5 km S von Veliki Snežnik, NE von Sežanje, Grčovec, *Acer*, J.Prügger (SN041.46/1) & B.Surina [3]. – ibid., *Acer*, J.Prügger (SN041.55/1) & B.Surina [LJU-6770] [2]. – 2 km SW von Kozarišče, S von Vrtača, NE von Gabrov vrh, *Corylus*, J.Prügger (SN105.41/1) & B.Surina [2]. – 6 km N von Veliki Snežnik, 4 km SSW von Kozarišče, S von Jazben vrh, *Fagus*, J.Prügger (SN065.10/1) & H.Mayrhofer [3]. – SW von Kozarišče, 2,5 km W von Babno Plje, SW von Maslovec, *Ulmus*, J.Prügger (SN061.54/1), H.Mayrhofer & F.Batič. – ibid., *Abies*, J.Prügger (SN061.7/1), U.Suppan, H.Mayrhofer & F.Batič [LJU-7710] [2]. – WSW von Veliki Snežnik, Črni dol, 2 km W von Sviščaki, *Fagus*, J.Prügger (SN077a39/1) & B.Surina [LJU-6865] [2]. – SW von Kozarišže, 2,5 km W von Babno Polje, SW von Maslovec, *Quercus*, J.Prügger (SN061.46/1), U.Suppan, H.Mayrhofer & F.Batič [LJU-7708]. – Pohorje, Naturpark Pragozd, Umgebung des Wasserfalls Veliki Šumik, *Acer*, B.Wieser. – Graben NW von Mizni vrh, SE von Koča na Klopnem vrhu, *Acer*, H.Mayrhofer (12792), Z.Belec & M.Suanjak [2]. – 3 km NE von Ribnica na Pohorju, 1 km W des Answesens Ocvirk, *Fraxinus*, M.Koch, H.Mayrhofer & E.Unger [3]. – 500 m S von Žigartov vrh SW Ruše, *Tilia cordata*, M.Koch [LJU-720] [2]. – Drautal, 2 km E von Vuhred, Anwesen Božič, *Malus domestica*, M.Koch, H.Mayrhofer & E.Unger [2]. – E von Vuzenica, 500 m S des Anwesens 'Ropret', *Alnus*, F.Batič, Z.Belec & M.Koch [3]. – Graben des Črni-Baches SW von Ribnica na Pohorju, Anwesen 'Blazovnik', *Fraxinus*, M.Koch & H.Mayrhofer [GJO]. – Graben des Oplotnica-Baches zwischen Jurgovo und Lukanja SE von Pesek, M.Koch & H.Mayrhofer [GJO]. – Oplotnica Graben, bei Jurgovo E von Rogla, *Alnus*, H.Mayrhofer (12405) [LJU-2077] [3]. – Razpotje zwischen Lehen na Pohorju und Lovrenc na Pahorju, *Fraxinus*, M.Koch, H.Mayrhofer, E.Unger & B.Wieser [3]. – S von Vuzenica, im Tal des Baches Plavžnica, unter dem Anwesen Ebjenk, *Pyrus*, M.Koch, H.Mayrhofer, F.Batič & Z.Belec [GJO]. – zwischen Dom na Osankarici und Črno jezero, *Acer*, M.Koch, H.Mayrhofer, E.Unger & B.Wieser [5]. – Ebenk jarek, Vuzenica, *Malus*, F.Batič [LJU-1106] [2oli+1mon]. – Polhograjsko Hribovje, Todraž pri Gorenji vasi, Žirovski vrh, *Quercus sessiliflora*, F.Batič [LJU-70] [3]. – Rajhenavski Rog, pragozd, MTB 0356/1, 965 m, *Fagus*, 15.XI.1976, F.Batič [LJU-1952] [2]. – Trnovski gozd, 1 km S von Nemci, SE von Kamni breg, an der Forststraße in Richtung Vitovski vrh, *Fraxinus*, J.Prügger (64223) [5]. – 2.9 km E von Mala Lazna Richtung Vojsko, Paradana, am Weg zur Eishöhle, *Fagus*, J.Prügger (61918) [LJU-5768]. – 3.2 km SW von Mala Lazna, Westrand des Smrečje, NE von Krnica, E von Preval, *Acer*, J.Prügger (62503) [LJU-5760]. – 3.5 km SW von Lokve, Rastplatz bei km 16.5 an der Straße 312a/1067 Richtung Nova Gorica, *Abies*, J.Prügger (64105) [LJU-5769] [2]. – E von Nova Gorica, an der Straße 312/1064 von Predmeja nach Lokve, 1.5 km NW von Predmeja, *Fagus*, J.Prügger (60922) [LJU-5770] [2]. – Gospodova Senožet, an der Straße von Predmeja Richtung Smreče, S Nagnovec, *Acer*, J.Prügger (65804) [LJU-5771] [2]. – Krnica, 300 m N des Gehöftes Krnica Richtung Smreče, *Acer*, J.Prügger (64526b) [LJU-5767]. – Smreče, an der

Straße Richtung Petrov hrib, N von Mali Čremjak, *Picea*, J.Prügger (65202) & H.Mayrhofer [LJU-5764] [2]. – Upper Savinjska dolina, Okonina, MTB 9655/3, 400 m, *Quercus sessiliflora*, F.Batič [LJU-867] [3]. – Uršlja gora, Ravne na Koroškem, Gehöft Krvavc SE von Kot pri Prevaljah, *Malus*, H.Mayrhofer & U.Suppan [GJO]. – ibid., *Malus*, H.Mayrhofer & U.Suppan [2]. – ibid., *Malus*, H.Mayrhofer & U.Suppan [LJU-4232]. – S von Ravne na Koroškem, Graben Suhodol, 300 m W von Plešivški mlin, *Fraxinus*, H.Mayrhofer, J.Prügger & U.Suppan [2]. – ibid., H.Mayrhofer, J.Prügger & U.Suppan [LJU-4414] [2].

NORTH AMERICA:

U.S.A., VERMONT, Bennington County, Lye Brook Wilderness, Green Mt. National Forest, northwest corner of Little Mud Pond, 4 miles SE of Manchaster, C.M.Wetmore (72825) [2]. – VIRGINIA, Page County, Shenandoah National Park, Skyline Drive S of Thornton Gap, Scescent Rock Overlook, J.Hafellner (8238).

10. *Cetrelia olivetorum* (Nyl.) W.L.Culb. & C.F.Culb.

10.1. Diagnostic Morphological Characters
(for further details see section 4)

Pseudocyphellae on the upper surface rather small and usually not raised ('type III'), often concentrated at the submarginal parts of the lobes, sometimes lacking in the central parts of the lobes. – Pseudocyphellae on the lower surface not developed in sterile lobes or appearing as small white dots of "type II". – Soralia often smooth, strongly convex. – Soredia fine to rather coarse (25–55 μm).

Chemistry: atranorin (high concentrations in the soralia, low concentrations in the cortex), olivetoric acid, anziaic acid (tr.), 4-*O*-demethylmicrophyllinic acid (tr.; best seen in "B", very slightly below the level of norstictic acid). A fatty acid-like substance (best seen in "C" below the fatty acid of *C. monachorum*) sometimes present. – Spot tests (medulla and soralia): C+ strongly sanguineous/red, KC+ and CKC+ reddish.

10.2. Specimens examined (111)
(for abbreviations see notes under *Cetrelia cetrarioides* sub 'specimens examined', chapter 7.2.)

ASIA:

GEORGIA, [Abchasia], Caucasus occidentalis, distr. Sukhumi, vicinitas pagi Akhaslheni, in valle fluminis Zapadnaia Gumista, 400–700 m,13.VII.1980, V.Vašák.

EUROPE:

AUSTRIA, BURGENLAND, W oberhalb von Bad Tatzmannsdorf, 360 m, 7.III.1980, J.Poelt. – Südburgenland, Günser Gebirge, Große Plische bei Oberpodgoria, MTB 8664/3, 20.I.1991, W.Maurer (406) [1oli+1mon]. – Südburgenland, Saubach Graben NW von Mogersdorf, MTB 9063/1, 240 m, Eichen-Hainbuchenwald, *Quercus*, 1.VI.1990, J.Hafellner (24504) & W.Maurer. – Südburgenland, SE Großpetersdorf, Nordhang des Eisenberges, MTB 8764/3, *Quercus*, 30.XII.1990,

W.Maurer (405) [1oli+1cetr]. – Tobaj N von Güssing, S-exponierte Hänge des Tobajer Berges, Rinngraben, MTB 8963/2, 250 m, *Quercus*, 18.IV.1990, J.Hafellner (24982) & W.Maurer. - CARINTHIA (= KÄRNTEN), Karawanken, im Bärental, 4,5 km S von Feistritz im Rosental, W unter dem Gehöft Wretschek, 800 m, *Alnus*, 4.VII.1985, J.Hafellner (13551) [2oli+2cetr+3mon]. – Rosenbachtal S von St.Jakob, MTB 9450, 700 m, *Acer*, 10,X.1990, R.Türk (19513) [LI]. – Zell-Schaida, Straße zum Meleschnik-Sattel, in der Kehre oberhalb des Hofes Meleschnik, 1000 m, *Fraxinus*, 3.XI.1985, B.Auer (1196) [1oli+3mon]. – Gailtaler Alpen, Spittal an der Drau, Weißensee, Ostufer, Weg vom Gasthof Dolomitenblick zu Ortsee, 46°41'56"N, 013°24'39"E, MTB 9346/1, 928 m, *Alnus*, 16.VIII.2005, R.Türk (37858). – LOWER AUSTRIA (= NIEDERÖSTERREICH), Gemeinde Mitterbach, Steinbachgraben W des Erlaufsees, 900 m, 3.VI.2001, O.Breuss (18435) [LI] [1oli+1mon]. – ibid., 840–900 m, 3.VI.2001, O.Breuss (18453) [LI] [1oli+2mon]. – Göstlinger Alpen, Ybbssteinbach, Umgebung vom Jagdschloss, MTB 8355, 750 m, *Acer*, 24.IX.1992, R.Türk (22009) [LI] [3oli+2cet]. – SALZBURG, Strobl am Wolfgangsee, S vom Bürglstein, 47°43'23"N, 013°29'15"E, MTB 8246, 545 m, *Tilia*, 27.I.2001, R.Türk (30128) [LI]. – ibid., *Fraxinus*, 27.I.2001, R.Türk (30113) [LI]. – Weg vom Krottensee zum Almkogel bei Steingartenhütten, MTB 8146, 730 m, *Acer*, 2.X.1998, R.Türk (26095) [LI] [5oli+1mon]. – Weg von Fürberg nach Ried am Wolfgangsee, 47°46'00"N, 013°23'29"E, MTB 8246/1, 543 m, *Acer*, 1.V.2007, R.Türk (41738). – Tal des Steinbaches, W der Henndorfer Berge 47°54'30"N, 013°15'16"E, MTB 8045/4, 640 m, *Acer*, 26.IV.2007, R.Türk (41683) & al. [3cet+1mon+1oli]. – STYRIA (= STEIERMARK), NORDALPEN, Dachstein-Gruppe, Ramsau, 1.9 km ENE of the church of Ramsau-Ort, grange 'Feisterer', 47°25'50"N, 013°40'33"E, MTB 8548/2, *Acer*, W.Obermayer (11420) [2]. – Ennstaler Alpen, 3,5 km E von St.Gallen, Wolfsbachgraben, MTB 8354/1, 590 m, *Acer*, 3.V.1995, H.Mayrhofer & G.Böttger [2]. – Johnsbachtal, *Picea*, 25.VIII.1950, K.Schittengruber (912) [2oli+3cet+7mon]. – W von Großreifling, Eckhütte, MTB 8354/1, 700 m, *Malus,* 16.X.1994, G.Böttger [GJO] [2]. – Gesäuse, Einmündung des Haindlkars, 2 km W von Gstatterboden, MTB 8453/2, 610 m, *Acer*, 20.V.1988, J.Hafellner (20381) & E.Schreiner [2]. – Türnitzer Alpen, NE von Mariazell, SE des Franz-Josef-Denkmals im Rechengraben, Finstergraben, 47°47'24"N, 015°21'48"E, MTB 8258/1, 880 m, einzelne, alte Phorophyten auf einer Lichtung, auf *Fagus* (+Moosauflage), 14.VIII.2002, P.Bilovitz (1878) [1oli+1mon]. – Ybbstaler Alpen, Vordere Eßling bei Altenmarkt bei St.Gallen, Weg zum Bärenkopf, 600–900 m,5.VII.2003, O.Breuss (22758) [LI]. – STYRIA, ZENTRALALPEN, Grazer Bergland, Weizklamm 6 km NW von Weiz, Hänge am Jägersteig, 660–700 m,26.VI.1976, J.Poelt. – Frohnleiten, am Waldweg in die Gams, lichter Buchenwald, *Fagus*, 19.IV.1942, K.Schittengruber (734) [1oli+1mon]. – Gurktaler Alpen, Stadl an der Mur, Paal, Stöller, Leiminggraben, MTB 8950/3, 1200 m, Gestein (+Moosauflage), 26.X.2000, D.Soukup (467) [2]. – Koralpe, Pack Graben SW vom Packer Stausee, 5 km W von Modriach, 900 m, Grauerlenau, *Alnus*, 5.VI.1985, W.Pongratz (534). – Reinisch Kogel NW von Stainz, am rechten Ufer des Fallegg Baches, bei einer verfallenen Mühle S unter der Sommereben, 940 m, Tannen-Fichtenwald, 22.V.1984, J.Hafellner & W.Pongratz (258). – Mausegger Graben NW von Stainz, 46 55'30"N, 015 11'30"E, MTB 9057/3, 480 m, Laubmischwald in Bachnähe, *Fraxinus*, 10.V.1997, J.Miadlikowska & J.Hafellner (40625) [2]. – Murberge, Ranten, Mündungsbereich des Kulmbaches in den Rantenbach, 47°09'11", 014°05'48", MTB 8850/2, 880 m, *Alnus*, 4.XII.2000, D.Soukup (960) [2]. – ibid., D.Soukup (961) [2]. – Niedere Tauern, Schladminger

Tauern, Kleinsölktal, Breitlahnalm, 0,9 km S der Breitlahnhütte, Grauerlensaum entlang des Schwarzenseebaches, 47°18'35"N, 013°53'05"E, MTB 8649/3, 1085 m, *Alnus*, 9.VII.1998, P.Bilovitz (521) [1oli+1cet+4mon]. – ibid., 0,6 km S der Breitlahnhütte, Grauerlensaum entlang des Schwarzenseebaches, 1080 m, *Alnus* (abgestorben), 18.V.1999, P.Bilovitz (548) & H.Mayrhofer [2]. – ibid., *Alnus*, 26.VI.1993, H.Mayrhofer (11113) [1oli+3mon, c.ap.]. – Seetaler Alpen, 0.7 km SSW of St.Wolfgang, along the rivulet 'Granitzenbach', *Alnus*, W.Obermayer (11388) [3]. – STYRIA, VORLAND, Oststeirisches Riedelland, an der Straße von Weiz nach Anger, 1 km S von Oberfeistritz, MTB 8760/1, 460 m, Mischwald, *Alnus*, 22.X.1989, J.Hafellner (22157) & A.Hafellner [1oli+1mon]. – 2 km NW von Feldbach, Kornberger Teiche, MTB 9061/1, 300 m, *Alnus*, 24.VI.1993, B.Wieser (896) [2]. – ibid., *Fraxinus*, 24.VI.1993, B.Wieser (897) [GJO] [3]. – ibid., *Fraxinus*, 24.VI.1993, B.Wieser (895). – Gleichenberger Kogel, Steinbruch W des Kogels und nördliche Abhänge, MTB 9161/1, 380 m, *Alnus* (Borke), 19.III.1994, B.Wieser (1358) [2]. – ibid., B.Wieser (894) [2]. – Kirchberg an der Raab, 2 km W von Kirchberg, Umgebung einer Schottergrube im Radersdorfbachtal, MTB 9060/1, 310 m, *Fraxinus*, 1.IX.1994, B.Wieser (898). – kleiner Seitengraben des Raabtales, 4 km SE von Fehring, Katzlergraben, MTB 9062/3, 280 m, Erlenwald entlang eines Bächleins, *Alnus*, 24.II.1994, B.Wieser [2]. – Limbachtal S von Kapfenstein, Jeserbachgraben NE von Neustift, 280 m, *Fagus* (Borke), 29.XII.1993, B.Wieser (910) [2]. – Raabtal, 3 km NE von Fehring, Katzlergraben, MTB 9062/3, 280 m, *Alnus*, 24.II.1994, B.Wieser (900). – Westliche Abhänge des Stradner Kogels, MTB 9161/4, 580 m, Basaltsteinbruch, *Quercus*, 20.VI.1993, B.Wieser (902). – 7 km E von Straden, Teichanlage E von Pichla, MTB 9261/2, 260 m, *Fraxinus*, 3.II.1994, B.Wieser (909) [GJO]. – 7 km E von Straden, Teichanlage E von Pichla, MTB 9261/2, 260 m, *Fraxinus*, 3.II.1994, B.Wieser (911). – 8 km N von Bad Radkersburg, Königsberg bei Klöch, Koglwald, MTB 9261/2, 350 m, *Quercus*, 3.II.1994, B.Wieser (901). – Weststeirisches Riedelland, St. Stefan ob Stainz, *Carpinus*, 31.VI.1870, Penecke. – 2.2 km W of Wundschuh, Kaiserwald-area, 0.5 km SW of the pond 'Neuteich', MTB 9858/4, 348 m, *Quercus*, 19.VI.2007, W.Obermayer (11374 + 11377) [2]. – Windische Bühel, S-Steiermark, Fötschachtal bei Sabathe E unterhalb von Leutschach, Kreis Arnfels, 400 m,7.V.1972, J.Poelt. – TIROL, Brandenberger Ache, Weg vom Kaiserhaus zu Trauersteg, MTB 8437, 710-800 m, *Salix*, 3.VIII.1996, R.Türk (22714) [LI]. – Karwendel Gebirge, Stallental bei Schwaz, Hänge unterhalb St.Georgenberg, 800–900 m, Acer, 13.XI.1976, J.Poelt [2oli+2mon]. – NW-Tirol, Tannheimer Tal, bei Rauth, oberhalb des Ortes, am Wiesen-Waldrand, 1100 m, *Acer*, 13.VIII.1998, U.Kirschbaum (3726) [Kirschbaum]. – UPPER AUSTRIA (= OBERÖSTERREICH), Dachstein, Gosau-Lacke, [47°31'N, [013°32'E], MTB 8447/3, 1000 m, *Acer*, 22.IV.2000, F.Grims [LI-413771] [1oli+4cet+2mon]. – Ennstal, Dürnbach bei Steyer, 700 m, *Pyrus*, 28.VIII.1942, K.Schittengruber (733) [3]. – Hausruck, NNE von Frankenburg, *Quercus*, 9.VIII.1949, H.Becker [LI-866689] [2oli+1mon]. – Höllengebirge, Höllbachtal, morscher Baum, 7.IV.1971, F.Grims [LI-830965] [3oli+15-mon]. – Kalkalpen, Reichraminger Hintergebirge, Tal des Schwarzen Bachs, zwischen Biwak Weißwasser und Schleierfall, 600 m, 30.VIII.2004, O.Breuss (23762) [LI] [4oli+2mon]. – Oberer Weilhadtforst bei Burghausen, Laubbäume, 6.IV.1971, W.Repetzky (349[b]) [LI] [1oli+2mon]. – Oberösterreichische Kalkalpen, Höllbachtal im Höllengebirge, 800 m, *Acer*, 3.V.1969, F.Grims [LI] [4oli+2cet]. – Pyhrn-Eisenwurzen, 7 km S von Großraming, Tal des Brunnbaches, 520–650 m, 20.V.2002, O.Breuss (20468) [LI] [1oli+1mon]. – Pyhrn-Eisenwurzen, Unteres Stodertal nach

dem Stromboding-Fall, 570 m, 22.VIII.2003, O.Breuss (23260) [LI]. – ibid., O.Breuss (23270) [LI] [1oli-c.ap.+1cet]. – Salzkammergut, zwischen Obertraun und Koppenbrüller Höhle, 520 m, *Acer*, 19.VIII.1986, H.Mayrhofer (6557) [2]. – Sauwald, 'Mäuern' am Haugstein, *Acer*, 16.IV.1966, F.Grims [LI-831765] [1oli+3mon]. – Schlagberg bei Linz, *Fraxinus*, 6.VI.1938, H.Haslinger (263) [LI-299537]. – Südfuß des Sengsengebirges, NW von Windischgarsten, Hinteres Rettenbachtal, SE vom Rießriegel, 600 m, *Acer*, S.Wagner [LI] [2]. – Totes Gebirge, Almsee, Weg vom Seehaus zur Klause, MTB 8249, 600 m, *Fagus*, 17.V.1996, R.Türk (21035) [LI]. – ibid., *Fagus*, 17.V.1996, R.Türk (21036) [LI] [1oli+1mon, c.ap.]. – ibid., Alnetum auf der SE-Seite des Südendes, MTB 8249, 595 m, *Salix*, 31.V.1998, R.Türk (25588) & T.Tønsberg [1oli+1mon, c.ap.]. – Vorderstoder, Vordertambergau, *Prunus*, X.1947, H.Haslinger (603) [LI-299532] [1oli+1cet+1mon]. – Oberösterreich[?], Kürnberg [near Linz?], 24.IX.1878, J.Hinteröcker [LI].

CZECH REPUBLIC, Bohemia meridionalis, Lomnicen n/z. Naskále v lese upohodnice, 31.III.1886, A.Weidenau[?].

GERMANY, BAVARIA (= BAYERN), Oberbayern, Wettersteingebirge, Kreis Garmisch-Partenkirchen, Südostufer des Eibsees, 980 m, Fichten-Bergwald, 28.VI.1970, J.Poelt (8461).

HUNGARY, Budakorzer [Budakeszi?] Gebirge bei Ofen [district of Budapest], 20.VIII.1892, W.Steinitz.

PORTUGAL, MADEIRA, bei Ribeiro Frio, in Richtung Balcoes, 900 m, *Quercus*, 5.IX.2001, U.Kirschbaum (5090) [Kirschbaum].

ROMANIA, DISTR. PRAHOVA, in montibus Ciucaș, ad pedem mont. Zăganul, *Fagus*, 22.VI.1936, P.Cretziou (Lich.Rom.Exs. 28) [1oli+1mon].

SLOVENIA, Gorianci, Krakovo, pragozd, blizu Kostanjevice na Krki, MTB 0158/2, 150 m, *Quercus*, 15.VII.1976, F.Batič [LJU-1880] [1oli+1mon]. – Goteniški Snešnik, Medvedjekov gozd, E von Gotinška Gora, W von Grčarice, W von Kočevje, 750 m, *Acer*, 15.VI.1995, H.Mayrhofer (12531), F.Batič, M.Grube & U.Suppan [LJU-2174] [1oli+1mon]. – Javorniki, E von Cerkniško jezero, 2 km N von Lož, nahe Križna jama, MTB 0252/4, 660 m, Buchen-Tannen-Wald, *Fagus*, 3.X.1997, J.Prügger (SN060.12/1), U.Suppan, H.Mayrhofer & F.Batič [2]. – Julian Alps, Bohinj area, Voje valley, 3,5 km N fom Stara Fužina, 46°19'N, 13°53'10"E, MTB 9649/3, 680 m, open standing trees, *Tilia*, 19.VI.2002, F.Batič & T.Mrak (0165) [LJU-6247]. – Bohinj area, Voje valley, 3,5 km N fom Stara Fužina, 46°19'N, 13°53'10"E, MTB 9649/3, 680 m, forest, *Fagus*, 19.VI.2002, F.Batič & T.Mrak (0211) [LJU-5946]. – Bohinj area, Mostnica riverbeds, N of Stara Fužina, 46°18'30"N, 13°53'20"E, MTB 9649/3, 680 m, forest, *Fagus*, 17.V.2002, T.Mrak (0466) [LJU-6083]. – Ukanc, okolica Koče pri Savici, MTB 9748/2, 650 m, *Fagus*, 29.I.2003, T.Mrak [LJU-6143] [3]. – Spodnja Bohinjska dolina, levi breg Save Bohinjke pri Laškem Rovtu, nad kolovozom, MTB 9749/1, 540 m, *Fraxinus*, 11.III.2002, T.Mrak [LJU-6085]. – Kočevski Rog, Pečke, pragozd, pri Dolenjskih toplicah, Pečke nad Sot, MTB 0256/1, 900 m, *Fagus*, 19.IX.1976, F.Batič [LJU-1860]. – Pohorje, Ebenk jarek, Vuzenica, 530 m, *Malus*, 19.IX.1976, F.Batič [LJU-1106] [2oli+1mon]. – Osankarica, spomenik, 1240 m, *Fagus*, 13.XII.1989, F.Batič [LJU-946] [2].

NORTH AMERICA:

CANADA, QUÉBEC, Gatineau County, Parc de la Vérendrye, 3 miles N of south gate, near Lac Coupal, 46° 45'N, 076° 08'W, *Acer-saccharum-Betula-alleghe-*

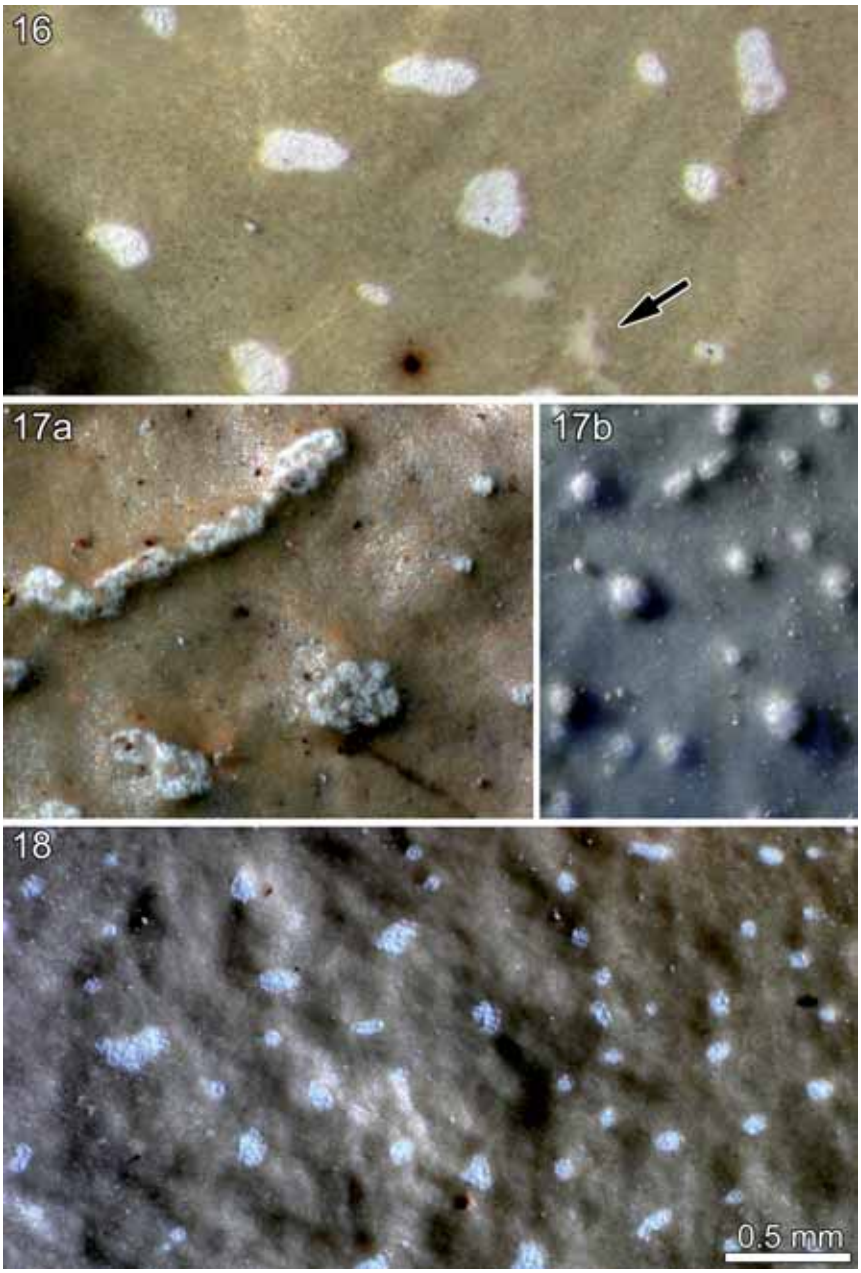

Fig. 16–18. Pseudocyphellae on the upper surface of *Cetrelia* (in their most typical forms). – Fig. 16. 'Type I', large, flat, homogeneous; arrow indicates white maculae (*C. chicitae*, Breuss 10410 [LI]). – Fig. 17a, 17b. 'Type II', raised, agglomerated (*C. monachorum*, a. Kirschbaum 3671 [Kirschbaum], b. Obermayer 11430). – Fig. 18. 'Type III', rather small, p.p. slightly immersed (*C. olivetorum*, Mayrhofer 6557). – Scale applies to all figures. All photographs were taken with strongly lateral illumination.

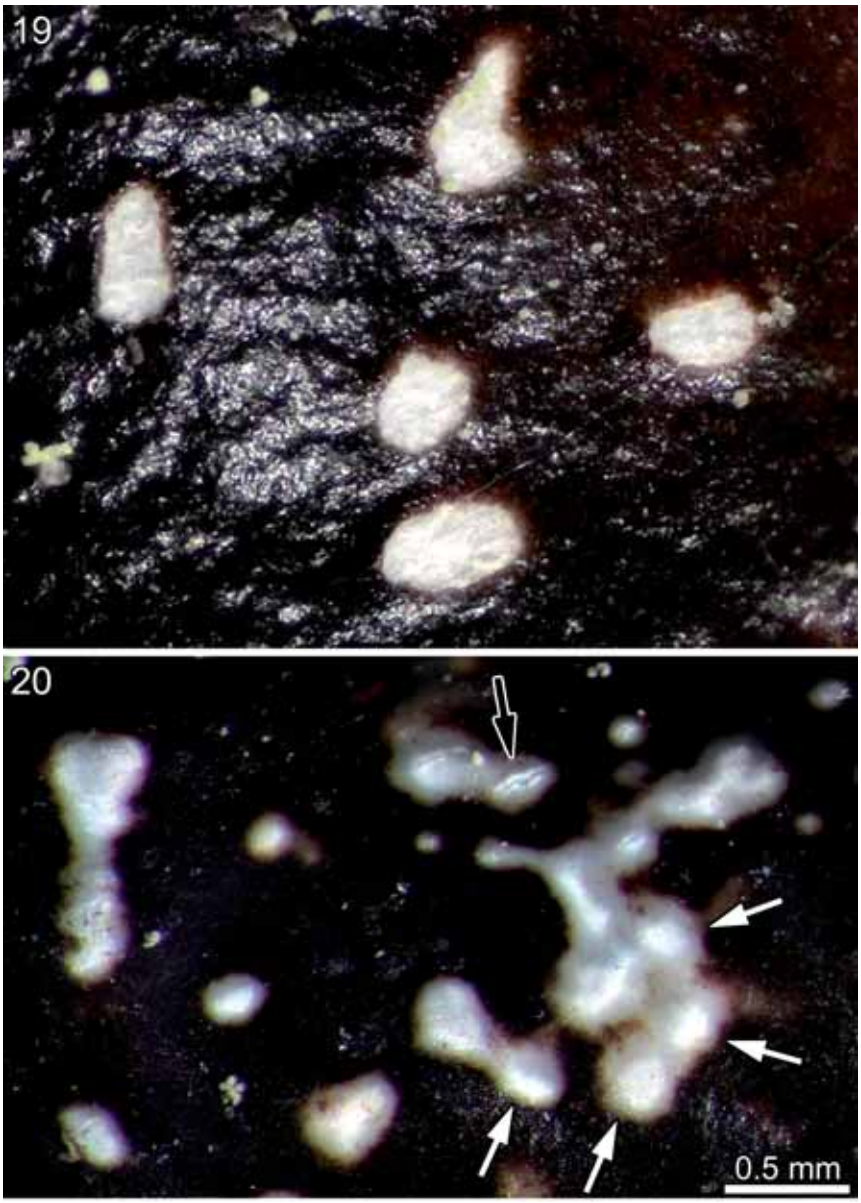

Fig. 19–20. Pseudocyphellae of the lower surface of *Cetrelia*. – Fig. 19. 'Type I', homogenous, white (*C. cetrarioides*, OBERMAYER 11393). – Fig. 20. 'Type II', clustered, surrounded by a pale (corticate) rim with a white ('decorticate') centre (see white arrows). The black arrow indicates a fissure (*C. cetrarioides*, BILOVITZ 521). – Scale applies to both figures.

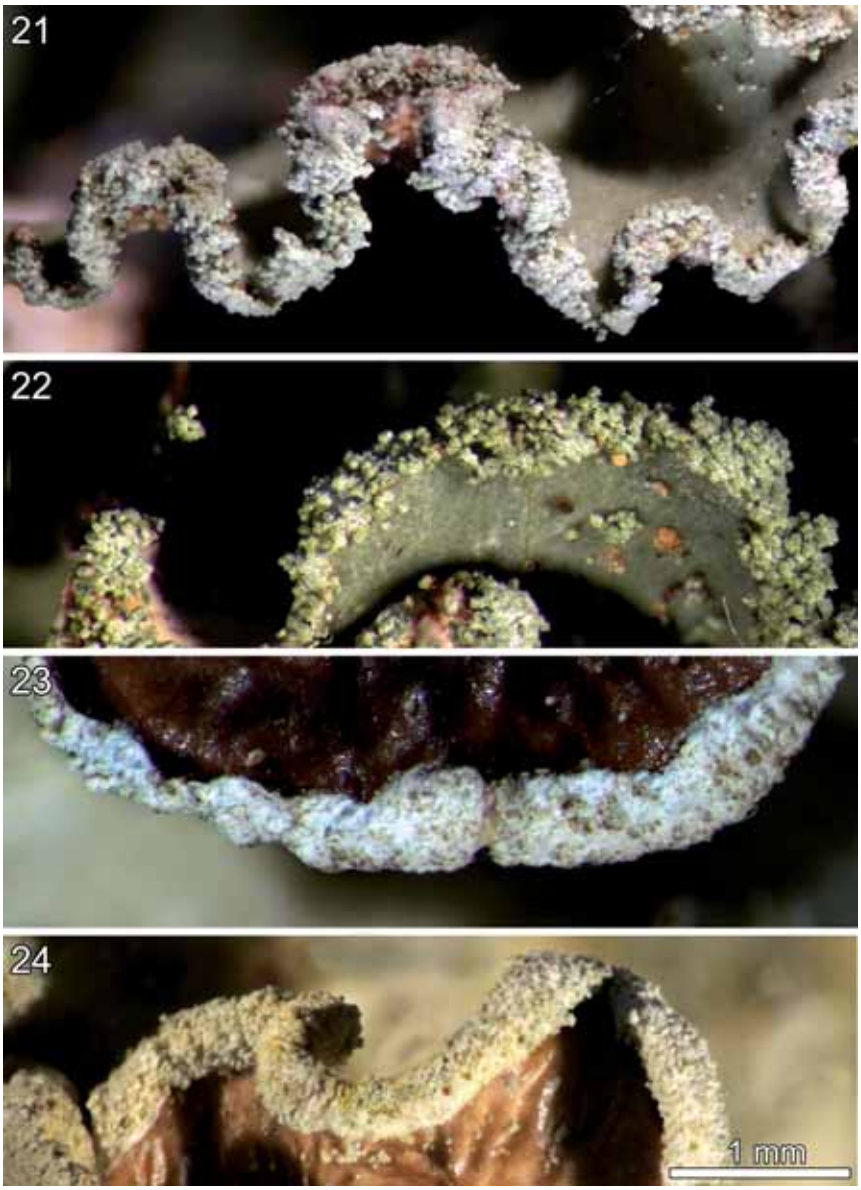

Fig. 21–24. Shape of marginal soralia in *Cetrelia*. – Fig. 21. *C. chicitae*. Strongly twisted soralia with coarse soredia (Bilovitz 2300). – Fig. 22. *C. monachorum*. Coarse soredia (Hafellner 67532). – Fig. 23. *C. olivetorum*. Rather smooth soralium seen from the lower side (Mayrhofer 3.5.1995). – Fig. 24. *C. cetrarioides*. Smooth soralium with fine soredia seen from the lower side (Bilovitz 675 & Mayrhofer). – Scale applies to all figures.

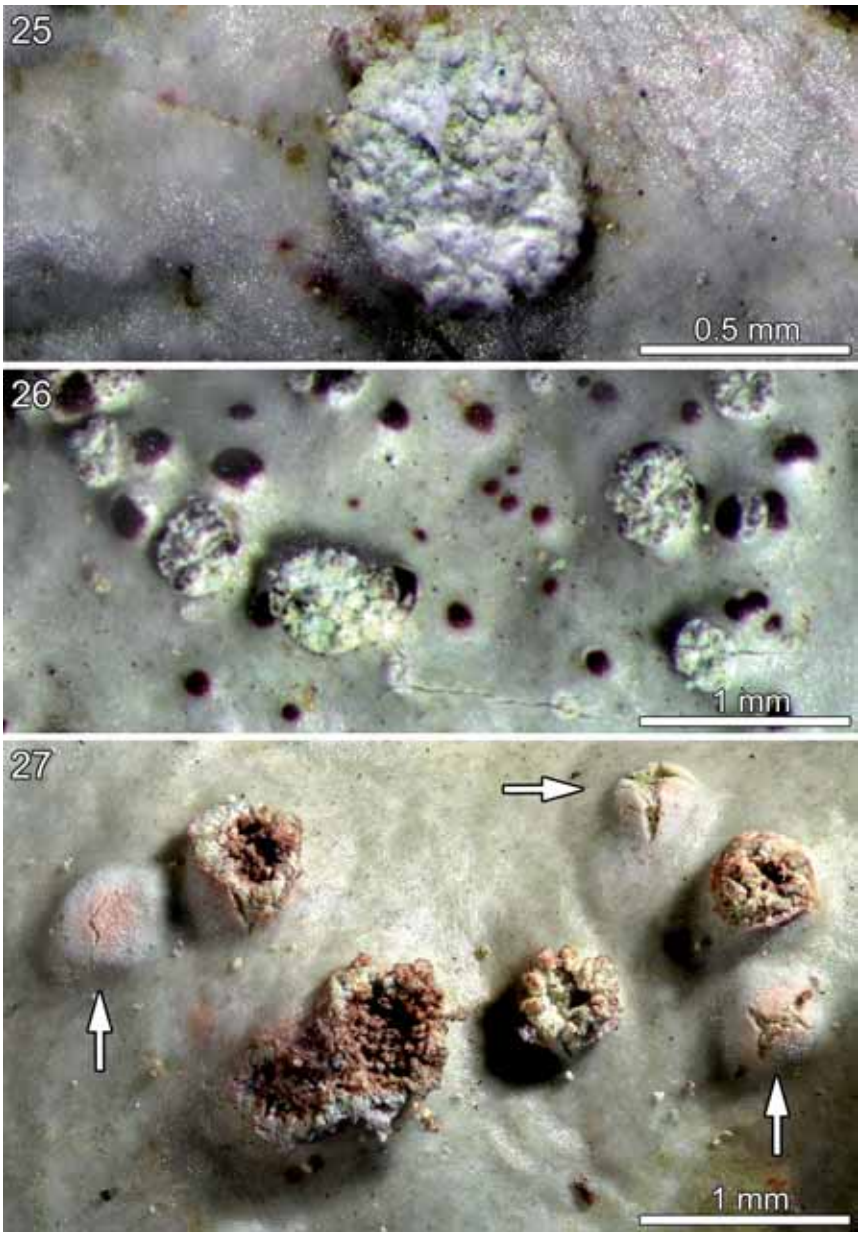

Fig. 25–27. Laminal soralia in *Cetrelia*. – Fig. 25. *C. monachorum* (Bilovitz 2521). – Fig. 26. *C. monachorum* (Obermayer 11338). Soralia amongst apothecial initials (dark spots) – Fig. 27. *C. cetrarioides* (Mayrhofer 14082). Arrows indicate juvenile stages erupting from pseudocyphellae on the upper surface.

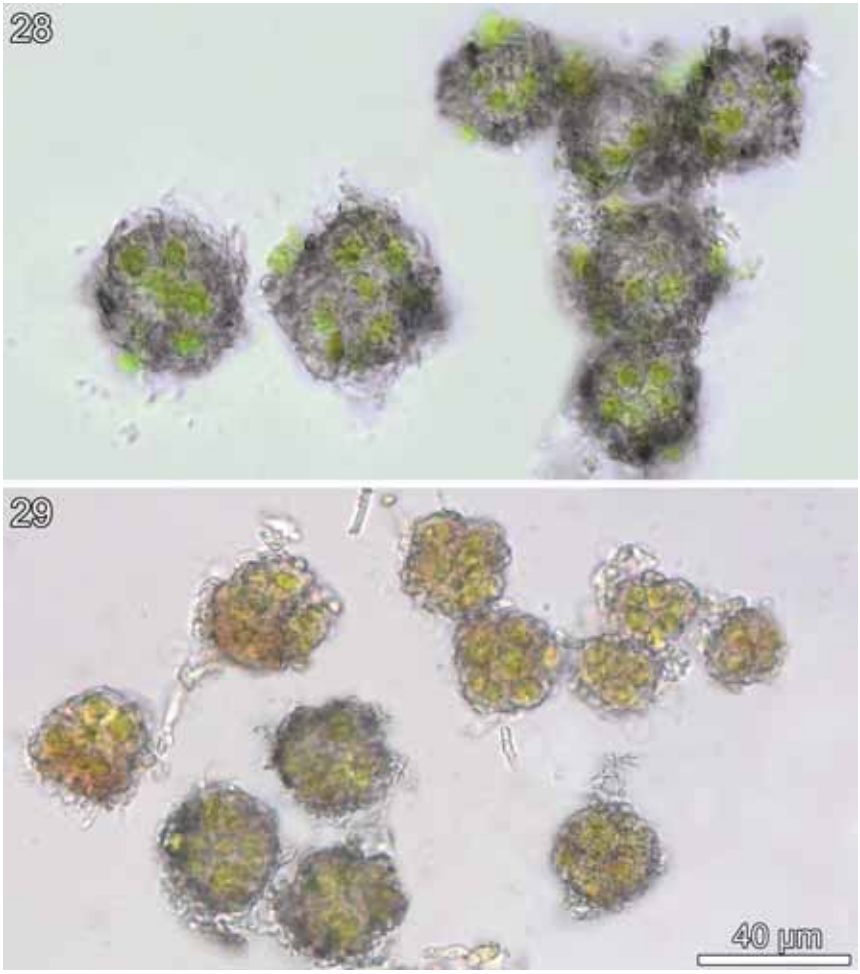

Fig. 28–29. Size of soredia in *Cetrelia*. – Fig. 28. *C. chicitae* (Obermayer 11398). – Fig. 29. *C. cetrarioides* (Mayrhofer 16032c). – Scale applies to both figures.

Fig. 30-31. Veined and ridged lower surface of some morphotypes of *Cetrelia*. – Fig. 30. *C. olivetorum* (WIESER 24.2.1994). – Fig. 31. *C. cetrarioides* (PRÜGGER [LJU 7719]). – Scale applies to both figures.

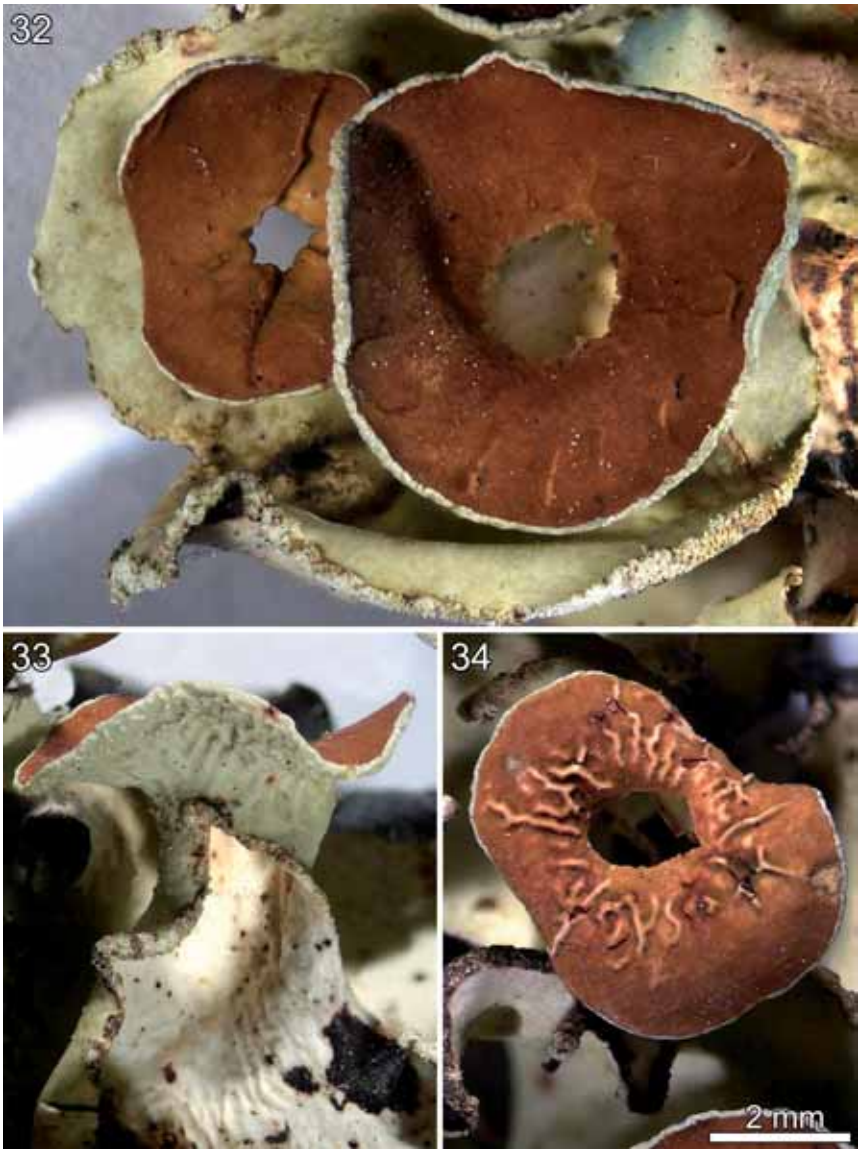

Fig. 32–34. Perforate apothecia of *Cetrelia cetrarioides* (MAYRHOFER 16032a). – Fig. 33 shows the almost white coloured lower surface of the thallus. – Scale applies to all figures.

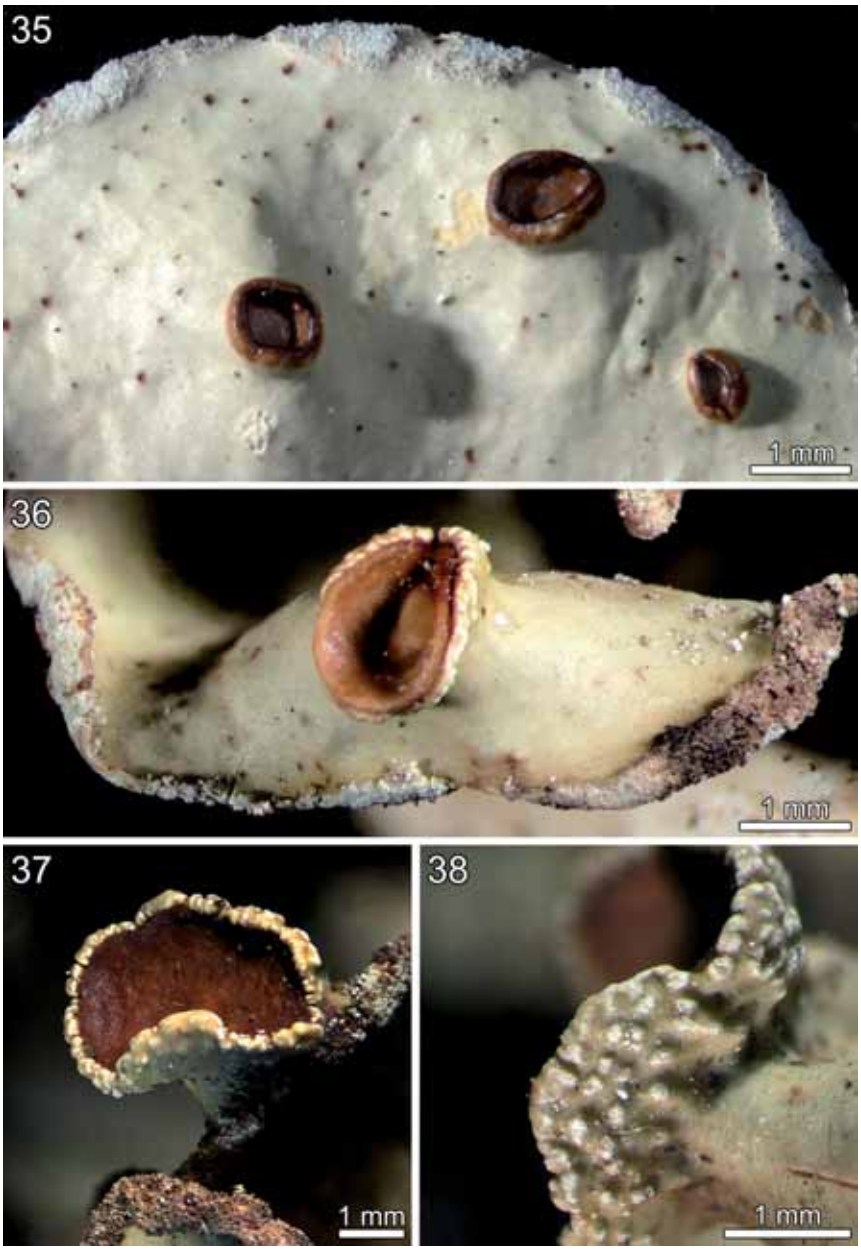

Fig. 35–38. Eperforate apothecia of *Cetrelia cetrarioides*. – Fig. 35. Juvenile stages (Mayrhofer 14061). – Fig. 36. Juvenile stage with a deep depression but without a perforation. – Fig. 37. Relatively large, mature apothecium (Zeiner 168). – Fig. 38. Strongly pseudocyphellate marginal area of the same apothecium.

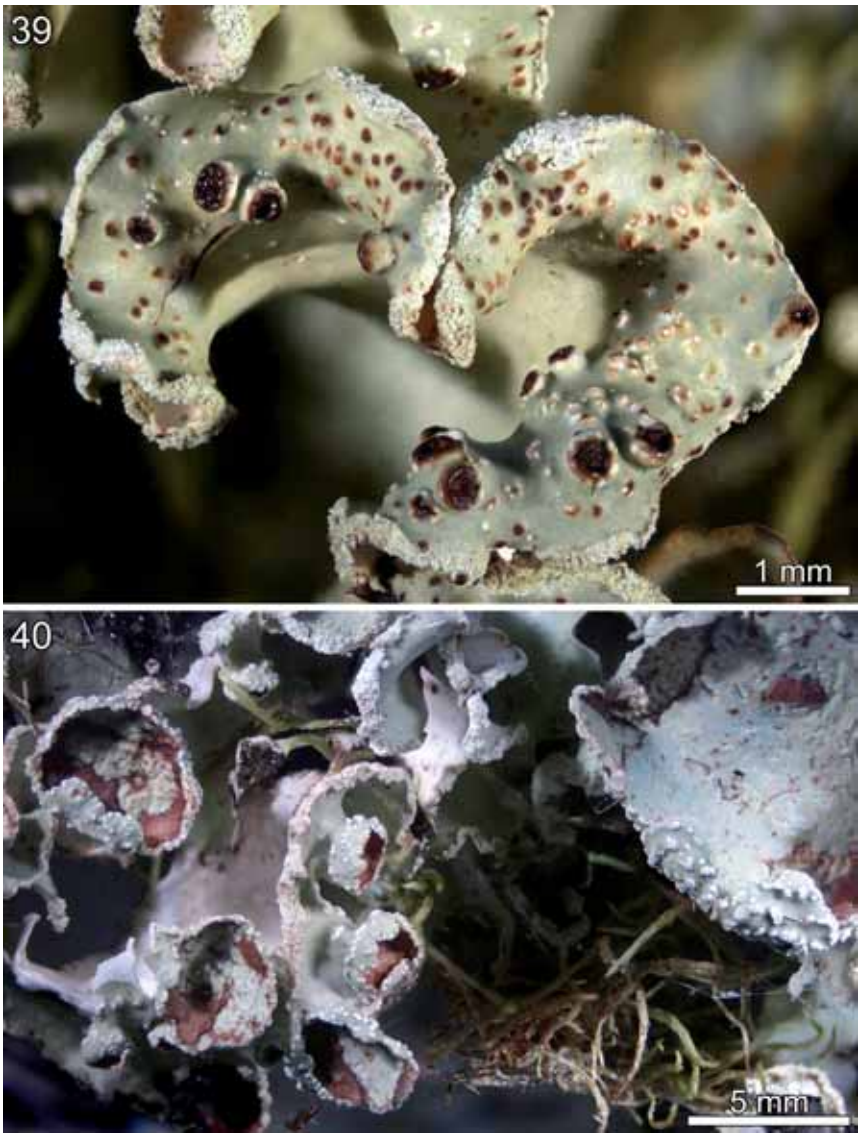

Fig. 39–40. Eperforate apothecia of *Cetrelia monachorum* (MAYRHOFER 16081a). – Fig. 39. Juvenile apothecia and initials of apothecia. – Fig. 40. Mature apothecia with strongly pseudocyphellate margins. Right-hand corner of the image: part of a huge apothecium (more than 1 cm wide), with an almost totally eroded hymenium (due to invertebrates feeding?).

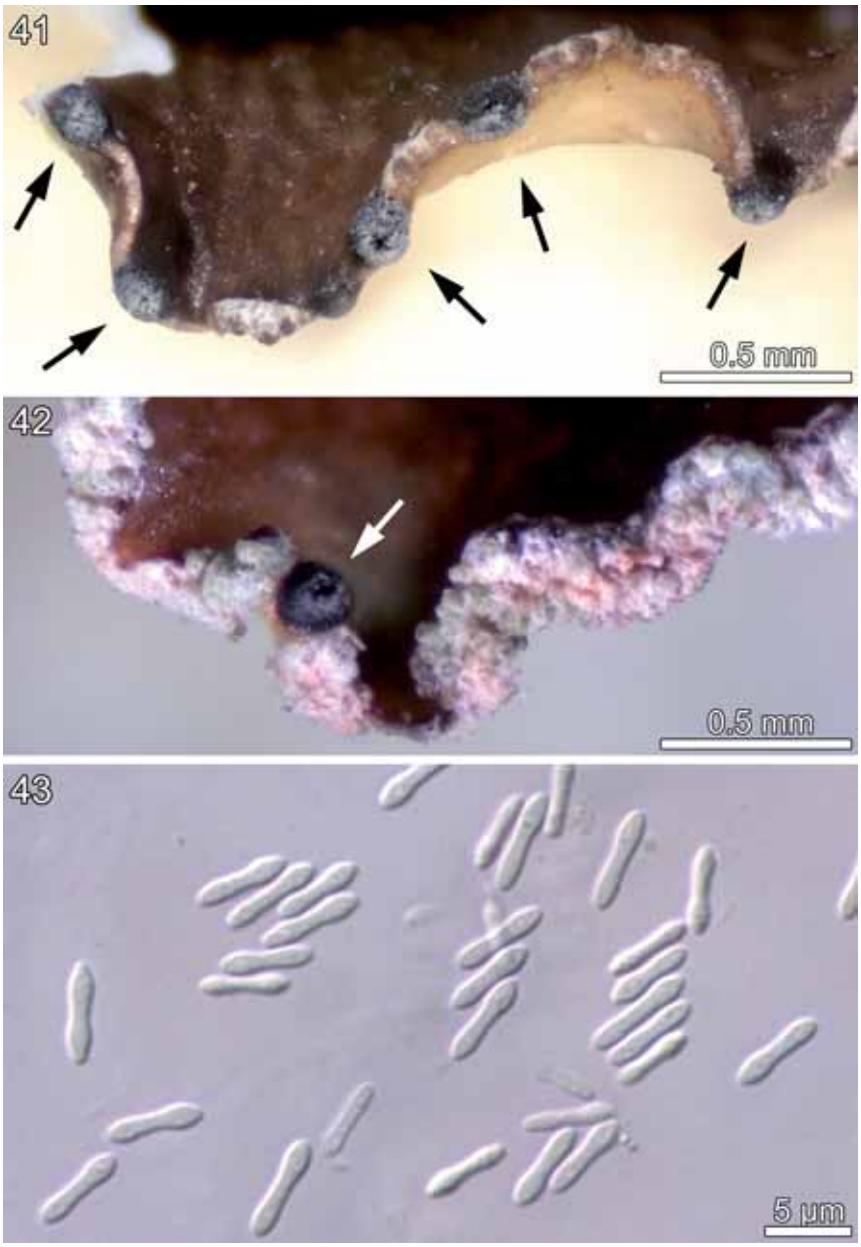

Fig. 41–43. Pycnidia and spermatia in *Cetrelia chicitae*. – Fig. 41. Slightly white pruinose pycnidia (see arrows) on an almost esorediate thallus margin (KIRSCHBAUM 5468 [KIRSCHBAUM]). – Fig. 42. Pycnidium (see arrow) on a sorediate thallus margin (OBERMAYER 11398). – Fig. 43. Weakly bifusiform spermatia (OBERMAYER 11398).

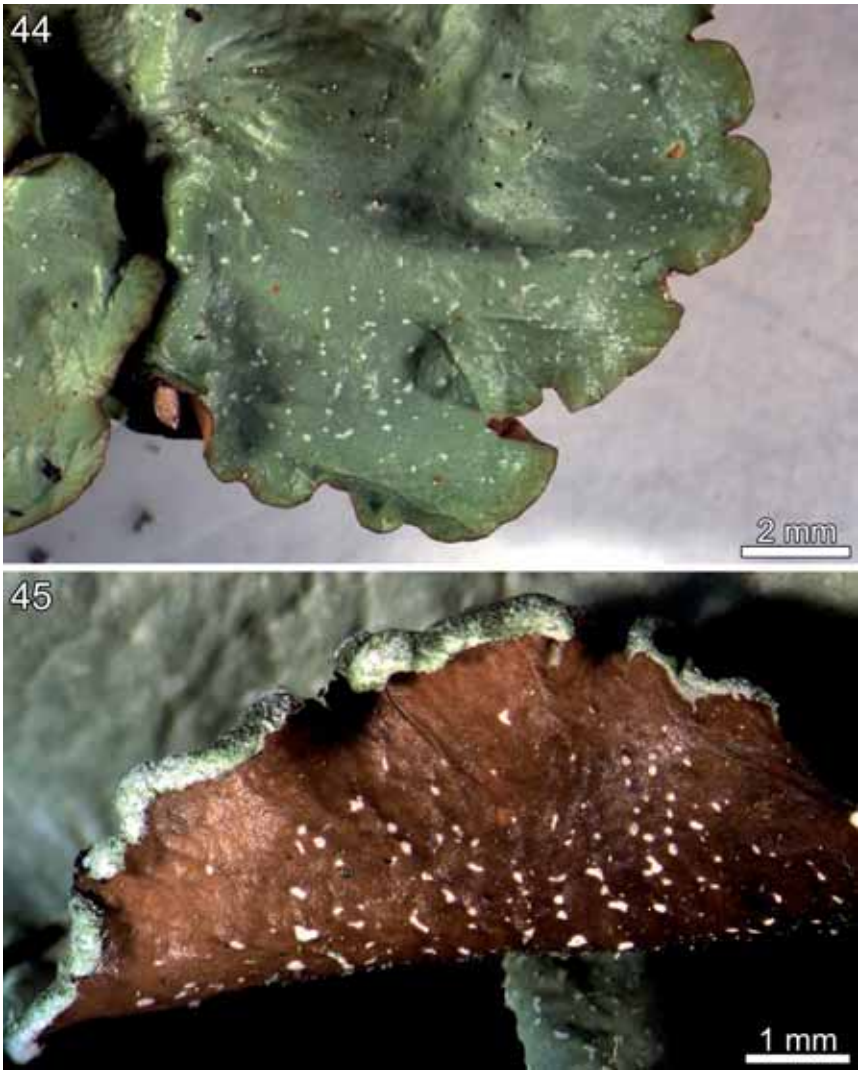

Fig. 44–45. *Cetrelia cetrarioides*. – Fig. 44. Esorediate thallus with rather large pseudocyphellae on the upper surface (Obermayer 11383). – Fig. 45. Typical upwards contorted lobe with conspicuous pseudocyphellae on the lower surface, smooth soralia with fine soredia (Obermayer 11289).

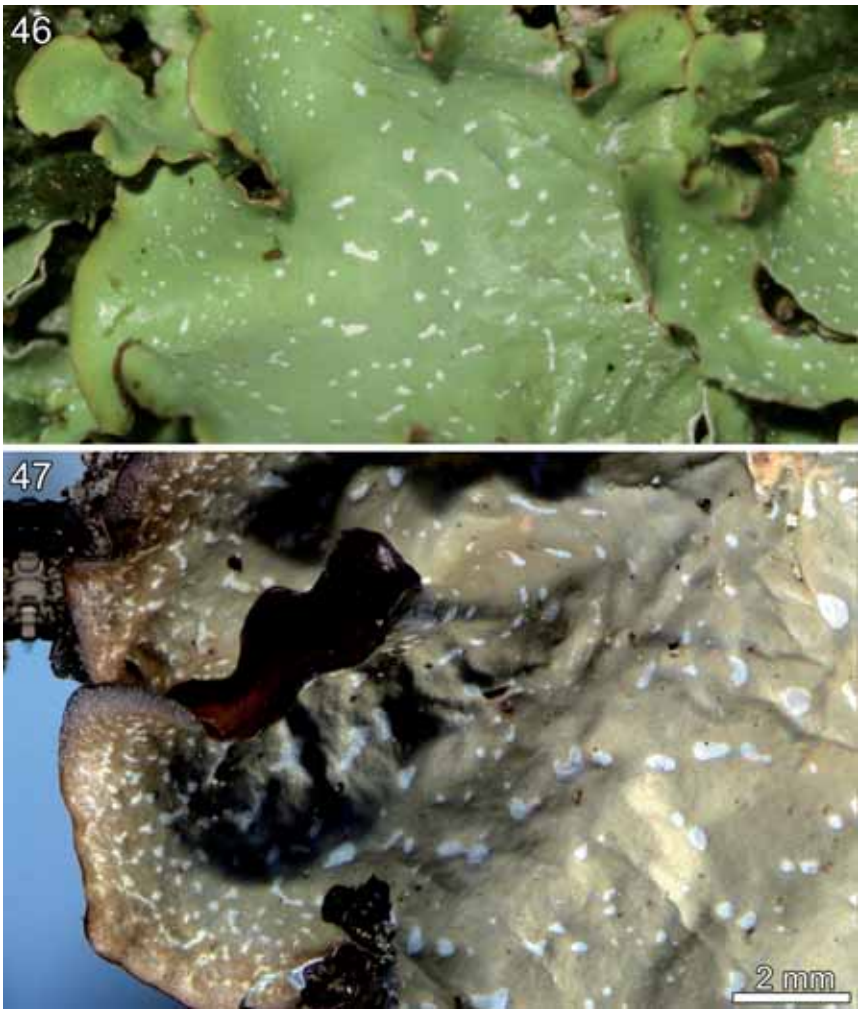

Fig. 46–47. *Cetrelia chicitae*. – Fig. 46. Wet thallus, photographed in the field (Obermayer 11429). – Fig. 47. Herbarium material (Kirschbaum 5468 [Kirschbaum]). – Scale applies to both figures.

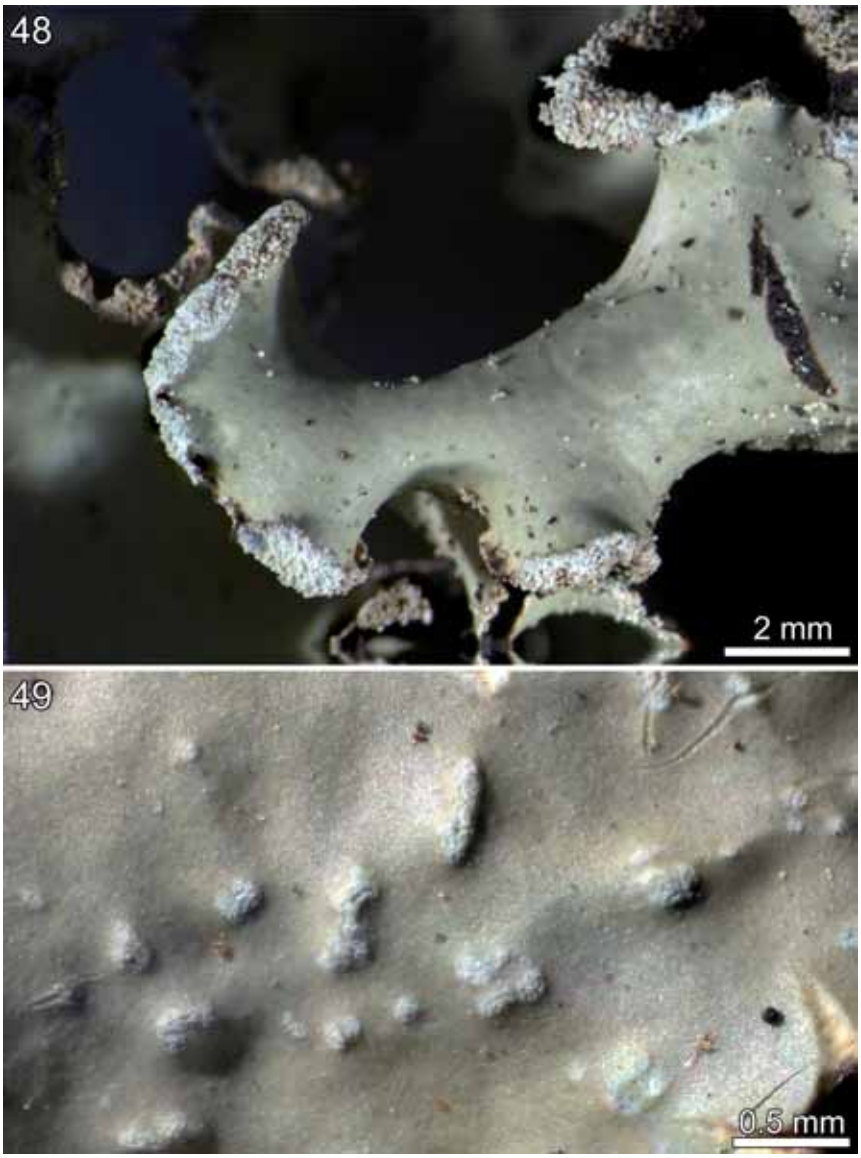

Fig. 48–49. *Cetrelia monachorum*. – Fig. 48. Strongly convex contorted thallus (pseudocyphellae on the upper surface very sparse) with coarse marginal soredia (Bilovitz 521). – Fig. 49. Typical, slightly convex pseudocyphellae (photographed with strong lateral illumination) (Hafellner 8238).

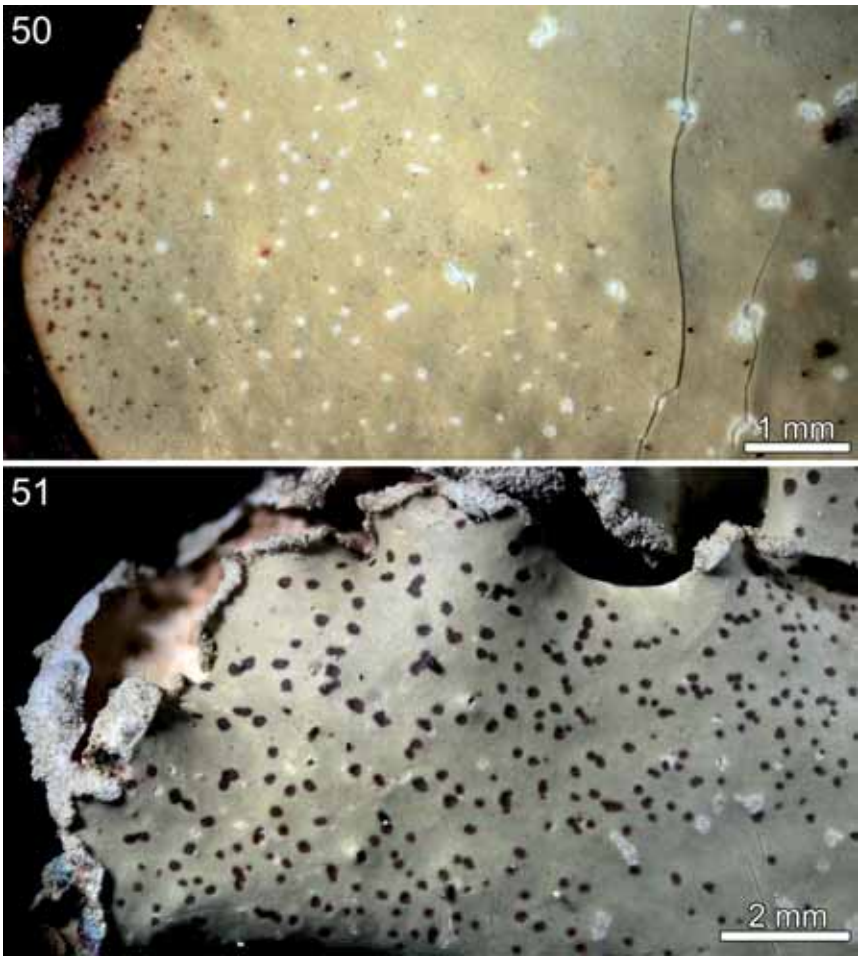

Fig. 50–51. *Cetrelia olivetorum*. – Fig. 50. Thallus with very young initials of apothecia (dark dots) and young (small) and 'mature' (large) pseudocyphellae on the upper surface (MAYRHOFER 6558). – Fig. 51. Thallus with many (?overmature) initials of fruiting bodies (black dots) (BILOVITZ 548).

niensis-Fagus-grandifolia forest on hillside, *Betula allegheniensis*, 22.III.1973, I.M.Brodo (19114). – ONTARIO, Frontenac County, Perth Road, 9 mile NE of Sydenham, 2 miles SW of Buck Lake, N-facing granitic cliff, 10 ft. high, shades cliff, 15.VII.1977, P.Y.Wong (2558).

U.S.A., MICHIGAN, Keweenaw County, Isle Royale National Park, at end of Tobin Harbor in spruce-fir-aspen-birch woods with some rocks and wet area,25.-VIII.1972, C.M.Wetmore (21188). – ibid., Conglomerate Bay near Saginaw Mine, 48°04'31"N, 088°34'34"W, 190 m, rocky shore of bay, rock cliff, 13.VII.1959, C.M.Wetmore (5121A; Wetmore, Lich.Exs.Univ.Minesota 137) [2]. – ibid., C.M.Wetmore (5121B; Lich.Exs.Univ.Minesota 138) [3]. – MINNESOTA, Cook County, 8 miles SW of Grand Marais on U.S.Route 61, Cascade River State Park, along Cascade River, 47 30'N, 90 32'W, deep gorge with rock ledges and mossy banks, *Picea-Abies* forest surrounding river, rock ledge over cascades, 23.VIII.1965, I.M.Brodo (5915). – Koochiching County, Voyageurs National Park, Dryweed Island in western Rainy Lake, south side of the island, rocky outcrops, 12.VI.1979, C.M.Wetmore (37129). – St. Louis County, Voyageurs National Park, SW side of Blind Ash Bay in eastern Kabetogama Lake, 48 26'N, 092 52'W, below black spruce (*Picea mariana*)-balsam fir (*Abies balsamea*) forest on steep slope into the bay, rock cliff, 3.VI.1978, C.M.Wetmore (32016; Wetmore, Min.Lich.Exs. 35). – NEW YORK, Essex County, along Ausable River, W-side of NY Route #21, 44 17'35"N, 073 56'00"W, 152 m, hardwood swamp with maple (*Acer*), elm (*Ulmus*), and sparse conifers, twigs of a dead conver, 18.IX.2004, J.C.Lendemer (3053; Lich.E-N-Am.Exs. 179). – NORTH CAROLINA, Alleghany County, Blue Ridge Parkway, near Lowgap, mixed forest, III.1970, W.L.Culberson & J.Poelt (8271). – Transylvania county, Blue Ridge Parkway lookout over John Rock south of intersection with U.S.Highway 276, 1620 m, moist oak woods, 28.V.1967, R.C.Harris (3342-A) [2chi+1oli]. – VERMONT, Lamoille County, Forest Health Monitoring Plot #21, Molly Bog, N of Stowe, 44 33'15"N, 072 37'40"E, 600 m, stunted *Picea* forest and Ericerus shrubs, clean air site, 21.IX.1994, R.Rosentreter (8976). – VIRGINIA, Hawksbill Mountain, Shenandoah National Park, Madison County, 1130–1220 m, Eichenmischwald mit *Abies fraseri*, 27.III.1970, M.E.Hale & J.Poelt (8128). – Little Stony Man, Shenandoah National Park, Page County, 914 m, *Quercus*-reicher Wald, 27.III.1970, M.E.Hale & J.Poelt (8101).

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