

Identification key to the European cetrarioid species

- 1 Entire thallus or its upper surface clearly yellow (usnic acid in the cortex) 2
– Entire thallus or its upper surface grey, brown or black (usnic acid absent) 12
- 2 Medulla bright yellow (pinastric and vulpinic acids) 3
– Medulla white (pinastric and vulpinic acids absent) 5
- 3 Thallus sorediate *Vulpicida pinastri* (Scop.) J.-E. Mattsson & M.J. Lai
[widely in whole Europe]
- Thallus not sorediate 4
- 4 Lobes dorsiventral, lobe margins thin; pycnidia marginal, on projections; mainly corticolous, rarely terricolous *Vulpicida juniperinus* (L.) J.-E. Mattsson & M.J. Lai
[northern Europe and subalpine areas of central and southern Europe]
- Lobes usually terete, occasionally dorsiventral and then lobe margins thick; pycnidia marginal or laminal, on projections or immersed; mainly terricolous, sometimes corticolous *Vulpicida tubulosus* (Schaer.) J.-E. Mattsson & M.J. Lai
[northern Europe and subalpine areas of central and southern Europe]
- 5 Thallus sorediate; corticolous or lignicolous 6
– Thallus not sorediate; terricolous or epilithic 7
- 6 Lower surface with small pseudocyphellae and lobe margins with scattered cilia; pycnoconidia bifusiform *Nephromopsis laureri* (Kremp.) Kurok.
[montane regions of central Europe]
- Pseudocyphellae and cilia absent; pycnoconidia filiform
..... *Allocetraria oakesiana* (Tuck.) Randle & A. Thell
[montane regions of central Europe]
- 7 Thallus largely foliose, adnate to the substratum
..... *Asahinea chrysantha* (Tuck.) W.L. Culb. & C.F. Culb.
[northern regions of Norway and Russia]
- Thallus cylindrical or lacinate, suberect to erect 8
- 8 Thallus branches \approx round in cross section 9
– Thallus distinctly dorsiventral although the lobes may be canaliculate or subtubular
..... 11
- 9 Thallus little branched or unbranched, 2–7 cm tall, entirely hollow; cortex and/or medulla C+ red (gyrophoric acid) *Dactylina arctica* (Richardson) Nyl.
[Svalbard and northern regions of Russia]

- Thallus well branched, usually less than 2 cm tall, arachnoid in the center or partly hollow; cortex and medulla C – 10
- 10 Thallus greenish yellow, not pruinose; center filled with arachnoid hyphae
.....*Allocetraria madreporiformis* (Ach.) Kärnefelt & A. Thell
[Svalbard, northern regions of Russia, and alpine areas of central Europe]
- Thallus yellowish brown, usually with pale violet pruina towards the tips; center partly hollow, partly filled with arachnoid hyphae*Dactylina ramulosa* (Hook.) Tuck.
[Finland, Norway, and alpine areas of central Europe]
- 11 Lobes strongly canaliculate or subtubular; surface rather smooth; basal parts reddish.....
.....*Flavocetraria cucullata* (Bellardi) Kärnefelt & A. Thell
[widely in arctic-alpine areas of Europe]
- Lobes plane, not canaliculate or subtubular; surface foveolate and wrinkled; basal parts dark yellow.....*Flavocetraria nivalis* (L.) Kärnefelt & A. Thell
[widely in arctic-alpine areas of Europe]
- 12 Entire thallus or its upper surface olive or brown (to almost black)..... 13
- Entire thallus or its upper surface grey 43
- 13 Corticolous or lignicolous..... 14
- Terricolous or epilithic..... 20
- 14 Thallus marginally sorediate..... *Tuckermanopsis chlorophylla* (Willd.) Hale
[widely in whole Europe]
- Thallus not sorediate 15
- 15 Thallus branches terete or angular, with longitudinal furrows; depressed pseudocyphellae distinct..... *Cetraria crespoe* (Barreno & Vázquez) Kärnefelt
[the Iberian peninsula and Italy]
- Thallus distinctly dorsiventral although the lobes may be canaliculate or subtubular; laminal pseudocyphellae absent..... 16
- 16 Medulla C+ pink (olivetric acid); marginal cilia frequent.....
.....*Tuckermanopsis ciliaris* (Ach.) Gyeln.
[Finland]
- Medulla C–; marginal cilia absent or sparse..... 17

- 17 Apothecia always present; ascospores globose, $3.5\text{--}6 \times 3.5\text{--}5 \mu\text{m}$; marginal pseudocyphellae present and distinct, linear-elongate.....
..... *Tuckermanopsis inermis* (Nyl.) Kärnefelt
..... [Svalbard]
- Apothecia present or absent; ascospores ellipsoid, $7\text{--}10.5 \times 4.0\text{--}6.5 \mu\text{m}$; marginal pseudocyphellae absent..... 18
- 18 Thallus margins with sparse cilia; contains rangiformic and norrangiformic acids (TLC) *Arctocetraria nigricascens* (Nyl.) Kärnefelt & A. Thell
..... [Svalbard and northern regions of Russia]
- Thallus not ciliate; contains other fatty acids, mainly of lichesterinic-protolichesterinic type (TLC) 19
- 19 Thallus dark olive-green, sometimes foveolate and with isidia-like structures; lobes up to 11 mm broad *Kaernefeltia merrillii* (Du Rietz) A. Thell & Goward
..... [the Iberian peninsula]
- Thallus brown, rather smooth, always without isidia; lobes up to 3 mm broad
..... '*Cetraria*' *sepincola* (Ehrh.) Ach.
..... [widely in whole Europe]
- 20 Epilithic..... 21
- Terricolous 26
- 21 Thallus fruticose, erect, with branches 0.3–1 mm wide and 0.5–2 cm high..... 22
- Thallus foliose, adnate, with lobes 1–4 mm broad 23
- 22 Thallus stiff, unbranched or only little branched, firmly attached to the substratum
..... *Cornicularia normoerica* (Gunnerus) Du Rietz
..... [arctic-alpine areas of central and western Europe]
- Thallus fragile, richly and repeatedly branched, unattached
..... *Cetraria odontella* (Ach.) Ach.
..... [Fennoscandia and northern regions of Russia]
- 23 Thallus with isidia-like outgrowths clustered in soralia-like areas; apothecia not known..... *Melanelia sorediella* (Lettau) V.J. Rico, van den Boom & Barrasa
..... [the Iberian Peninsula and subalpine areas of central Europe]
- Thallus without such outgrowths; apothecia often present..... 24
- 24 Lower surface black; medulla K+ yellow to red, Pd+ orange (stictic and norstictic acids)..... *Melanelia hepatizon* (Ach.) A. Thell
..... [widely in arctic-alpine areas of Europe]

- [Svalbard and northern regions of Russia]
- Thallus dark brown; lobes narrower, 0.5–1.5 mm broad; contains other fatty acids, of lichesterinic-protolichesterinic type (TLC); *Cetraria nigricans* Nyl.
- [Fennoscandia and northern regions of Russia]
- 40 Medulla Pd+ red (fumarprotocetraric acid) *Cetraria islandica* (L.) Ach.
- * Lobes rather narrow (1–5 mm broad), canaliculate or subtubular; surface of the lobes pitted and ridged; laminal pseudocyphellae often small and poorly developed.....*C. i. ssp. crispiformis* (Räsänen) Kärnefelt
- [northern Europe and alpine areas of Austria]
- ** Lobes wider (4–10 mm broad), canaliculate to almost flat; surface of the lobes smooth or slightly ridged; laminal pseudocyphellae usually well developed.....*C. i. ssp. islandica*
- [widely in whole Europe]
- Medulla Pd– 41
- 41 Laminal pseudocyphellae absent; marginal pseudocyphellae present in the form of fragmentary or continuous white line along the margins of the lower surface.....
- *Cetraria ericetorum* Opiz
- [widely in whole Europe]
- Laminal pseudocyphellae present, either white and conspicuous or dark and inconspicuous; marginal pseudocyphellae present or absent..... 42
- 42 Laminal pseudocyphellae white and conspicuous; base often reddish; contains lichesterinic and protolichesterinic acids (TLC).....
- fumarprotocetraric acid deficient strain of *Cetraria islandica*
- * Lobes rather narrow (1–5 mm broad), canaliculate or subtubular; surface of the lobes pitted and ridged; laminal pseudocyphellae often small and poorly developed..... *C. i. ssp. crispiformis*
- [northern Europe and alpine areas of Austria]
- ** Lobes wider (4–10 mm broad), canaliculate to almost flat; surface of the lobes smooth or slightly ridged; laminal pseudocyphellae usually well developed.....
-*C. i. ssp. islandica*
- [widely in whole Europe]
- Laminal pseudocyphellae dark and inconspicuous; base yellowish brown; contains rangiformic and norrangiformic acids (TLC)

.....	<i>Arctocetraria andrejevii</i> (Oxner) Kärnefelt & A. Thell	
		[Norway]
43	Thallus isidiate and/or sorediate; on bark or rocks	44
–	Thallus neither isidiate nor sorediate; on ground or rocks.....	
.....	usnic acid deficient strain of <i>Asahinea chrysantha</i>	
	[northern regions of Norway and Russia]	
44	Thallus usually with isidia, soredia may be present or absent.....	45
–	Thallus with soredia only, isidia absent.....	46
45	Thallus surface rather smooth; isidia and soredia mainly on lobe margins; pseudocyphellae absent.....	<i>Platismatia glauca</i> (L.) W.L. Culb. & C.F. Culb.
		[widely in whole Europe]
–	Thallus surface strongly reticulated; isidia and pseudocyphellae mainly laminal, on ridges; soredia absent.....	<i>Platismatia norvegica</i> (Lynge) W.L. Culb. & C.F. Culb.
		[Fennoscandia and Great Britain (Scottish highlands)]
46	Pseudocyphellae absent on both surfaces	<i>Platismatia glauca</i>
		[widely in whole Europe]
–	Pseudocyphellae present in the form of white dots both on the upper and on the lower surface.....	
		47
47	Medulla C+ red/pink (olivetic acid)	
.....	<i>Cetrelia olivetorum</i> (Nyl.) W.L. Culb. & C.F. Culb.	
		[scattered in many regions of Europe]
–	Medulla C–.....	48
48	Medulla KC+ pink (alectoronic acid)	
.....	<i>Cetrelia chicitae</i> (W.L. Culb.) W.L. Culb. & C.F. Culb.	
		[scattered mainly in central and southern regions of Europe]
–	Medulla KC–.....	49
49	Contains perlatolic acid as major medullary substance (TLC).....	
.....	<i>Cetrelia cetrarioides</i> (Delise ex Duby) W.L. Culb. & C.F. Culb.	
		[scattered in many regions of Europe]
–	Contains imbricatic acid as major medullary substance (TLC).....	
.....	<i>Cetrelia monachorum</i> (Zahlbr.) W.L. Culb. & C.F. Culb.	
		[scattered in Europe – Great Britain, Russia, Spain, Ukraine]