

**Supplementary material 2. Additional tables with list of specimens used in this study, data matrices for ancestral character state reconstructions and probabilities of reconstructions with model Mk1.**

Table S1. List of *Micarea* specimens used in this study and their GenBank accession numbers.

Sequences newly generated for this study are given in **bold**. If sequences from a single specimen were produced for two different studies or the taxonomical classification of the specimen was verified in further study, two or more references are cited for a single sample.

Species	Country/region	Voucher	Reference	mtSSU	ITS	<i>Mcm7</i>
<i>M. adnata</i>	Norway	Andersen 48 (BG)	Andersen 2004, Andersen & Ekman 2004,	AY567751	AY756468	
<i>M. adnata</i>	France	E. Sérusiaux s.n., DNA 3438 (LG)	van den Boom et al. 2017	KX459344		
<i>M. aeruginoprasina</i>	Azores	van den Boom 51445, DNA 3973, holotype (LG)	this paper	<b>MK562024</b>		<b>MN105888</b>
<i>M. azorica</i>	Azores	van den Boom 51360, DNA 3980 (LG)	this paper	<b>MK562028</b>		<b>MN105889</b>
<i>M. azorica</i>	Azores	van den Boom 51330, DNA 3976 (LG)	this paper	<b>MK562025</b>		<b>MN105890</b>
<i>M. azorica</i>	Azores	van den Boom 51468 DNA 3977, holotype (LG)	this paper	<b>MK562026</b>		<b>MN105891</b>
<i>M. azorica</i>	Azores	van den Boom 51733, DNA 3978 (LG)	this paper	<b>MK562027</b>		

<i>M. byssacea</i>	Norway	Andersen 34 (BG)	Andersen & Ekman 2005, Andersen 2004, Guzow- Krzemińska & Czarnota 2010	AY567749	AY756485	
<i>M. byssacea</i>	Poland	Czarnota 4751 (GPN)	Guzow-Krzemińska & Czarnota 2010	EF453664		
<i>M. byssacea</i>	Estonia	Czarnota 4781 (GPN)	Guzow-Krzemińska & Czarnota 2010	EF453670		
<i>M. byssacea</i>	Germany	van den Boom, 50037, LG DNA 3495 (hb. van den Boom)	van den Boom et al. 2017, this paper	KX459345		<b>MN105892</b>
<i>M. byssacea</i>	Finland	Launis 289103 DNA A98 (H)	Launis et al. 2019a	MG707768	MG521562	MG692527
<i>M. byssacea</i>	Finland	Launis 289102, DNA A97 (H)	Launis et al. 2019a	MG707769	MG521563	MG692528
<i>M. byssacea</i>	Finland	Launis 289101, DNA A96 (H)	Launis et al. 2019a	MG707770	MG521564	MG692529
<i>M. czarnotae</i>	Poland	Czarnota 4059 (GPN)	Guzow-Krzemińska & Czarnota 2010, Launis et al. 2019a	EF453663		
<i>M. czarnotae</i>	Poland	Czarnota 3632 (GPN)	Guzow-Krzemińska & Czarnota 2010, Launis et al. 2019a	EF453668		

<i>M. czarnotae</i>	Poland	Czarnota 3179 (GPN)	Guzow-Krzemińska & Czarnota 2010, Launis et al. 2019a	EF453674		
<i>M. czarnotae</i>	Poland	Czarnota 4179 (GPN)	Guzow-Krzemińska & Czarnota 2010, Launis et al. 2019a	EF453691		
<i>M. czarnotae</i>	Finland	Launis 109111, DNA A604 (H)	Launis et al. 2019a	MG707759		
<i>M. czarnotae</i>	Finland	Launis 1010133, DNA A455 (H)	Launis et al. 2019a	MG707760	MG521557	MG692517
<i>M. czarnotae</i>	Belgium	van den Boom 50312, DNA 3712 (LG)	Launis et al. 2019a	MG707761		
<i>M. elachista</i>	Finland	Launis 67113, DNA A340 (H)	Launis et al. 2019a	MG707745	MG521548	
<i>M. elachista</i>	Sweden	Koffman 399 (hb Koffman)	Andersen & Ekman 2005	AY567755		
<i>M. elachista</i>	Poland	Czarnota 2986 (GPN)	Guzow-Krzemińska & Czarnota 2010	EF453680		
<i>M. globulosella</i>	Finland	Launis 67112, DNA A240 (H)	Launis et al. 2019a	MG707743	MG521546	MG692507
<i>M. globulosella</i>	Finland	Launis 67114, DNA A243 (H)	Launis et al. 2019a	MG707744	MG521547	MG692508
<i>M. hedlundii</i>	Poland	Czarnota 3915 (GPN)	Guzow-Krzemińska & Czarnota 2010	EF453667		

<i>M. hedlundii</i>	Poland	Czarnota 3895 (GPN)	Guzow-Krzemińska & Czarnota 2010	EF453672		
<i>M. hedlundii</i>	Poland	Czarnota 4589 (GPN)	Guzow-Krzemińska & Czarnota 2010	EF453677		
<i>M. hedlundii</i>	Finland	Launis 67119, DNA A254 (H)	Launis et al. 2019a	MG707749	MG521551	MG692512
<i>M. hedlundii</i>	Bolivia	AF25384 (KRAM)	Guzow-Krzemińska et al. 2019	MK561614		
<i>M. herbarum</i>	Poland	Czarnota 4634 (GPN)	Guzow-Krzemińska & Czarnota 2010, van den Boom et al. 2017	EF453692		
<i>M. herbarum</i>	Netherlands	P. & G. van den Boom, 52575, LG DNA 4236 (hb. van den Boom)	van den Boom et al. 2017 Launis et al. 2019a	KX459349		MG692513
<i>M. herbarum</i>	Netherlands	Brand 63193, LG DNA 3852 (hb. Brand)	van den Boom et al. 2017, this paper	KX459350		<b>MN105893</b>
<i>M. cf. herbarum</i>	Poland	Czarnota 3464 (GPN)	Guzow-Krzemińska & Czarnota 2010, van den Boom et al. 2017	EF453665		
<i>M. isidioprasina</i>	France	E. Sérusiaux s.n., DNA 3437 (LG)	van den Boom et al. 2017, this paper	KX459362	<b>MN095788</b>	<b>MN105894</b>
<i>M. isidioprasina</i>	Belgium	E. Sérusiaux s.n., DNA 3609 (LG)	van den Boom et al. 2017, this paper	KX459363		<b>MN105895</b>

<i>M. isidioprasina</i>	Germany	van den Boom 53248, DNA 4590 (LG)	this paper	<b>MK562030</b>		<b>MN105896</b>
<i>M. isidioprasina</i>	Poland	Kukwa 17367a & Łubek, holotype (UGDA)	this paper	<b>MK562016</b>	<b>MN095789</b>	<b>MN105897</b>
<i>M. isidioprasina</i>	Poland	Kukwa 17493 (UGDA)	this paper	<b>MK562015</b>		<b>MN105898</b>
<i>M. cf. isidioprasina</i>	USA	Tønsberg 30856 (BG)	Andersen 2004, Guzow-Krzemińska & Czarnota 2010, this paper	AY756452		
<i>M. laeta</i>	Finland	Launis 59153, DNA A825 (H)	Launis et al. 2019a	MG707771	MG521565	MG692530
<i>M. laeta</i>	Finland	Launis 49151, DNA A819 (H)	Launis et al. 2019a	MG707772	MG521566	MG692531
<i>M. laeta</i>	Finland	Launis 59154, DNA A824 (H)	Launis et al. 2019a	MG707773	MG521567	MG692532
<i>M. laeta</i>	Finland	Launis 59155, DNA A827 (H)	Launis et al. 2019a	MG707774		MG692533
<i>M. laeta</i>	Finland	Launis 49152, DNA A823 (H)	Launis et al. 2019a	MG707775		MG692534
<i>M. laeta</i>	Finland	Launis 269141, DNA A806 (H)	Launis et al. 2019a	MG707776		MG692536

<i>M. laeta</i>	Finland	Launis 286151, DNA A816 (H)	Launis et al. 2019a	MG707777		MG692537
<i>M. laeta</i>	Finland	Launis 1010133, DNA A477 (H)	Launis et al. 2019a	MG707778	MG521568	MG692538
<i>M. laeta</i>	Finland	Launis 1010134, DNA A478 (H)	Launis et al. 2019a	MG707779	MG521569	MG692539
<i>M. laeta</i>	Finland	Launis 1510131, DNA A762 (H)	Launis et al. 2019a	MG707780		MG692540
<i>M. laeta</i>	Finland	Launis 1010135, DNA A427 (H)	Launis et al. 2019a	MG707781	MG521570	MG692541
<i>M. levicula</i>	Reunion	E. Sérusiaux s.n., DNA 3590 (LG)	this paper	<b>MK562021</b>		<b>MN105899</b>
<i>M. levicula</i>	Reunion	E. Sérusiaux s.n., DNA 3532 (LG)	this paper	<b>MK562019</b>		<b>MN105900</b>
<i>M. levicula</i>	Reunion	E. Sérusiaux s.n., DNA 3585 (LG)	this paper	<b>MK562020</b>		
<i>M. meridionalis</i>	Portugal	van den Boom s.n., DNA 4279 (LG)	van den Boom et al. 2017, this paper	KX459353		<b>MN105901</b>
<i>M. meridionalis</i>	Portugal	van den Boom s.n., LG DNA 4281 (hb. van den Boom)	van den Boom et al. 2017, this paper	KX459354		<b>MN105902</b>

<i>M. microareolata</i>	Sweden	Launis 148131, DNA A393 (H)	Launis et al. 2019a	MG707762	MG521558	MG692518
<i>M. microareolata</i>	Sweden	Launis 148132, DNA A394 (H)	Launis et al. 2019a	MG707763	MG521559	MG692519
<i>M. microareolata</i>	Finland	Launis 59152, DNA A826 (H)	Launis et al. 2019a	MG707764	MG521560	MG692520
<i>M. microareolata</i>	Finland	Pykälä 47787, DNA A797 (H)	Launis et al. 2019a	MG707765		MG692522
<i>M. microareolata</i>	Finland	Pykälä 47783, DNA A798 (H)	Launis et al. 2019a			MG692521
<i>M. microareolata</i>	Finland	Launis 59133, DNA A565 (H)	Launis et al. 2019a	MG707766	MG521561	MG692523
<i>M. microareolata</i>	Finland	Launis 89133, DNA A629 (H)	Launis et al. 2019a	MG707767		MG692524
<i>M. microareolata</i>	Finland	Pykälä 47948, DNA A801 (H)	Launis et al. 2019a			MG692526
<i>M. microareolata</i>	Finland	Launis 186151, DNA A802 (H)	Launis et al. 2019a			MG692525
<i>M. micrococca</i>	Poland	Czarnota 4456 (GPN)	Guzow-Krzemińska & Czarnota 2010	EF453662		

<i>M. micrococca</i>	Estonia	Czarnota 4782 (GPN)	Guzow-Krzemińska & Czarnota 2010	EF453676		
<i>M. micrococca</i>	Poland	Czarnota 4553 (GPN)	Guzow-Krzemińska & Czarnota 2010	EF453683		
<i>M. micrococca</i>	Netherlands	P. & B. van den Boom, 50314, LG DNA 3853 (hb. van den Boom)	van den Boom et al. 2017	KX459356		
<i>M. micrococca</i>	Netherlands	P. & B. van den Boom, 51244, LG DNA 3854 (hb. van den Boom)	van den Boom et al. 2017	KX459357		
<i>M. micrococca</i>	Netherlands	P. & B. van den Boom, 52570, LG DNA 4237 (hb. van den Boom)	van den Boom et al. 2017	KX459358		
<i>M. micrococca</i>	Finland	Launis 299101, DNA A100 (H)	Launis et al. 2019a	MG707753	MG521552	MG692514
<i>M. micrococca</i>	USA	Launis 146127, DNA A320 (H)	Launis et al. 2019a	MG707754	MG521553	MG692515
<i>M. micrococca</i>	Netherlands	van den Boom 50316, DNA 3713 (LG)	this paper	<b>MK562023</b>		<b>MN105903</b>
<i>M. microsorediata</i>	Netherlands	van den Boom 50279, DNA 3711 (LG)	this paper	<b>MK562022</b>		<b>MN105904</b>



<i>M. microsorediata</i>	Poland	Kukwa 16994 (UGDA)	this paper	<b>MK562011</b>	<b>MN095790</b>	<b>MN105905</b>
<i>M. microsorediata</i>	Poland	Kukwa 17053, holotype (UGDA)	this paper	<b>MK562012</b>	<b>MN095791</b>	<b>MN105906</b>
<i>M. microsorediata</i>	Poland	Kukwa 17546 & Łubek (UGDA)	this paper	<b>MK562009</b>	<b>MN095792</b>	<b>MN105907</b>
<i>M. misella</i>	Finland	Launis 108111, DNA A264 (H)	Launis et al. 2019a	MG707742	MG521545	MG692506
<i>M. misella</i>	Norway	Andersen 73 (BG)	Andersen 2004	AY567752	AY756486	
<i>M. nigra</i>	Portugal	van den Boom 53726, DNA 4573 (LG)	this paper	<b>MK562029</b>		
<i>M. nowakii</i>	Poland	Czarnota 4181 (GPN)	Guzow-Krzemińska & Czarnota 2010	EF453688		
<i>M. nowakii</i>	Poland	Czarnota 4688 (GPN)	Guzow-Krzemińska & Czarnota 2010	EF453689		
<i>M. nowakii</i>	Romania	E. Sérusiaux s.n., DNA 4380 (LG)	van den Boom et al. 2017, this paper	KX459359		<b>MN105908</b>
<i>M. nowakii</i>	Romania	E. Sérusiaux s.n., DNA 4385 (LG)	van den Boom et al. 2017, this paper	KX459360		<b>MN105909</b>
<i>M. nowakii</i>	Finland	Launis 245131, DNA A684 (H)	Launis et al. 2019a	MG707751		

<i>M. pauli</i>	Poland	Kukwa 14101 & Łubek (UGDA)	this paper	<b>MN094374</b>	<b>MN095793</b>	<b>MN105910</b>
<i>M. pauli</i>	Poland	Kukwa 17227 & Łubek (UGDA)	this paper		<b>MN095794</b>	<b>MN105911</b>
<i>M. pauli</i>	Poland	Kukwa 17240 & Łubek, holotype (UGDA)	this paper	<b>MK562014</b>		<b>MN105912</b>
<i>M. pauli</i>	Poland	Kukwa 17544 & Łubek (UGDA)	this paper	<b>MK562010</b>	<b>MN095795</b>	<b>MN105913</b>
<i>M. pauli</i>	Poland	Kukwa 17621 & Łubek (UGDA)	this paper	<b>MK562013</b>		<b>MN105914</b>
<i>M. peliocarpa</i>	USA	Launis 66123, DNA A324 (H)	Launis et al. 2019a	MG707741	MG521544	MG692505
<i>M. prasina</i>	Russia	Hermansson 4927 (UPS)	Andersen & Ekman 2005, Guzow-Krzemińska & Czarnota 2010	AY567750		
<i>M. prasina</i>	Poland	Czarnota 3914 (GPN)	Guzow-Krzemińska & Czarnota 2010	EF453669		
<i>M. prasina</i>	Poland	Czarnota 4489 (GPN)	Guzow-Krzemińska & Czarnota 2010	EF453678		
<i>M. prasina</i>	Poland	Czarnota 4319 (GPN)	Guzow-Krzemińska & Czarnota 2010	EF453679		

<i>M. prasina</i>	Finland	Launis 265101, DNA A92 (H)	Launis et al. 2019a	MG707747	MG521549	MG692510
<i>M. prasina</i>	Finland	Launis 199105, DNA A93 (H)	Launis et al. 2019a	MG707748	MG521550	MG692511
<i>M. prasina</i>	Germany	van den Boom 50033, DNA 3494 (LG)	this paper	<b>MK562018</b>		
<i>M. prasina</i>	Germany	van den Boom 50040, DNA 3492 (LG)	this paper	<b>MK562017</b>	<b>MN095796</b>	<b>MN105915</b>
<i>M. pseudomicrococca</i>	Finland	Launis 59151, DNA A811 (H)	Launis et al. 2019a	MG707755	MG521554	
<i>M. pseudomicrococca</i>	Finland	Launis 89132, DNA A599 (H)	Launis et al. 2019a	MG707756	MG521555	
<i>M. pseudomicrococca</i>	Finland	Launis 258131, DNA A603 (H)	Launis et al. 2019a	MG707757		
<i>M. pseudomicrococca</i>	Scotland	Launis 171141, DNA A645 (H)	Launis et al. 2019a	MG707758	MG521556	MG692516
<i>M. pycnidiophora</i>	USA	Tønsberg 30881 (BG)	Andersen & Ekman 2005	AY567754		
<i>M. soralifera</i>	Poland	Kukwa 12999 & Łubek (UGDA)	Guzow-Krzemińska et al. 2016, this paper	KT119885	<b>MN095797</b>	<b>MN105916</b>
<i>M. soralifera</i>	Poland	Kukwa 13001 & Łubek (UGDA)	Guzow-Krzemińska et al. 2016, this paper	KT119886	KT119887	<b>MN105917</b>

<i>M. soralifera</i>	Finland	Launis 1710131, DNA A714 (H)	Launis et al. 2019a	MG707746		MG692509
<i>M. stipitata</i>	USA	Ekman s. n.	Andersen & Ekman 2005	AY567753		
<i>M. subviridescens</i>	UK, Scotland	Czarnota 3599 (GPN)	Guzow-Krzemińska & Czarnota 2010	EF453666		
<i>M. synotheoides</i>	Norway	Andersen 47 (BG)	Andersen & Ekman 2005	AY567756		
<i>M. tomentosa</i>	Poland	Czarnota 3949 (GPN)	Guzow-Krzemińska & Czarnota 2010	EF453686		
<i>M. tomentosa</i>	Finland	Launis 11013, DNA A773 (H)	Launis et al. 2019a	MG707750		
<i>M. viridileprosa</i>	Poland	Czarnota 3436 (GPN)	Guzow-Krzemińska & Czarnota 2010	EF453671		
<i>M. viridileprosa</i>	Poland	Czarnota 3869 (GPN)	Guzow-Krzemińska & Czarnota 2010	EF453673		
<i>M. viridileprosa</i>	Poland	Czarnota 4527 (GPN)	Guzow-Krzemińska & Czarnota 2010	EF453682		
<i>M. viridileprosa</i>	Poland	Czarnota 4518 (GPN)	Guzow-Krzemińska & Czarnota 2010	EF453684		
<i>M. viridileprosa</i>	Netherlands	P. & B. van den Boom, 50066, LG DNA 3493 (hb. van den Boom)	van den Boom et al. 2017, this paper	KX459366		<b>MN105918</b>

<i>M. xanthonica</i>	USA	Tønsberg 25674 (BG)	Andersen 2004	AY756454		
<i>Micarea</i> sp.	UK, Scotland	Launis 171142, DNA A648 (H)	Launis et al. 2019a	MG707782	MG521571	MG692542

Table S2. Data matrix for multistate ancestral state reconstruction analysis.

Morphology: 0 – other or unknown, 1 – goniocysts, 2 – soredia, 3 – isidia; chemistry: 0 – lack of any substances, 1 – prasinic acid, 2-micareic acid, 3 – methoxymicareic acid, 4 – gyrophoric acid, 5 – thiophanic acid; pigments in apothecia: 0 – lack of pigments or unknown, 1 – Sedifolia-grey, 2 – Cinereorufa-green, 3 – Elachista-brown, 4 – Superba-brown.

<b>Species/Characters</b>	<b>Morphology</b>	<b>Chemistry</b>	<b>Pigments</b>
<i>M. adnata</i>	0	0	0
<i>M. aeruginoprasina</i>	1/3	2	1
<i>M. azorica</i>	1	2	4
<i>M. byssacea</i>	1	3	1
<i>M. czarnotae</i>	1	3	1
<i>M. elachista</i>	0	0	3
<i>M. globulosella</i>	0	4	1
<i>M. hedlundii</i>	1	0	1
<i>M. herbarum</i>	0	0	1
<i>M. isidioprasina</i>	3	2	0
<i>M. laeta</i>	1	3	0
<i>M. levicula</i>	1	4	0
<i>M. meridionalis</i>	0/1	2	1
<i>M. microareolata</i>	1	3	0
<i>M. micrococca</i>	1	3	0

<i>M. microsorediata</i>	2	3	0
<i>M. misella</i>	0	0	1
<i>M. nigra</i>	1/3	3	2
<i>M. nowakii</i>	0	2	1
<i>M. pauli</i>	3	3	1
<i>M. peliocarpa</i>	0	4	4
<i>M. prasina</i>	1	2	1
<i>M. pseudomicrococca</i>	1	3	0
<i>M. soralifera</i>	2	2	1
<i>M. subviridescens</i>	1	1	0
<i>M. tomentosa</i>	1	0	0
<i>M. viridileprosa</i>	1/2	4	1
<i>M. xanthonica</i>	1	5	0

Table S3. Binary data matrix for ancestral state reconstruction analysis (0 – absence, 1 – presence).

Species/ Characters	Prasinic acid	Micareic acid	Methoxymicareic acid	Gyrophoric acid	Thiophanic acid	Sedifolia-grey	Cinereorufa-green	Elachista-brown	Superba-brown	Goniocysts	Isidia	Soredia
<i>M. adnata</i>	0	0	0	0	0	0	0	0	0	0	0	0
<i>M. aeruginoprasina</i>	0	1	0	0	0	1	0	0	0	1	1	0
<i>M. azorica</i>	0	1	0	0	0	0	0	0	1	1	0	0
<i>M. byssacea</i>	0	0	1	0	0	1	0	0	0	1	0	0
<i>M. czarnotae</i>	0	0	1	0	0	1	0	0	0	1	0	0
<i>M. elachista</i>	0	0	0	0	0	0	0	1	0	0	0	0
<i>M. globulosella</i>	0	0	0	1	0	1	0	0	0	0	0	0
<i>M. hedlundii</i>	0	0	0	0	0	1	0	0	0	1	0	0
<i>M. herbarum</i>	0	0	0	0	0	1	0	0	0	0	0	0
<i>M. isidioprasina</i>	0	1	1	0	0	0	0	0	0	0	1	0
<i>M. laeta</i>	0	0	0	1	0	0	0	0	0	1	0	0
<i>M. levicula</i>	0	1	0	0	0	1	0	0	0	1	0	0
<i>M. meridionalis</i>	0	0	1	0	0	0	0	0	0	0/1	0	0
<i>M. microareolata</i>	0	0	1	0	0	0	0	0	0	1	0	0
<i>M. micrococca</i>	0	0	1	0	0	0	0	0	0	1	0	0
<i>M. microsorediata</i>	0	0	0	0	0	1	0	0	0	0	0	1
<i>M. misella</i>	0	0	1	0	0	0	0	0	0	0	0	0
<i>M. nigra</i>	0	1	0	0	0	1	1	0	0	1	1	0
<i>M. nowakii</i>	0	0	1	0	0	1	0	0	0	0	0	0
<i>M. pauli</i>	0	0	0	0	0	0	0	0	0	0	1	0
<i>M. peliocarpa</i>	0	0	0	1	0	0	0	0	1	0	0	0
<i>M. prasina</i>	0	1	0	0	0	1	0	0	0	1	0	0



<i>M. pseudomicrococca</i>	0	0	1	0	0	0	0	0	0	1	0	0
<i>M. soralifera</i>	0	1	0	0	0	1	0	0	0	0	0	1
<i>M. subviridescens</i>	1	0	0	0	0	0	0	0	0	1	0	0
<i>M. tomentosa</i>	0	0	0	0	0	0	0	0	0	1	0	0
<i>M. viridileprosa</i>	0	0	0	1	0	1	0	0	0	1	0	1
<i>M. xanthonica</i>	0	0	0	0	1	0	0	0	0	1	0	0

Table S4. Marginal probability of ancestral state reconstruction with model Mk1.

<b>Characters</b>	<b>Estimated rate</b>	<b>-log L</b>
Morphological characters	1.45210713	25.32618349
Secondary metabolites	1.44457682	38.41084255
Presence of apothecial pigments	3.3812887	43.25105316
Goniocysts	5.68397501	17.21832258
Isidia	2.76286135	15.03016547
Soredia	1.98490477	13.2675093
Gyrophoric acid	2.72379937	14.05017558
Methoxymicareic acid	2.13799717	13.66441469
Micareic acid	2.09408297	11.77771957
Prasinic acid	0.59798349	5.55015615
Thiophanic acid	0.59895939	5.28961174
Cinereorufa-green	0.59555288	6.00554598
Elachista-brown	0.6018539	5.67309737
Sedifolia-grey	64.52362281	19.38262328
Superba-brown	1.23653739	8.25954583