

Supplementary Material

Table S1. Sampling data of RRS *James Cook* cruise JC42 including names of the species, sample ID, sample depths [m] and coordinates, used gears and fixation types.

Species	Sample ID	Site	Area	Depth [m]	Start Longitude	Start Latitude	Date	Gear	Fixation
<i>Cladorhiza elsaae</i>	SMF-12210	JC42-3-17	E2	2641	-56.08963333°	-30.31775°	24.01.10	ROV	Ethanol
<i>Cladorhiza elsaae</i>	SMF-12211	JC42-3-17	E2	2641	-56.08963333°	-30.31775°	24.01.10	ROV	Formaldehyde
<i>Cladorhiza elsaae</i>	SMF-12212	JC42-3-15	E2	2642	-56.08936667°	-30.3172167°	23.01.10	ROV	Ethanol
<i>Abyssocladia truespacemeri</i>	SMF-12213	JC42-4-15	E9	2402	-60.04303333°	-29.98125°	04.02.10	ROV	Ethanol
<i>Abyssocladia hendrixii</i>	SMF-12214	JC42-4-7	E9	2402	-60.04281667°	-29.9822667°	30.01.10	ROV	Ethanol
<i>Abyssocladia hendrixii</i>	SMF-12215	JC42-4-15	E9	2402	-60.04303333°	-29.98125°	04.02.10	ROV	Formaldehyde

Table S2. *Abyssocladia truespacemeni* and sizes of its different types of spicules compared to other species of *Abyssocladia* with a similar shape. Minimum-mean-and numbers of measured spicules are shown (in brackets). For some of the species used for comparison only the size ranges of different spicules are given. If no values are given, the type of spicule is absent.

Specimen	Holotype	<i>Abyssocladia polycephalus</i>	<i>Abyssocladia natushimae</i>	<i>Abyssocladia inflata</i>	<i>Abyssocladia carcharias</i>	<i>Abyssocladia lakwollii</i>
	SMF-12213	Hestetun, Pomponi & Rapp, 2016 [19]	Ise & Vaelet, 2010 [39]	Vacelet, 2006 [41]	Kelly & Vacelet, 2011 [36]	Kelly & Vacelet, 2014 [42]
Mycalostyles						
length [μm]	750.0-1328.3-1600.0 (30)	720.0-933.0-1070	1350.0-1647.0-1940.0	1075.0-1800.0	510.0-1070.0	750.0-1800.0
diameter max. [μm]	7.5-20.8-27.5 (30)	14.0-17.0-22.0	19.0-24.0-26.5	21.0-33.0	8.0-19.0	15-31
Arcuate isochelae I						
length [μm]	60.0- 87.8 -113.8 (30)	28.0- 43.0 -50.0		140.0-150.0	60.0-86.0	27.0-36.0
shaft diameter [μm]	5.0- 7.7 -10.0 (30)			25.0-50.0		
End diameter [μm]	25.0- 32.5 -42.5 (30)					
Front alae length [μm]	21.3- 33.1 -42.0 (30)					
Front alae diameter [μm]	11.3- 15.8 -29.0 (30)					
Arcuate isochelae II						
length [μm]	27.5- 32.4 -40.0 (30)				35.0-48.0	
shaft diameter [μm]	1.0- 1.6 -2.5 (30)					
Oxeas						
length [μm]	65.0- 109.0 -172.5 (30)			130.0-350.0		
diameter max. [μm]	2.5- 4.1 -5.0 (30)			3.0-5.0		
Sigmancistras I						
length [μm]	17.0-19.8-22.0 (30)	9.4-9.8-11.0	9.0-10.7-12.0	15.0-18.0	8.0-12.0	15.0-20.0
diameter [μm]	1.2-1.8-2.0 (30)					
Sigmancistras II						
length [μm]	27.0- 29.2 -32.0 (30)		20.0- 22.0 -23.0		15.0-16.2	
diameter [μm]	1.7-2.0-3.0 (30)				1.9-2.0	

Table S3. Spicule sizes of the holotype and the paratype of *Abyssocladia hendrixii*. Minimum-mean-and numbers of measured spicules are shown (in brackets). Comparison to spicule sizes of *A.dominalba* and *A. bruuni*, size ranges are given. If no values are given, the type of spicule is absent.

Specimen	Holotype	Paratype	<i>Abyssocladia dominalba</i>	<i>Abyssocladia bruuni</i>
	SMF-12214	SMF-12215	Vacelet, 2006 [41]	Lévi, 1964 [3]
Mycalostyles				
length [µm]	700.0- 1334.5 -1600,0 (30)	750.0- 1447.9 -2005.0 (30)	620.0-2500.0	1300.0-1650.0
diameter max. [µm]	12.5- 23.0 -30.0 (30)	15.0- 24.2 -40.0 (30)	7.0-35.0	25.0-28.0
Arcuate isochelae				
length [µm]	62.5- 81.4 -91.25 (30)	52.5- 76.8 -97.5 (30)	80,0-170.0	70.0-75.0
shaft diameter [µm]	5.5- 7.5 -9.5 (30)	7.0- 10.0 -5.0 (30)	8.0	
End diameter [µm]	25.0- 32.3 -37.5 (30)	20.0- 28.3 -35.5 (30)		
Front alae length [µm] Front alae diameter [µm]	26.3- 31.9 -38.0 (30)	17.5- 29.4 -35.0 (30)		
	12.0- 15.7 -20.0 (30)	10.0- 13.7 -20.0 (30)		
Sigmancistras I				
length [µm]	19.0- 21.4 -24.0 (30)	17.5- 19.4 -22.5 (30)	9.0-12,5	
diameter [µm]	1.9- 1.3 -2.7 (30)	1.4- 1.9 -2.5 (30)		
Sigmancistras II				
length [µm]	22.0-30.8-34.5 (30)	22.5-26.9-30.0 (30)	30.0-40.0	29.0-30.0
diameter [µm]	2.0-2.7-4.0 (30)	1.8-2.2-2.75 (30)		

Table S4. Spicule sizes of *Cladorhiza elsaae*. Minimum-mean-and numbers of measured spicules are shown (in brackets). For comparison, measured spicules of *Cladorhiza abyssicola* and *Cladorhiza gelida* are also shown.

Specimen	Holotype	Paratype 1	Paratype 2	<i>Cladorhiza abyssicola</i> Sars, 1872 [2]	<i>Cladorhiza gelida</i> Lundbeck, 1905 [46]
	SMF-12210	SMF-12211	SMF-12212	Hestetun et al. 2017 [48]	Hestetun et al. 2017 [48]
Mycalostyles I					
length [μm]	520.0- 751.7 -950.0 (30)	450.0- 762.2 -1001.0 (30)	420.0- 740.6 -1000.0 (30)	310.0- 549.0 -930.0	380.0- 622.0 -1000.0
diameter max. [μm]	10.0- 19.5 -30.5 (30)	9.0- 17.8 -28.0 (30)	9.0- 16.8 -24.0 (30)	5.2- 13.6 -25.1	7.0- 16.6 -25.1
Mycalostyles II					
length [μm]	275.0- 583.3 -700.0 (30)	370.0- 689.0 -940 (30)	410.0- 657.0 -830.0 (30)		
diameter max. [μm]	1.2- 5.2 -9.0 (30)	1.0- 5.0 -9.0 (30)	2.0- 5.2 -9.0 (30)		
Anisochelae					
length [μm]	31.0- 34.1 -37.0 (30)	31.3- 36.0 -40.0 (30)	32.0- 34.4 -37.0 (30)	18.2- 22.2 -28.6	22.8- 31.2 -42.3
shaft diameter [μm] upper end	2.3- 3.2 -4.0 (30)	2.5- 3.1 -4.0 (30)	2.8- 3.3 -5.0 (30)		
diameter [μm]	9.0- 10.7 -14.0 (30)	10.0- 11.5 -15.0 (30)	10.0- 12.1 -14.0 (30)		
lower end diameter [μm]	3.0- 4.2 -5.0 (30)	3.0- 5.1 -6.5 (30)	3.0- 4.6 -6.0 (30)		
Sigmas					
length [μm]	140.0- 148.7 -160.0 (30)	110.0- 154.4 -179.0 (30)	140.0- 153.9 -180.0 (30)	65.0- 92.3 -127.4	86.0- 139 - 174.0
diameter [μm]	5.0- 9.2 -12.5 (30)	6.0- 9.0 -11.0 (30)	7.3- 8.9 -10.0 (30)		
Sigmancistras I					
length [μm]	49.0- 58.5 -72.5 (30)	50.0- 63.0 -73.0 (30)	51.0- 61.5 -85.0 (30)	34.5- 40.5 -52.8	37.7- 52.3 -85.8
diameter [μm]	1.5- 2.4 -3.9 (30)	1.9- 2.4 -3.0 (30)	2.0- 2.6 -4.0 (30)		
Sigmancistras II					
length [μm]	50.0- 55.2 -67.0 (30)	45.0- 52.6 -61.0 (30)	47.5- 54.2 -60.0 (30)		
diameter [μm]	2.9- 3.5 -4.2 (30)	2.8- 3.5 -4.8 (30)	3.0- 3.7 -5.0 (30)		