Supplementary Material for Organic & Biomolecular Chemistry

Supplementary data

Conformational studies of free and Li^+ complexed jasplakinolide, a cyclic depsipeptide from the Fijian marine sponge *Jaspis splendens*

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Table S1. ^{1}H and ^{13}C NMR data of jasplakinolide in $CDCl_3$ and CD_3CN at 400/100 MHz.

Atom	^{13}C (δ/ppm, mult)	^{13}C (δ/ppm, mult)	^{1}H (δ/ppm, mult, *J*/Hz)	^{1}H (δ/ppm, mult, *J*/Hz)
	$CDCl_3$	CD_3CN	$CDCl_3$	CD_3CN
1	176.1 (s)	174.7 (s)		
2	40.8 (d)	39.6 (d)	2.45 (1H, m)	2.48 (1H, m)
3	41.8 (t)	41.8 (t)	A. 2.32, (dd, 15.6, 16.0)	A. 2.18 (1H, m)
			B. 1.85, (1H, d, 15.6)	B. 1.89 (1H, m)
4	134.7 (s)	133.0 (s)		
5	128.9 (d)	129.4 (d)	4.75, (1H, d, 8.4)	4.79 (1H, d, 8.4)
6	30.2 (d)	29.2 (d)	2.19 (1H, m)	2.67 (1H, m)
7	44.4 (d)	43.2 (d)	A. 1.26 (1H, m)	A. 1.42 (1H, m)
			B. 1.05 (1H, m)	B. 1.16 (1H, m)
8	71.8 (d)	70.1 (d)	4.57 (1H, m)	4.66 (1H, m)
10	175.4 (s)	174.6 (s)		
11	41.2 (t)	40.4 (t)	A. 2.63 (1H, dd, 4.8)	2.67 (1H, dd, 4.4, 4.8)
			B. 2.57 (1H, dd, 5.6, .0)	2.59 (1H, dd, 6.8, 7.2)
12	50.0 (d)	49.0 (d)	5.23 (1H, m)	5.16 (1H, m)
13			7.52 (1H, d, 8.8)	7.32 (1H, d, 8.8)
14	171.8 (s)	168.8 (s)		
15	56.5 (d)	55.6 (d)	5.78 (1H, dd, 6.4, 8.4)	5.64 (1H, dd, 6.4)
17	170.0 (s)	173.8 (s)		
18	47.0 (t)	45.7 (t)	4.67 (1H, d , 6.8)	4.61 (1H, m)
19			6.57 (1H, d, 6.4)	6.62 (1H, d, 6.4)
21	21.3 (q)	19.1 (q)	1.07 (3H, d, 6.8)	1.01 (3H, d, 6.8)
22	19.6 (q)	19.1 (q)	1.53 (3H, s)	1.52 (3H, s)
23	23.0 (q)	21.0 (q)	0.77 (3H, d, 6.4)	0.82 (3H, d, 6.4)
24	20.1 (q)	19.2 (q)	1.02 (3H, d, 6.4)	1.05 (3H, d, 6.0)
26	132.5 (s)	132.4 (s)		
27	128.3 (d)	127.4 (d)	6.90 (1H, d, 8.4)	6.94 (1H, d, 8.4)
28	116.6 (d)	116.5 (d)	6.62 (1H, d, 8.4)	6.68 (1H, d, 8.4)
29	156.7 (s)	156.2 (s)		
30	116.6 (s)	116.5 (d)	6.62 (1H, d, 8.4)	6.68 (1H, d, 8.4)
31	128.3 (s)	127.4 (d	6.90 (1H, d, 8.4)	6.94 (1H, d, 8.4)
34	24.3 (t)	23.9 (t)	A. 3.32 (1H, dd, 6.4, 6.8)	3.23 (1H, dd, 6.0, 6.4)
			B. 3.19, (1H, dd, 10.4)	3.05 (1H, dd, 9.6, 10.0)
35			8.56 (1H, bs)	9.58 (1H, s)
36	110.1 (s)	110.3 (s)		
37	111.2 (s)	109.3 (s)		
38	128.3 (s)	127.5 (s)		
39	119.2 (d)	118.5 (d)	7.52 (1H, d, 8.4)	7.57, 1H, d, 8.0)
40	121.2 (d)	119.8 (d)	7.05 (1H, dd, 3.6, 7.2)	7.03 (1H, dd, 1.2, 7.2)
41	123.5 (d)	122.2 (d)	7.09 (1H, dd, 3.6, 6.8)	7.11 (1H, dd, 1.2, 7.1)
42	111.6 (d)	110.8 (d)	7.21 (1H, d, 8.0)	7.29 (1H, d, 8.4)
43	137.2 (s)	136.6 (s)		
45	31.9 (q)	31.0 (q)	2.94 (3H, s)	2.99 (3H, s)
47	18.8 (q)	17.6 (q)	0.68 (3H, d, 6.8)	0.73 (3H, d, 7.2)

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Table S2. ^{1}H, ^{13}C NMR, ^{1}H-^{1}H COSY and HMBC data at 400/100 MHz and literature ^{13}C NMR data[20] of jasplakinolide-Li^{+} complex in CD_3CN.

Atom	^{13}C (lit) (δ/ppm, mult)	^{13}C (δ/ppm, mult)	^{1}H (δ/ppm, mult, *J*/Hz)	COSY ($^{1}H \rightarrow ^{1}H$)	HMBC ($^{13}C \rightarrow ^{1}H$)
1	177.1 (s)	175.3 (s)			H-3A, H-3B, H-21, H-47, H-18
2	40.3 (d)	39.6 (d)	2.56 (1H, m)	H-3A, H-3B, H21	
3	42.4 (t)	41.7 (t)	A. 2.16 (1H, m)	H-2, H-3B	
			B. 1.88 (1H, m)	H-2, H-3A	
4	134.2 (s)	132.9 (s)			H-3
5	129.7 (d)	129.5 (d)	4.82 (1H, dd, 1.2, 9.6)	H-6	H-22, H-23
6	30.1 (d)	29.3 (d)	2.26 (1H, m)	H-5	
7	43.4 (t)	43.0 (t)	A. 1.47 (1H, m)	H-8, H-7B	
			B. 1.21 (1H, m)	H-8, H-7A	
8	72.0 (d)	70.5 (d)	4.70 (1H, m)	H-7A, H-7B, H-24	H-7, H-24
10	173.2 (s)	171.3 (s)			H-11A, 11B
11	41.8 (t)	40.8 (t)	A. 2.68 (1H, m)	H-11B	
			B. 2.66 (1H, m)	H-11A	
12	50.5 (d)	49.2 (d)	5.20 (1H, m)	NH-13	H-11A, 11B, H-26/31
13			7.52 (1H, d, 8.8)	H-12	
14	170.4 (s)	169.3 (s)			H-11A, H11B
15	57.2 (d)	55.8 (d)	5.59 (1H, dd, 6.8)	H-34A, H-34B	
17	174.5 (s)	173.7 (s)			H-34A, H-34B, H-15
18	46.8 (d)	45.8 (d)	4.62 (1H, m)	H-47	
19			7.44 (1H, Bs)		
21	19.3 (q)	19.0 (q)	1.03 (3H, d, 6.8)	H-1	
22	18.9 (q)	17.6 (q)	1.54 (3H, s)		
23	22.0 (q)	21.0 (q)	0.82 (3H, d, 6.8)		
24	19.8 (q)	19.0 (q)	1.05 (3H, d, 6.0)	H-8	
26	132.5 (s)	132.0 (s)			
27	128.3 (d)	127.4 (d)	6.93 (1H, d, 8.4)		
28	116.3 (d)	115.4 (d)	6.73 (1H, d, 8.4)		
29	157.4 (s)	156.5 (s)			H-28/30, H-27/31
30	116.3 (d)	115.4 (d)	6.73 (1H, d, 8.4)		
31	128.3 (d)	127.4 (d)	6.93 (1H, d, 8.4)		
34	25.3 (t)	28.9 (t)	A. 3.24 (1H, dd, 6.8)	H-15, H-34B	
			B. 3.06 (1H, dd 6.8)	H-34A, H-15	
35			9.80 (1H, s)		
36	109.9 (s)	109.9 (s)			
37	110.3 (s)	109.4 (s)			
38	128.3 (s)	127.4 (s)			
39	119.4 (d)	118.5 (d)	7.57 (1H, 7.6)	H-41	H-41
40	120.5 (d)	119.7 (d)	7.01 (1H, dd, 1.2, 7.2)	H41	
41	122.8 (d)	122.1 (d)	7.10 (1H, dd, 1.2, 7.2)	H-42, H-39, H40	
42	111.7 (d)	110.9 (d)	7.34 (1H, d, 8.4)	H-41	
43	137.4 (s)	136.6 (s)			H-41, H-39
45	32.5 (q)	31.0 (q)	3.02 (3H, s)		H-34A, H-34B
47	18.5 (q)	17.5 (q)	0.80 (3H, d, 6.8)	H-18	H-18

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Table S3 ^{13}C chemical shift differences between Jasplakinolide and the jasplakinolide-Li^+ complex in CD_3CN.

	jasplakinolide	jasplakinolide-Li	Difference
Carbon #	δ/ppm	δ/ppm	Δδ/ppm
1	174.7	175.3	0.6
2	39.6	39.6	0
3	41.8	41.7	-0.1
4	133	132.9	-0.1
5	129.4	129.5	0.1
6	29.2	29.3	0.1
7	43.2	43.0	-0.2
8	70.1	70.5	0.4
10	174.6	171.3	-3.3
11	40.4	40.8	0.4
12	49	49.2	0.2
14	168.8	169.3	0.5
15	55.6	55.8	0.2
17	173.8	173.7	-0.1
18	45.7	45.8	0.1
21	19.1	19.0	-0.1
22	19.1	17.6	-1.5
23	21.0	21.0	0
24	19.2	19.0	-0.2
26	132.4	132.0	-0.4
27	127.4	127.4	0
28	116.5	115.4	-1.1
29	156.2	156.5	0.3
30	116.5	115.4	-1.1
31	127.4	127.4	0
34	23.9	28.9	5
36	110.3	109.9	-0.4
37	109.3	109.4	0.1
38	127.5	127.4	-0.1
39	118.5	118.5	0
40	119.8	119.7	-0.1
41	122.2	122.1	-0.1
42	110.8	110.9	0.1
43	136.6	136.6	0
45	31.0	31.0	0
47	17.6	17.5	-0.1

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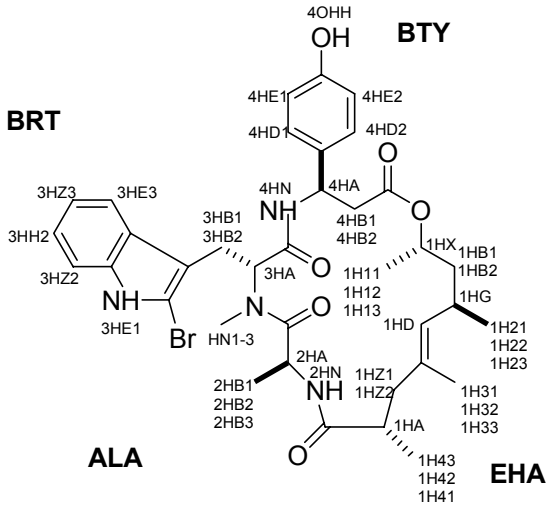

Structure numbering used for restraints

Table S4 Restraints used for NOE restrained structure calculation of jasplakinolide in $CDCl_3$.

res	atom	res	atom	NOE (Å)
1	H1#	3	HN#	6.000
1	H3#	1	H1#	6.000
1	H3#	1	H2#	6.000
1	H4#	1	HB#	5.500
1	HA	1	HZ2	3.500
1	HA	1	H3#	5.500
1	HA	1	H4#	4.000
1	HA	1	H1#	5.500
1	HB#	1	H4#	4.000
1	HB#	1	H1#	5.500
1	HB#	1	H2#	5.500
1	HD	1	HX	5.000
1	HD	1	HA	2.500
1	HD	1	HZ1	3.500
1	HD	1	HG	5.00
1	HD	1	HZ2	5.000
1	HD	1	H3#	5.500
1	HD	1	HB#	3.500
1	HD	1	H4#	5.500
1	HD	1	H2#	4.000
1	HG	1	H3#	4.000
1	HG	1	HB#	5.000
1	HG	1	H4#	4.000
1	HG	1	H1#	4.000
1	HG	1	H2#	4.000
1	HX	1	HG	3.500

1	HX	1	H3#	5.500
1	HX	1	HB#	3.500
1	HX	1	H4#	4.000
1	HX	1	H1#	3.000
1	HX	1	H2#	5.500
1	HZ1	1	HZ2	2.500
1	HZ1	1	H3#	4.000
1	HZ1	1	H4#	5.500
1	HZ2	1	H3#	5.500
1	HZ2	1	H4#	4.000
2	HA	2	HN	3.500
2	HA	2	HB#	4.000
2	HA	3	HN#	3.000
2	HB#	3	HN#	4.500
2	HN	1	HA	3.500
2	HN	1	HZ1	5.000
2	HN	1	HZ2	5.000
2	HN	1	H4#	5.500
2	HN	2	HB#	4.000
3	HA	3	HB1	3.500
3	HA	3	HB2	3.500
3	HA	3	HN#	5.500
3	HB1	3	HB2	2.500
3	HB1	3	HN#	4.000
3	HB2	3	HN#	4.000
3	HE1	3	HZ2	5.000
3	HE3	4	HD#	3.500
3	HE3	4	HA	5.000
3	HZ2	3	HH2	2.500
4	HA	4	HB#	2.500
4	HB1	4	HB2	2.500
4	HD#	1	HB#	5.000
4	HD#	3	HA	5.000
4	HD#	4	HE#	2.500
4	HD#	4	HA	3.500
4	HD#	4	HB#	3.500
4	HE#	3	HA	5.000
4	HN	3	HA	3.500
4	HN	3	HB1	5.000
4	HN	3	HB2	5.000
4	HN	3	HN#	4.000
4	HN	4	HE#	5.000
4	HN	4	HB#	5.000

Table S5 Torsion angle restraints for jasplakinolide in $CDCl_3$

	J/Hz	Angle (deg.)
2HN-2N-2CA-2HA	6.8	140 ±30
4HN-4N-4CA-4HA	7.6	145 ± 30

Table S6 Energies (kcal/mol) for jasplakinolide minimum energy structure in $CDCl_3$

E_{total}	E_{bonds}	E_{angle}	$E_{improper}$	$E_{van\ der\ Waals}$	E_{nOe}
1.45597	0.140928	0.898113	0.194131	0.194131	0.221675

Table S7 Statistics for 22 lowest energy structures of jasplakinolide in $CDCl_3$

Average global displacements				Average local RMSDs	Average local displacements		
Res# name	BB	heavy	heavysc		BB	heavy	heavysc
1 EHA	0.22	0.41	0.38	0.00	0.00	0.00	0.00
2 ALA	0.16	0.19	0.24	0.15	0.15	0.18	0.20
3 BRT	0.10	0.65	0.74	0.07	0.05	0.58	0.67
4 BTY	0.11	0.80	0.98	0.00	0.00	0.00	0.00

Table S8 Restraints used for NOE restrained structure calculation of jasplakinolide in CD_3CN.

atom	**res**	**atom**	**res**	**NOE (Å)**
4	HD#	4	HE#	2.500
3	HE3	3	HZ3	3.500
3	HA	3	HE3	3.500
3	HA	4	HN	3.500
3	HA	4	HD#	5.000
4	HA	4	HN	5.000
4	HA	4	HD#	3.500
2	HA	2	HN	5.000
3	HB1	3	HE3	5.000
3	HN#	3	HE3	5.500
3	HN#	4	HN	5.500
4	HB2	4	HN	5.000
4	HB2	4	HD#	3.500
1	HA	2	HN	2.500
1	H3#	2	HN	5.500
1	H1#	4	HN	5.500
1	H1#	4	HD#	5.500
1	H1#	4	HE#	5.500
1	H4#	2	HN	5.500
2	HB#	2	HN	5.500
3	HA	3	HB1	3.500
3	HA	3	HB2	3.500
3	HA	1	H4#	5.500
4	HA	1	H4#	5.500
1	HD	3	HN#	5.500
2	HA	3	HN#	3.000
1	HA	1	HD	3.500
1	HZ1	1	HD	5.000
1	HX	1	HG	5.000
1	HZ2	1	HD	5.000
1	H3#	1	HD	5.500
1	H3#	1	HX	5.500
1	HB1	1	HD	3.500
1	HX	1	HB1	3.500
1	HB2	1	HD	5.000
1	HX	1	HB2	5.000

1	HD	1	H1#	5.500
1	HX	1	H1#	4.000
2	HA	1	H4#	5.500
1	H2#	1	HD	4.000
1	H2#	1	HX	4.000
2	HA	2	HB#	4.000
3	HB1	3	HB2	2.500
4	HB1	4	HB2	2.500
4	HB1	1	HG	5.000
1	HA	1	HZ1	5.000
1	HA	1	HZ2	5.000
1	HZ1	1	HZ2	2.500
1	HZ1	1	H3#	5.500
1	HG	1	H3#	4.000
1	HZ2	1	H3#	5.500
1	HG	1	HB1	5.000
1	HG	1	HB2	5.000
4	HB2	1	H1#	5.500
1	HG	1	H1#	5.500
1	HB1	1	HB2	2.500
1	HA	1	H4#	4.000
1	HZ1	1	H4#	5.500
1	HZ2	1	H4#	4.000
1	H3#	1	H1#	6.000
1	HB1	1	H1#	5.500
3	HN#	2	HB#	4.500
1	HG	1	H2#	4.000
1	H3#	1	H2#	6.000
1	HB1	1	H2#	5.500
1	HB2	1	H2#	4.000

Table S9 Torsion angle restraints for jasplakinolide in CD_3CN.

	J/Hz	Angle (deg.)
2HN-2N-2CA-2HA	7.2	142 ± 20
4HN-4N-4CA-4HA	8.8	152 ± 20

Table S10 Energies (kcal/mol) for jasplakinolide minimum energy structure in CD_3CN.

E_{total}	E_{bonds}	E_{angle}	$E_{improper}$	$E_{van\ der\ Waals}$	E_{nOe}
1.25941	0.122797	0.898113	0.830242	0.189806	0.109872

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Table S11 Statistics for 22 lowest energy structures of jasplakinolide in CD_3CN.

Average global displacements				Average local RMSDs	Average local displacements		
Res# name	BB	heavy	heavysc		BB	heavy	heavysc
1 EHA	0.10	0.83	0.93	0.00	0.00	0.00	0.00
2 ALA	0.06	0.07	0.08	0.04	0.03	0.05	0.05
3 BRT	0.06	1.68	1.94	0.10	0.06	1.69	1.95
4 BTY	0.17	1.02	1.19	0.00	0.00	0.00	0.00

Table S12 Restraints used for NOE restrained structure calculation of the jasplakinolide-Li^+ complex in CD_3CN

atom	res	atom	res	NOE(Å)
	1 HA		1 HZ2	2.5
	1 HA		1 H4#	3
	1 HD		1 HA	3.5
	1 HD		1 HG	3.5
	1 HD		4 HB1	3.5
	1 HD		1 HZ2	3.5
	1 HD		1 HB1	3.5
	1 HD		1 HB2	3.5
	1 HD		2 HB#	5.5
	1 HX		4 HB1	3.5
	1 HX		1 HG	3.5
	1 HX		1 HB1	3.5
	1 HX		1 H2#	5.5
	1 HZ2		1 HB1	5
	1 HZ2		2 HB#	5.5
	2 HA		3 HN#	3
	2 HA		1 HA	5
	2 HA		2 HB#	3
	3 HA		3 HB1	3.5
	3 HA		3 HB2	3.5
	3 HA		3 HN#	4
	3 HA		1 H3#	5.5
	3 HA		1 HB1	5
	3 HB1		3 HN#	3
	3 HE3		3 HB1	5
	3 HE3		3 HB2	3.5
	3 HE3		3 HZ3	3.5
	3 HE3		3 HA	2.5
	3 HN#		1 H1#	3.5
	3 HN#		2 HB#	3.5
	4 HA		3 HB1	5
	4 HA		4 HB1	3.5
	4 HA		1 H1#	4
	4 HD#		4 HA	3.5

4 HD#	1 HD	5
4 HD#	2 HA	5
4 HD#	4 HB1	3.5
4 HD#	1 HA	2.5
4 HD#	1 HZ1	5
4 HD#	1 H4#	5.5
4 HD#	2 HB#	5.5
4 HE#	1 HX	5
4 HE#	4 HB1	5
4 HE#	1 H2#	5.5
4 HN	4 HD#	3.5
4 HN	3 HA	3.5
4 HN	4 HA	5
4 HN	4 HB1	3.5
4 HN	2 HB2	5

Table S13 Torsion angle restraints for the jasplakinolide-Li^+ complex in CD_3CN.

	J/Hz	Angle (deg.)
2HN-2N-2CA-2HA	7.2	158 ± 20
4HN-4N-4CA-4HA	6.8	139 ± 20

Table S14 Energies (kcal/mol) for the jasplakinolide-Li^+ complex minimum energy structure in CD_3CN.

E_{total}	E_{bonds}	E_{angle}	$E_{improper}$	$E_{van\ der\ Waals}$	E_{nOe}
10.0043	0.625872	1.82149	0.550594	2.77335	4.23295

Table S15 Statistics for 22 lowest energy structures of the jasplakinolide-Li^+ complex in CD_3CN.

Average global displacements				Average local RMSDs	Average local displacements		
Res# name	BB	heavy	heavysc		BB	heavy	heavysc
1 EHA	0.08	0.15	0.16	0.00	0.00	0.00	0.00
2 ALA	0.06	0.09	0.14	0.05	0.05	0.07	0.08
3 BRT	0.05	0.45	0.51	0.05	0.03	0.42	0.48
4 BTY	0.08	0.65	0.79	0.00	0.00	0.00	0.00