Electronic Supporting Information

Biosynthesis of Fungal Terpenoids

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Table S1 Class I monoterpene cyclase in fungi

No.	Cyclase name	Accession number	Strain	Main product	Structural identification method	Reference
1	Hyp3	AHY23922	*Hypoxylon* sp.	1,8-cineole	GC-MS, standard	1

Cyclase information is available at the NCBI database website. https://www.ncbi.nlm.nih.gov (NCBI)

Table S2 Class I sesquiterpene cyclase in fungi

No.	Cyclase name	Accession number	Strain	Main product	Structural identification method	Reference
1	Tri5	AAD13657	*Fusarium sporotrichioides*	trichodiene	-	2
2	Ari1	AAA33694	*Penicillium roqueforti*	(+)-aristolochene	GC-MS, standard	3
3	AtARS	AF198360	*Aspergillus terreus*	(+)-aristolochene	-	4
4	PeTS1	KGO48192	*Penicillium expansum*	(+)-aristolochene	NMR	5
5	BcBOT2	ATZ56107	*Botrytis cinerea*	presilphiperfolan-8β-ol	NMR	6
6	Cop1	EAU89322	*Coprinus cinereus* 9/55	germacrene A	GC-MS, standard	7
7	Cop2	EAU85264	*Coprinus cinereus* 9/55	germacrene A	GC-MS, standard	7
8	Omp3	4636 (JGI)	*Omphalotus olearius*	germacrene A	GC-MS, standard	8
9	Cop3	A8NE23	*Coprinus cinereus* 9/55	α-muurolene	GC-MS, standard	7
10	Omp1	1311 (JGI)	*Omphalotus olearius*	α-muurolene	GC-MS, standard	8
11	PpSTS01	Pospl1_60326 (JGI)	*Postia placenta* MAD-698	α-muurolene	GC-MS	9
12	CpSTS5	LC436349 (DDBJ)	*Clitopilus pseudo-pinsitus* ATCC 20527	α-muurolene	GC-MS	10
13	Agr3	MN146026	*Agrocybe aegerita* AAE-3	α-muurolene	GC-MS, standard	11
14	Cun0759	-	*Cerrena unicolor*	α-muurolene	GC-MS	12
15	Cop4	A8NU13	*Coprinus cinereus* 9/55	δ-cadinene	GC-MS, standard	7
16	Hyp2	KJ433270	*Hypoxylon* sp.	δ-cadinene	GC-MS, standard	1
17	Omp4	1447 (JGI)	*Omphalotus olearius*	δ-cadinene	GC-MS, standard	8
18	Stehi128017	EIM91001	*Stereum hirsutum* FP-91666 SS1	δ-cadinene	GC-MS	13
19	PpSTS10	Pospl1_98072 (JGI)	*Postia placenta* MAD-698	δ-cadinene	GC-MS	9
20	Agr1	MN146024	*Agrocybe aegerita* AAE-3	δ-cadinene	GC-MS, standard	11
21	Agr4	MN146027	*Agrocybe aegerita* AAE-3	δ-cadinene	GC-MS, standard	11
22	CpSTS2	LC436346 (DDBJ)	*Clitopilus pseudo-pinsitus* ATCC 20527	δ-cadinene	GC-MS	10
23	ShSTS7	161672 (JGI)	*Stereum hirsutum* FP-91666 SS1	δ-cadinene	GC-MS	10
24	ShSTS10	111121 (JGI)	*Stereum hirsutum* FP-91666 SS1	δ-cadinene	GC-MS	10
25	ShSTS11	128017 (JGI)	*Stereum hirsutum* FP-91666 SS1	δ-cadinene	GC-MS	10
26	Cun3158	-	*Cerrena unicolor*	δ-cadinene	GC-MS	12

27	Cop6	A8NCK5	*Coprinus cinereus* 9/55	α-cuprenene	GC-MS, standard	7
28	Fompi1	84944 (JGI)	*Fomitopsis pinicola* CS-1	α-cuprenene	GC-MS, standard	8
29	FgCLM1	GU123140	*Fusarium graminearum* 9F1	longiborneol	NMR	14
30	FgJ01056	PCD18636	*Fusarium graminearum* J1-012	longiborneol	NMR	15
31	Armga1	AGR34199	*Armillaria gallica* FU02472	Δ^6-protoilludene	GC-MS, standard	16
32	Dia1	-	*Diaporthe* sp.	Δ^6-protoilludene	GC-MS	17
33	Omp6	4774 (JGI)	*Omphalotus olearius*	Δ^6-protoilludene	GC-MS, standard	8
34	Omp7	2271 (JGI)	*Omphalotus olearius*	Δ^6-protoilludene	GC-MS, standard	8
35	Stehi25180	P9WEW0	*Stereum hirsutum* FP-91666 SS1	Δ^6-protoilludene	GC-MS	13
36	Stehi64702	P9WEW1	*Stereum hirsutum* FP-91666 SS1	Δ^6-protoilludene	GC-MS	13
37	Stehi73029	P9WEW2	*Stereum hirsutum* FP-91666 SS1	Δ^6-protoilludene	GC-MS	13
38	PpSTS08	Pospl1_59374 (JGI)	*Postia placenta* MAD-698	Δ^6-protoilludene	NMR	9
39	CpSTS4	LC436348 (DDBJ)	*Clitopilus pseudo-pinsitus* ATCC 20527	Δ^6-protoilludene	GC-MS	10
40	ShSTS15	64702 (JGI)	*Stereum hirsutum* FP-91666 SS1	Δ^6-protoilludene	GC-MS	10
41	ShSTS16	73029 (JGI)	*Stereum hirsutum* FP-91666 SS1	Δ^6-protoilludene	GC-MS	10
42	ShSTS17	69906 (JGI)	*Stereum hirsutum* FP-91666 SS1	Δ^6-protoilludene	GC-MS	10
43	ShSTS18	25180 (JGI)	*Stereum hirsutum* FP-91666 SS1	Δ^6-protoilludene	GC-MS	10
44	Agr6	MN146029	*Agrocybe aegerita* AAE-3	Δ^6-protoilludene	NMR	11
45	Agr7	MN146030	*Agrocybe aegerita* AAE-3	Δ^6-protoilludene	NMR	11
46	Denbi1_659367/DbPROS	Denbi1_659367 (JGI)	*Dendrothele bispora* CBS 962.96 v1.0	Δ^6-protoilludene	GC-MS	11
47	Hetan2_454193	Hetan2_454193 (JGI)	*Heterobasidion annosum* v2.0	Δ^6-protoilludene	GC-MS	11
48	Hypsu1_138665	Hypsu1_138665 (JGI)	*Hypholoma sublateritium* v1.0	Δ^6-protoilludene	GC-MS	11
49	Pro1	QJQ03973	*Armillaria gallica* FU02472	Δ^6-protoilludene	NMR	18
50	Omp5a	2392 (JGI)	*Omphalotus olearius*	γ-cadinene	GC-MS, standard	8
51	Omp5b	2393 (JGI)	*Omphalotus olearius*	γ-cadinene	GC-MS, standard	8
52	PpSTS03	Pospl1_99496 (JGI)	*Postia placenta* MAD-698	γ-cadinene	GC-MS	9
53	CpSTS18	LC436362 (DDBJ)	*Clitopilus pseudo-pinsitus* ATCC 20527	γ-cadinene	GC-MS	10
54	ShSTS5	161672 (JGI)	*Stereum hirsutum* FP-91666 SS1	γ-cadinene	GC-MS	10

55	Pilcr_825684	Pilcr_825684 (JGI)	*Hypholoma sublateritium* v1.0	γ-cadinene	GC-MS	11
56	Cun3817	-	*Cerrena unicolor*	γ-cadinene	GC-MS	12
57	Omp9	3258 (JGI)	*Omphalotus olearius*	α-barbatene	GC-MS	8
58	Omp10	3981 (JGI)	*Omphalotus olearius*	daucene	GC-MS, standard	8
59	Stehi159379	EIM83755	*Stereum hirsutum* FP-91666 SS1	β-barbatene	GC-MS	13
60	ShSTS1	159379 (JGI)	*Stereum hirsutum* FP-91666 SS1	β-barbatene	GC-MS	10
61	Ffsc6	HF563561	*Fusarium fujikuroi* IMI58289	(–)-α-acorenol	NMR	19
62	Ffsc4	HF563560	*Fusarium fujikuroi* IMI58289	koraiol	NMR	19
63	FgJ09920	KAF5245951	*Fusarium graminearum* J1-012	koraiol	NMR	15
64	Cgl02525	NMDCN0000QHS (NMDC)	*Colletotrichum gloeosporioides* ES026	koraiol	GC-MS	20
65	Hyp5	KJ433273	*Hypoxylon* sp.	Unknown, α-bulnesene	GC-MS	1
66	STC3	S0DX56	*Fusarium fujikuroi*	eremophilene	NMR	21
67	STC5	S0ENM8	*Fusarium fujikuroi*	guaia-6,10(14)-diene	NMR	21
68	FgJ02895	NMDCN0000QH6 (NMDC)	*Fusarium graminearum* J1-012	guaia-6,10(14)-diene	NMR	20
69	EC12-GS	315006 (JGI)	*Daldinia eschscholzii* EC12	τ-gurjunene	GC-MS	22
70	EC38-GPS	80361 (JGI)	*Hypoxylon* sp. EC38	τ-gurjunene	GC-MS	22
71	EC12-SS	24646 (JGI)	*Daldinia eschscholzii* EC12	α-selinene	GC-MS	22
72	EC12-ILS	70183 (JGI)	*Daldinia eschscholzii* EC12	isoledene	GC-MS	22
73	CI4A-CPS	322581 (JGI)	*Hypoxylon* sp. CI4A	β-chamigrene	GC-MS	22
74	CO27-CPS	392541 (JGI)	*Hypoxylon* sp. CO27	β-chamigrene	GC-MS	22
75	EC38-CPS	328361 (JGI)	*Hypoxylon* sp. EC38	β-chamigrene	GC-MS	22
76	CI4A-CS	6706 (JGI)	*Hypoxylon* sp. CI4A	caryophyllene-(II)	GC-MS	22
77	CO27-CS	397991 (JGI)	*Hypoxylon* sp. CO27	caryophyllene-(II)	GC-MS	22
78	EC38-CS	373976 (JGI)	*Hypoxylon* sp. EC38	caryophyllene-(II)	GC-MS	22
79	BvCS	KU668561	*Boreostereum vibrans*	(+)-torreyol/(+)-δ-cadinol	GC-MS, standard	23
80	GME3638	KX281944	*Lignosus rhinocerotis* TM02	(+)-torreyol/(+)-δ-cadinol	NMR	24
81	Copu5	XP_007765330	*Coniophora puteana*	(+)-torreyol/(+)-δ-cadinol	NMR	25
82	Copu9	XP_007765560	*Coniophora puteana*	(+)-torreyol/(+)-δ-cadinol	NMR	25
83	STC1	XM_023573743	*Fusarium fujikuroi* IMI58289	(–)-germacrene D	NMR	26

84	AcTPS1	KFH47455	*Acremonium chrysogenum* ATCC 11550	(–)-germacrene D	NMR	27
85	GME3634	KX281943	*Lignosus rhinocerotis* TM02	α-cadinol	NMR	24
86	GME9210	KX281945	*Lignosus rhinocerotis* TM02	1,3,4,5,6,7-hexahydro-2,5,5-trimethyl-2H-2,4a-ethanonaphthalene	GC-MS	24
87	AcTPS4	-	*Antrodia cinnamomea*	zonarene	GC-MS	28
88	AcTPS5	-	*Antrodia cinnamomea*	T-cadinol	GC-MS, standard	28
89	AcTPS9	-	*Antrodia cinnamomea*	1-*epi*-cubenol	GC-MS	28
90	ShSTS8	146390 (JGI)	*Stereum hirsutum* FP-91666 SS1	1-*epi*-cubenol	GC-MS	10
91	Copu2	XP_007771895	*Coniophora puteana*	β-copaene	NMR	29
92	Copu3	XP_007765978	*Coniophora puteana*	cubebol	NMR	29
93	AcCop4	-	*Antrodia cinnamomea*	cubebol	NMR	30
94	AstA	XP_001213594	*Aspergillus terreus*	(–)-daucane	NMR	31
95	STC4	-	*Termitomyces* sp.	(+)-intermedeol	NMR	32
96	STC9	KNZ74377	*Termitomyces* sp.	(–)-γ-cadinene	NMR	32
97	GsSTS43	OK500006	*Ganoderma sinensis*	(–)-γ-cadinene	GC-MS, standard	33
98	GsSTS45b	OK500007	*Ganoderma sinensis*	(–)-γ-cadinene	GC-MS, standard	33
99	GlSTS6	OK500005	*Ganoderma lucidum*	(–)-γ-cadinene	GC-MS, standard	33
100	STC15	KAG5727529	*Termitomyces* sp.	(+)-germacrene D-4-ol	NMR	32
101	FgFS	ESU09719	*Fusarium graminearum*	fusariumdiene, fusagramineol, *epi*-fusagramineol	NMR	34
102	PeniA	QDO73502	*Penicillium griseofulvum* NRRL35584	silphinene	NMR	35
103	AspeG	-	*Aspergillus aculeatus* CRI323-04	silphinene	NMR	36
104	TaTS	LC484924	*Trichoderma* sp.	trichobrasilenol	NMR	37
105	BraA	P9WER0	*Annulohypoxylon truncatum*	trichobrasilenol	NMR	38
106	Tvi09626	NMDCN0000QI8 (NMDC)	*Trichoderma viride* J1-030	brasilanol	NMR	39
107	AneC	A0A1L9WUI2	*Aspergillus aculeatus* ATCC16872	dauca-4,7-diene	NMR	40
108	FlvE	QRD86578	*Aspergillus flavus*	acoradiene	NMR	41
109	Agr2	MN146025	*Agrocybe aegerita* AAE-3	viridiflorene/ledene	GC-MS, standard	11
110	CpSTS13	LC436357 (DDBJ)	*Clitopilus pseudo-pinsitus* ATCC 20527	viridiflorene/ledene	GC-MS	10

111	CpSTS9	LC436353 (DDBJ)	*Clitopilus pseudo-pinsitus* ATCC 20527	viridiflorol	GC-MS	10
112	CpSTS12	LC436356 (DDBJ)	*Clitopilus pseudo-pinsitus* ATCC 20527	viridiflorol	GC-MS	10
113	Agr5	MN146028	*Agrocybe aegerita* AAE-3	viridiflorol	GC-MS, standard	11
114	Denbi1_816208	Denbi1_816208 (JGI)	*Dendrothele bispora* CBS 962.96 v1.0	viridiflorol	GC-MS	11
115	Sphst_47084	Sphst_47084 (JGI)	*Sphaerobolus stellatus* v1.0	viridiflorol	GC-MS	11
116	Agr8	MN146031	*Agrocybe aegerita* AAE-3	γ-muurolene	GC-MS, standard	11
117	Agr9	MN146032	*Agrocybe aegerita* AAE-3	γ-muurolene	GC-MS, standard	11
118	Cun3157	-	*Cerrena unicolor*	β-cubebene	GC-MS	12
119	FgJ04421	NMDCN0000QHG (NMDC)	*Fusarium graminearum* J1-012	β-cubebene	GC-MS	20
120	Cun3574	-	*Cerrena unicolor*	α-copaene	GC-MS	12
121	Cun5155	-	*Cerrena unicolor*	aromadendrene	GC-MS, standard	12
122	Cun0773	-	*Cerrena unicolor*	germacrene D	GC-MS	12
123	PpSTS06	Pospl1_45581 (JGI)	*Postia placenta* MAD-698	α-gurjunene	GC-MS	9
124	PpSTS14	Pospl1_101549 (JGI)	*Postia placenta* MAD-698	pentalenene	GC-MS	9
125	CpSTS6	LC436350 (DDBJ)	*Clitopilus pseudo-pinsitus* ATCC 20527	pentalenene	GC-MS	10
126	CpSTS1	LC436345 (DDBJ)	*Clitopilus pseudo-pinsitus* ATCC 20527	sterpurene	NMR	10
127	CpSTS8	LC436352 (DDBJ)	*Clitopilus pseudo-pinsitus* ATCC 20527	alloaromadendrene	GC-MS	10
128	CpSTS11	LC436355 (DDBJ)	*Clitopilus pseudo-pinsitus* ATCC 20527	9-alloaromadendrene	NMR	10
129	CpSTS16	LC436360 (DDBJ)	*Clitopilus pseudo-pinsitus* ATCC 20527	aristolene	GC-MS	10
130	CpSTS17	LC436361 (DDBJ)	*Clitopilus pseudo-pinsitus* ATCC 20527	β-caryophyllene	GC-MS	10
131	ShSTS13	50042 (JGI)	*Stereum hirsutum* FP-91666 SS1	β-caryophyllene	GC-MS	10
132	ShSTS4	52743 (JGI)	*Stereum hirsutum* FP-91666 SS1	hirsutene	GC-MS	10
133	ShSTS12	111127 (JGI)	*Stereum hirsutum* FP-91666 SS1	α-cubebene	GC-MS	10
134	Galma_104215	Galma_104215 (JGI)	*Galerina marginata* v1.0	β-gurjunene	GC-MS	11
135	CpSTS3	LC436347 (DDBJ)	*Clitopilus pseudo-pinsitus* ATCC 20527	δ-cadinol	GC-MS	10
136	Cun7050	-	*Cerrena unicolor*	δ-cadinol	GC-MS	12
137	Cun0716	-	*Cerrena unicolor*	δ-cadinol	GC-MS	12
138	ThmB	ULE36148	*Aspergillus fischeri* ATCC 18618	(–)-amorpha-4,11-diene	NMR	42
139	BcBOS	XP_001546971	*Botrytis cinerea* B05.10	(+)-α-bisabolol	NMR	43

140	LsBERS	TVY81921	*Lachnellula suecica*	(+)-α-bisabolol	NMR	43
141	NsBERS	MZ672113	*Nectria* sp. HLS206	(+)-α-*trans*-bergamotene	NMR	43
142	NsTAS	MZ672113	*Neonectria* sp. DH2	trichoacorenol	NMR	43
143	AaT08897/AaTPS	NMDCN0000QH2 (NMDC)	*Alternaria alternata* TPF6	7-*epi*-α-selinene	NMR	20
144	Cgl13309	NMDCN0000QJA (NMDC)	*Colletotrichum gloeosporioides* ES026	(–)-aristolochene	NMR	20
145	IlIS	-	*Irpex lacteus*	iltremulanol A	NMR, X-ray	44
146	SptA	WFJ08646	*Spiromastix* sp. MCCC 3A00308	guaia-1,5(6)-diene	NMR	45
147	GdlS	OP095378	*Aspergillus ustus* 3.3904	germacradienol	NMR	46
148	PeTS4	XP_016598880	*Penicillium expansum*	(+)-bicyclogermacrene	NMR	5
149	LdSTS7	-	*Lactarius deliciosus*	1, 9-aristolene, 1-aristolene	NMR	47
150	LdSTS11	-	*Lactarius deliciosus*	1, 9-aristolene, 1-aristolene	NMR	47
151	AsR6	AWM95795	*Acremonium strictum* IMI 501407	2*E*,6*E*,9*E*-humulene	NMR	48
152	PycR6	WHP53403	*Leptobacillium* sp. CF-236968	2*E*,6*E*,9*E*-humulene	NMR	49
153	EupR3	WHS04494	*Phaeosphaeriaceae* sp. CF-150626	2*Z*,6*E*,9*E*-humulene	NMR	49
154	EupE	QCO93112	*Phoma* sp. CGMCC 10481	2*Z*,6*E*,9*E*-humulene	GC-MS, standard	50
155	EupfG	-	*Penicillium janthinellum*	2*Z*,6*E*,9*E*-humulene	GC-MS	51
156	BcABA3	XP_024550392	*Botrytis cinerea* MAFF 306914	α-ionylideneethane	NMR	52

Cyclase information is available at the following database websites, and the unlabeled cyclase accession numbers above are NCBI database sources. https://www.ncbi.nlm.nih.gov (NCBI), https://img.jgi.doe.gov/ (JGI), https://nmdc.cn/en (NMDC), https://www.ddbj.nig.ac.jp (DDBJ)

Table S3 Class I diterpene cyclase in fungi

No.	Cyclase name	Accession number	Strain	Main product	Structural identification method	Reference
1	PaFS	AB267396	*Phomopsis amygdali* N2	fusicocca-2,10(14)-diene	NMR	53
2	AbFS	C9K2Q3	*Alternaria brassicicola* ATCC 96836	fusicocca-2,10(14)-diene	GC-MS	54
3	BscA	XP_007924161	*Pseudocercospora fijiensis*	fusicocca-2,10(14)-diene	NMR	55
4	PgFS	MW798217	*Pyricularia grisea*	fusicocca-2,10(14)-diene	NMR	56
5	PaPS	AB252833	*Phomopsis amygdali* N2	phomopsene	NMR	57
6	SdnA	A0A1B4XBG5	*Sordaria araneosa* Cain ATCC 36386	cycloaraneosene	NMR	58
7	Tvi11551	-	*Trichoderma viride* J1-030	cycloaraneosene	GC-MS	20
8	EvVS	LC063849 (DDBJ)	*Emericella variecolor* NBRC 32302	variediene	NMR	59
9	FgGS	KY462790	*Fusarium graminearum* J1-012	variediene	NMR	60
10	AbVS	OJJ72250	*Aspergillus brasiliensis* CBS 101.740	variediene	NMR	61
11	SmVS	MW798207	*Sordaria macrospora*	variediene	NMR	56
12	BpVS	MW798228	*Baudoinia panamericana*	variediene	NMR	56
13	AbVS′	MW798217	*Aspergillus brasiliensis*	variediene	NMR	56
14	AaGS	MW798231	*Aspergillus aculeatus*	variediene	NMR	56
15	CgDS	P9WEV7	*Colletotrichum gloeosporioides* ES026	dolasta-1(15),8-diene	NMR	62
16	Cgl13742	NMDCN0000QI3 (NMDC)	*Colletotrichum gloeosporioides* ES026	dolasta-1(15),8-diene	GC-MS	20
17	PcCS	LC411963 (DDBJ)	*Penicillium chrysogenum* MT-12	deoxyconidiogenol	NMR	63
18	PchDS	LC373222 (DDBJ)	*Penicillium chrysogenum* MAFF111241	deoxyconidiogenol	NMR	64
19	PrDS	CDM32996	*Penicillium roqueforti* IFM48062	deoxyconidiogenol	NMR	64
20	PhPS	MW798224	*Pseudovirgaria hyperparasitica*	deoxyconidiogenol	NMR	56
21	PaCS	MW798233	*Penicillium arizonense*	deoxyconidiogenol	NMR	56
22	SteTC1	XP_007305993	*Stereum histurum*	(−)-*R*-nephthenol	NMR	65
23	MgMS	MN413676	*Myrothecium gramineum* ZLW0801-19	myrothec-15(17)-en-7-ol	NMR	66
24	AcSS	MW798205	*Aspergillus calidoustus*	spiroviolene	NMR	56
25	AaT09930	NMDCN0000QH3 (NMDC)	*Alternaria alternata* TPF6	traversiadiene	NMR	20
26	TndC	QVR97762	*Aspergillus flavipes* CNL-338	talarodiene	NMR	67

27	TadA	ON624151	*Talaromyces wortmannii* ATCC 26942	talaro-7,13-diene	NMR	68
28	PsaD	OR221158	*Psathyrella candolleana*	guanacasta-1,3-diene	NMR	69

Cyclase information is available at the following database websites, and the unlabeled cyclase accession numbers above are NCBI database sources. https://www.ncbi.nlm.nih.gov (NCBI), https://nmdc.cn/en (NMDC), https://www.ddbj.nig.ac.jp (DDBJ)

Table S4 Class I sesterterpene cyclase in fungi

No.	Cyclase name	Accession number	Strain	Main product	Structural identification method	Reference
1	AcOS	ACLA_076850	*Aspergillus clavatus* NRRL 1	ophiobolin F	NMR, X-ray	70
2	AuOS	MW798208	*Aspergillus ustus*	ophiobolin F	NMR	56
3	BmOS	MW798226	*Bipolaris maydis*	ophiobolin F	NMR	56
4	EvSS	LC073704 (DDBJ)	*Emericella variecolor* NBRC 32302	stellata-2,6,19-triene	NMR	71
5	NfSS	EAW16201	*Neosartorya fischeri*	sesterfisherol	NMR	72
6	AaTPS1	XP_018386201	*Alternaria alternata* MB-30	sesterfisherol	NMR	73
7	AaSS	MW798204	*Alternaria alternata*	sesterfisherol	NMR	56
8	EvAS	LC113889 (DDBJ)	*Emericella variecolor* NBRC 32302	astellifadiene	NMR, crystalline sponge method	74
9	EvQS	LC155210 (DDBJ)	*Emericella variecolor* NBRC 32302	quiannulatene	NMR	75
10	FgMS	KY462789	*Fusarium graminearum* J1-012	mangicdiene	NMR	60
11	PbSS	LC228601 (DDBJ)	*Penicillium brasilianum* NBRC 6234	sesterbrasiliatriene	NMR	76
12	PaSS	MW798222	*Penicillium arizonense*	sesterbrasiliatriene	NMR	56
13	PvPS	LC228602 (DDBJ)	*Penicillium verruculosum* TPU1311	preasperterpenoid A	NMR	76
14	AstC	A0A3Q9FFM1	*Talaromyces wortmannii* ATCC 26942	preasperterpenoid A	NMR	77
15	TtPS	MW798214	*Thermothielavioides terrestris*	preasperterpenoid A	NMR	56
16	TvPS	MW798225	*Talaromyces verruculosus*	preasperterpenoid A	NMR	56
17	BmTS1	ENH98917	*Bipolaris maydis* ATCC48331	Bm1	NMR	78
18	BmTS2	ENI07344	*Bipolaris maydis* ATCC48331	Bm2	NMR	78
19	PbTS1	LC274619 (DDBJ)	*Phoma betae* PS-13	Pb1	NMR	78
20	$BtcA_{Co}$	N4V6D4.1	*Colletotrichum orbiculare*	Pb1	NMR	79
21	CoFS	MW798210	*Colletotrichum orbiculare*	Pb1	NMR	56
22	ChPS	MW798213	*Colletotrichum higginsianum*	Pb1	NMR	56
23	CsPS	MW798219	*Colletotrichum siamense*	Pb1	NMR	56
24	Cgl05950	NMDCN0000QHU (NMDC)	*Colletotrichum gloeosporioides* ES026	Pb1	GC-MS	20
25	BmTS3	ENH99278	*Bipolaris maydis* ATCC48331	Bm3	NMR	78
26	BsPS	KAF5853325	*Bipolaris sorokiniana* BS11134	Bm3	NMR	80
27	CfBS	MW798209	*Colletotrichum fioriniae*	Bm3	NMR	56

28	MpBS	MW798229	*Macrophomina phaseolina*	Bm3	NMR	56
29	AcldAS	CEL06489	*Aspergillus calidoustus* CBS121601	asperterpenol A	NMR	81
30	AuAS	MW387950	*Aspergillus ustus* 094102	aspergildiene A–D	NMR	82
31	AcAS	CEN61919	*Aspergillus calidoustus*	aspergildiene A–D, calidoustene	NMR	83
32	AtAS	ATEG_03568	*Aspergillus terreus* NIH 2624	preaspterpenacid I	NMR	84
33	FoFS	MW446505	*Fusarium oxysporum* FO14005	fusoxypene A	NMR	84
34	ZbSS	MW798202	*Zymoseptoria brevis*	sesterevisene	NMR	56
35	CiSS	MW798201	*Colletotrichum incanum*	sesterorbiculene	NMR	56
36	CoSS	MW798211	*Colletotrichum orbiculare*	sesterorbiculene	NMR	56
37	CgSS	MW798218	*Colletotrichum gloeosporioides*	sesterorbiculene	NMR	56
38	PfVS	MW798216	*Pestalotiopsis fici*	variculatriene A	GC-MS	56
39	ChVS	MW798212	*Colletotrichum higginsianum*	(–)-variculatriene B	NMR	56
40	PoVS	MW798215	*Pyricularia oryzae*	(–)-variculatriene B	NMR	56
41	LmVS	MW798221	*Lophiostoma macrostomum*	(–)-variculatriene B	NMR	56
42	CsVS	MW798223	*Colletotrichum sublineola*	(–)-variculatriene B	NMR	56
43	PoVS	MW798227	*Pyricularia oryzae*	(–)-variculatriene B	NMR	56
44	ChBS	MW798232	*Colletotrichum higginsianum*	brassitetraene A	GC-MS	56
45	CsSS	MW685620	*Cytospora schulzeri* 12565	schultriene	NMR	85
46	NnNS	MW685621	*Nectria nigrescens* 12199	nigtetraene	NMR	85
47	PstA	-	*Penicillium herquei* TJ403-A1	penisentene	NMR	86
48	AaTPS2	XP_018380014	*Alternaria alternata* MB-30	preterpestacin I	NMR	73
49	VrcA	XP_020054773	*Aspergillus aculeatus* ATCC 16872	variecoladiene	NMR	87

Cyclase information is available at the following database websites, and the unlabeled cyclase accession numbers above are NCBI database sources. https://www.ncbi.nlm.nih.gov (NCBI), https://nmdc.cn/en (NMDC), https://www.ddbj.nig.ac.jp (DDBJ)

Table S5 Class I triterpene cyclase in fungi

No.	Cyclase name	Accession number	Strain	Main product	Structural identification method	Reference
1	TvTS	P9WER5	*Talaromyces verruculosus* TS63-9	talaropentaene	NMR	88
2	MpMS	K2SUY0	*Macrophomina phaseolina* MS6	macrophomene	NMR	88
3	CgCS	7WIJ_A	*Colletotrichum gloeosporioides* ES026	colleterpenol	NMR	88

Cyclase information is available at the NCBI database website. https://www.ncbi.nlm.nih.gov (NCBI)

Table S6 Class II diterpene cyclase in fungi

No.	Cyclase name	Accession number	Strain	Main product	Structural identification method	Reference
1	FCPS/KS	AB003395	*Phaeosphaeria* sp. L487	*ent*-kaurene	GC-MS	89
2	GCPS/KS	BAA84917	*Gibberella fujikuroi* IFO30336	*ent*-kaurene	GC-MS	90
3	CPS	Y15013	*Gibberella fujikuroi* m567	copalyl diphosphate	-	91
4	PaDC2	AB252835	*Phomopsis amygdali* N2	copalyl diphosphate	NMR	92
5	PvCPS	LC316181 (DDBJ)	*Penicillium verruculosum* TPU1311	copalyl diphosphate	NMR	93
6	PfCPS	403578 (JGI)	*Penicillium fellutanum* ATCC 48694	copalyl diphosphate	NMR	93
7	PbACS	AB049075	*Phoma betae* PS-13	aphidicolan-16β-ol	MS, standard	94
8	PaDC1	AB252834	*Phomopsis amygdali* F6	phyllocladan-16α-ol	NMR	92
9	AN1594	A0A1U8QHE3	*Aspergillus nidulans* FGSC A4	*ent*-pimara-8(14),15-diene	GC-MS, standard	95
10	AfCPS-PS	XP_753151	*Aspergillus fumigatus* AF293	isopimara-7,15-diene	GC-MS, standard	96
11	AoCPS-PS	XP_001820661	*Aspergillus oryzae* RIB40	isopimara-7,15-diene	GC-MS, standard	96
12	AnCPS-PS	XP_001398730	*Aspergillus niger* CBS 513.88	sandaracopimaradiene	GC-MS, standard	96
13	NfCPS-PS	XP_001264196	*Neosartorya fischeri* NRRL 181	sandaracopimaradiene	GC-MS, standard	96
14	Ple3/CpPS/Pl-cyc	MG764077	*Clitopilus passeckerianus* ATCC 34646	premutilin	NMR	97
15	PunTC	XP_007383173	*Punctularia strigosozonata*	*ent*-kauran-16α-ol	NMR	65
16	SerTC	XP_007315031	*Serpula lacrymans*	*ent*-kauran-16α-ol	NMR	65

Cyclase information is available at the following database websites, and the unlabeled cyclase accession numbers above are NCBI database sources. https://www.ncbi.nlm.nih.gov (NCBI), https://img.jgi.doe.gov/ (JGI), https://www.ddbj.nig.ac.jp (DDBJ)

Table S7 Class II triterpene cyclase in fungi

No.	Cyclase name	Accession number	Strain	Main product	Structural identification method	Reference
1	Erg7	NP_011939	*Saccharomyces cerevisiae*	lanosterol	TLC, standard	98, 99
2	Gl-LS	GQ169529	*Ganoderma lucidum*	lanosterol	-	100
3	AcOSC	AIO10969	*Antrodia cinnamomea* WSY-01	lanosterol	GC-MS, standard	101
4	HelA	Q4WR16	*Aspergillus fumigatus* Af293	protosta-17(20)*Z*,24-dien-3β-ol	NMR	102
5	CfaOSC2	MF972287	*Cordyceps farinosa* KMCC47486	protosta-17(20)*Z*,24-dien-3β-ol	GC-MS	103
6	FusA	QBB00671	*Acremonium fusidioides* ATCC 14700	protosta-17(20)*Z*,24-dien-3β-ol	NMR	104
7	CepA	KFH43040	*Acremonium chrysogenum* ATCC 11550	protosta-17(20)*Z*,24-dien-3β-ol	NMR	105
8	AfumA	EDP50814	*Aspergillus fumigatus* A1163	21βH-hopane-3β,22-diol	NMR	106
9	PolA	AJ80_03956	*Polytolypa hystricis* UAMH7299	motiol	NMR	107

Cyclase information is available at the NCBI database website. https://www.ncbi.nlm.nih.gov (NCBI)

Table S8 Class II sesquiterpene cyclase in fungi

No.	Cyclase name	Accession number	Strain	Main product	Structural identification method	Reference
1	AstC	AO090026000582 (AspGD)	*Aspergillus oryzae* RIB40	drimanyl pyrophosate	NMR	108
2	DrtB	A0A0U5GNT1	*Aspergillus calidoustus*	drimenol	NMR	109

Cyclase information is available at the following database websites, and the unlabeled cyclase accession numbers above are NCBI database sources. https://www.ncbi.nlm.nih.gov (NCBI), http://www.aspgd.org/ (AspGD)

Table S9 UbiA-type sesquiterpene cyclase in fungi

No.	Cyclase name	Accession number	Strain	Main product	Structural identification method	Reference
1	FmaTC	AGI05042	*Aspergillus fumigatus* Af293	(–)-β-*trans*-bergamotene	NMR	110
2	StaTC5	OM891479	*Stachybotrys* sp. PYH05-7	(–)-β-*trans*-bergamotene	NMR	111
3	BC-TC	CCD48294	*Botryotonia cinerea*	(–)-β-*trans*-bergamotene	NMR	112
4	mFmaA	EXU98497	*Metarhizium robertsii* ARSEF 2575	(–)-β-*trans*-bergamotene	GC-MS	113
5	FusTC1	OM891474	*Fusarium* sp. JNU-XJ070152-01	(–)-α-bisabolol, (–)-*epi*-α-bisabolol	NMR	111
6	StaTC1	OM891475	*Stachybotrys* sp. PYH05-7	(–)-α-bisabolol	NMR	111
7	MyrTC3	OM891490	*Myrothecium* sp. ZL0801-19	(–)-*epi*-α-bisabolol	NMR	111
8	StaTC6	OM891480	*Stachybotrys* sp. PYH05-7	(–)-*epi*-α-bisabolol	NMR	111
9	StaTC2	OM891476	*Stachybotrys* sp. PYH05-7	(–)-4-*epi*-β-bisabolol	NMR	111
10	TalTC2	OM891486	*Talaromyces* sp. JNU18266-01	(*E*)-γ-bisabolene	NMR	111
11	MyrTC4	OM891491	*Myrothecium* sp. ZL0801-19	(+)-*Z*-α-bisabolene	NMR	111
12	Tps1A	KAI0942648	*Antrodia cinnamomea* s27	(+)-*Z*-α-bisabolene	NMR	114
13	Tps2A	KAI0928020	*Antrodia cinnamomea* s27	(+)-*Z*-α-bisabolene	NMR	114
14	StaTC8	OM891482	*Stachybotrys* sp. PYH05-7	(–)-α-*trans*-bergamotene	NMR	111
15	Tv86-TC	XP_013952584	*Trichoderma virens*	(–)-α-*trans*-bergamotene	NMR	112
16	StaTC4	OM891478	*Stachybotrys* sp. PYH05-7	**109**, **110**	NMR	111
17	TalTC1	OM891485	*Talaromyces* sp. JNU18266-01	**109**, **110**	NMR	111
18	MycTC	OM891487	*Mycoleptodiscus* sp. JNU2018AT0063Y	**109**, **110**	NMR	111
19	TriTC	PTB76894	*Trichoderma longibrachiatum* ATCC 18648	**109**, **110**	NMR	111
20	WesTC	XP_033655798	*Westerdykella ornata*	**109**, **110**	NMR	111

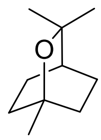
Cyclase information is available at the NCBI database website. https://www.ncbi.nlm.nih.gov (NCBI)

Table S10 UbiA-type diterpene cyclase in fungi

No.	Cyclase name	Accession number	Strain	Main product	Structural identification method	Reference
1	EriG	KY683782	*Hericium erinaceum*	cyatha-3,12-diene	NMR	115
2	CyaTC	KY683786	*Cyathus africatus*	cyatha-3,12-diene	NMR	115
3	DenTC3	KAA1470692	*Dentipellis* sp.	cyatha-3,12-diene	GC-MS, standard	65

Cyclase information is available at the NCBI database website. https://www.ncbi.nlm.nih.gov (NCBI)

Supplementary Figures



1,8-cineole

Fig. S1 Structure of class I monoterpene cyclase products

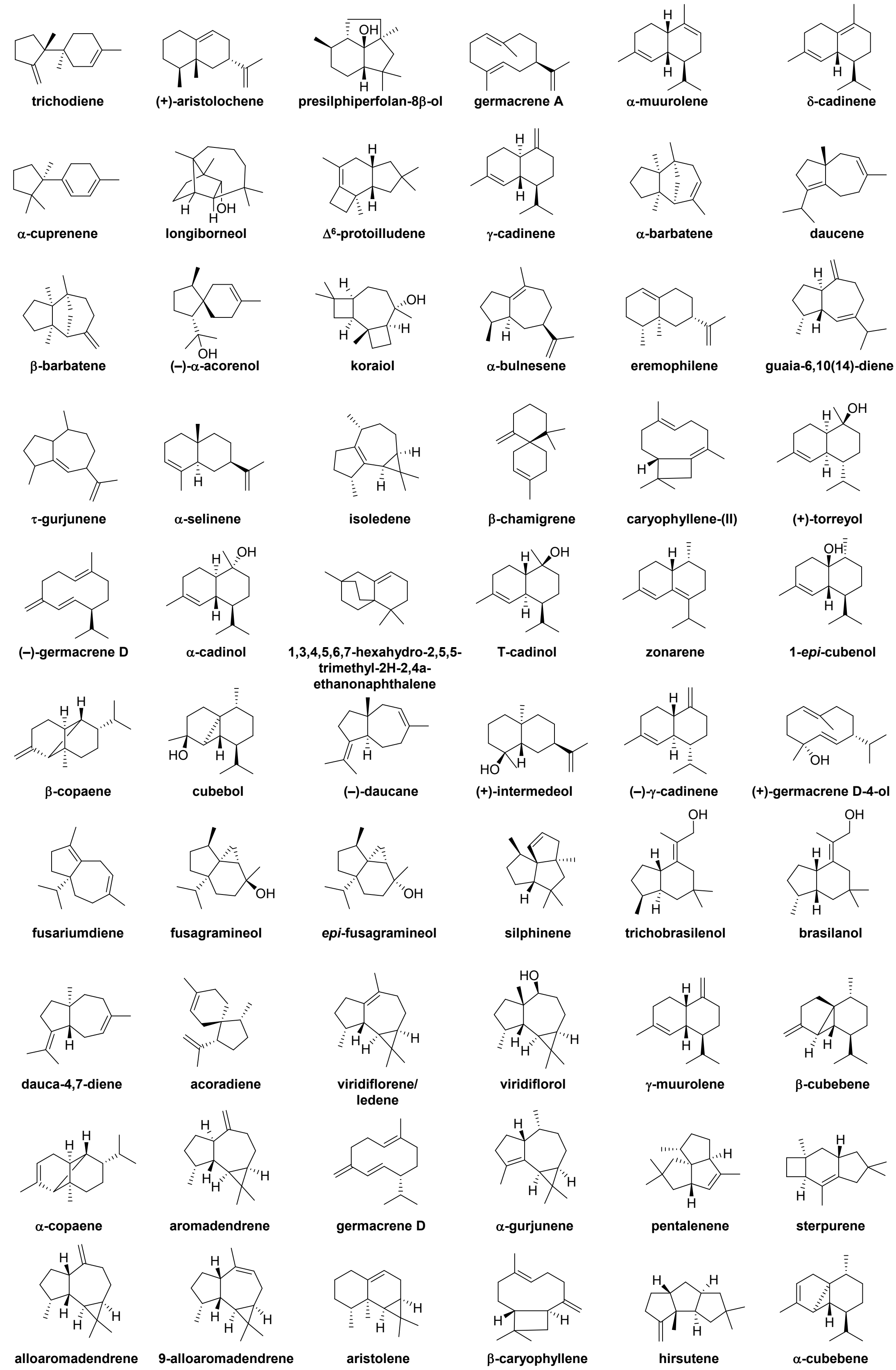


Fig. S2 Structure of class I sesquiterpene cyclase products

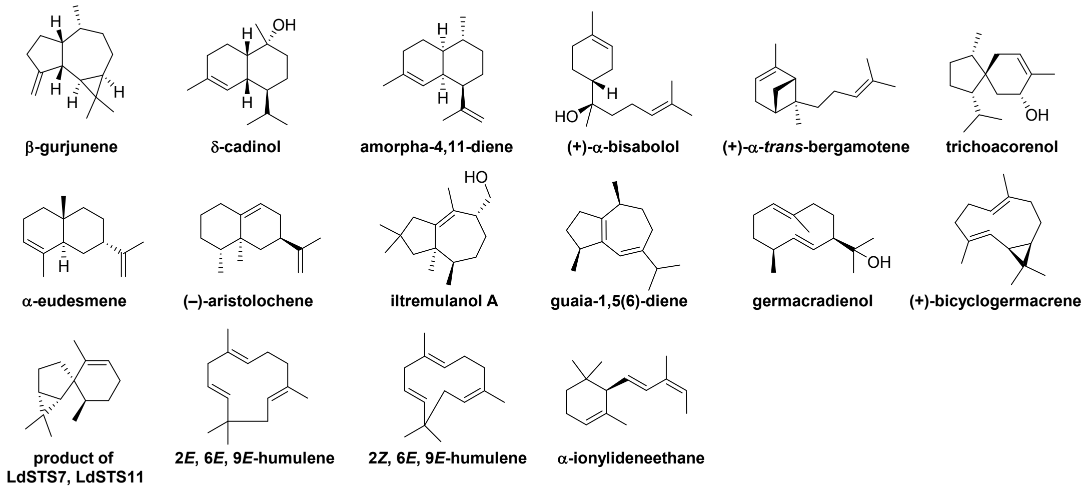


Fig. S2 Structure of class I sesquiterpene cyclase products (continued)

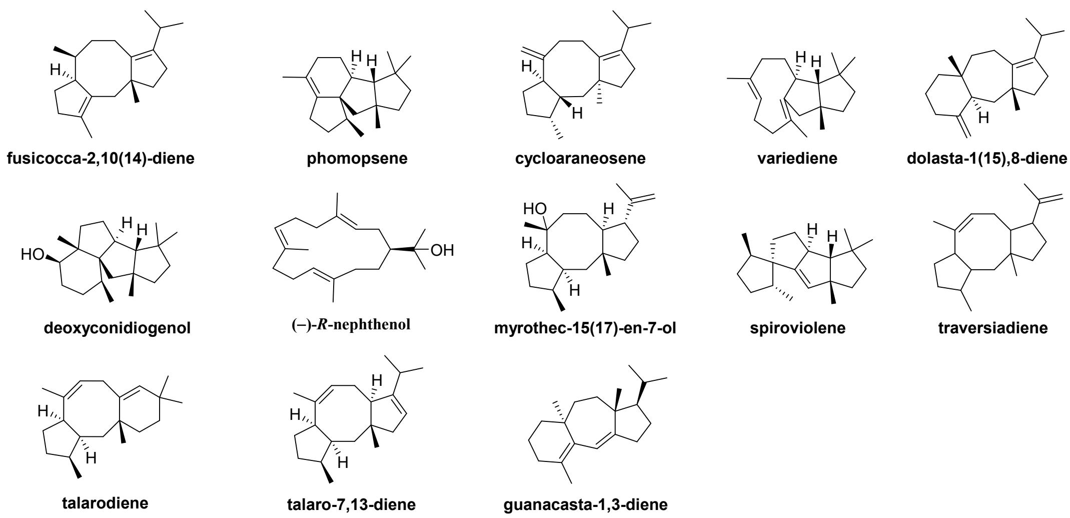


Fig. S3 Structure of class I diterpene cyclase products

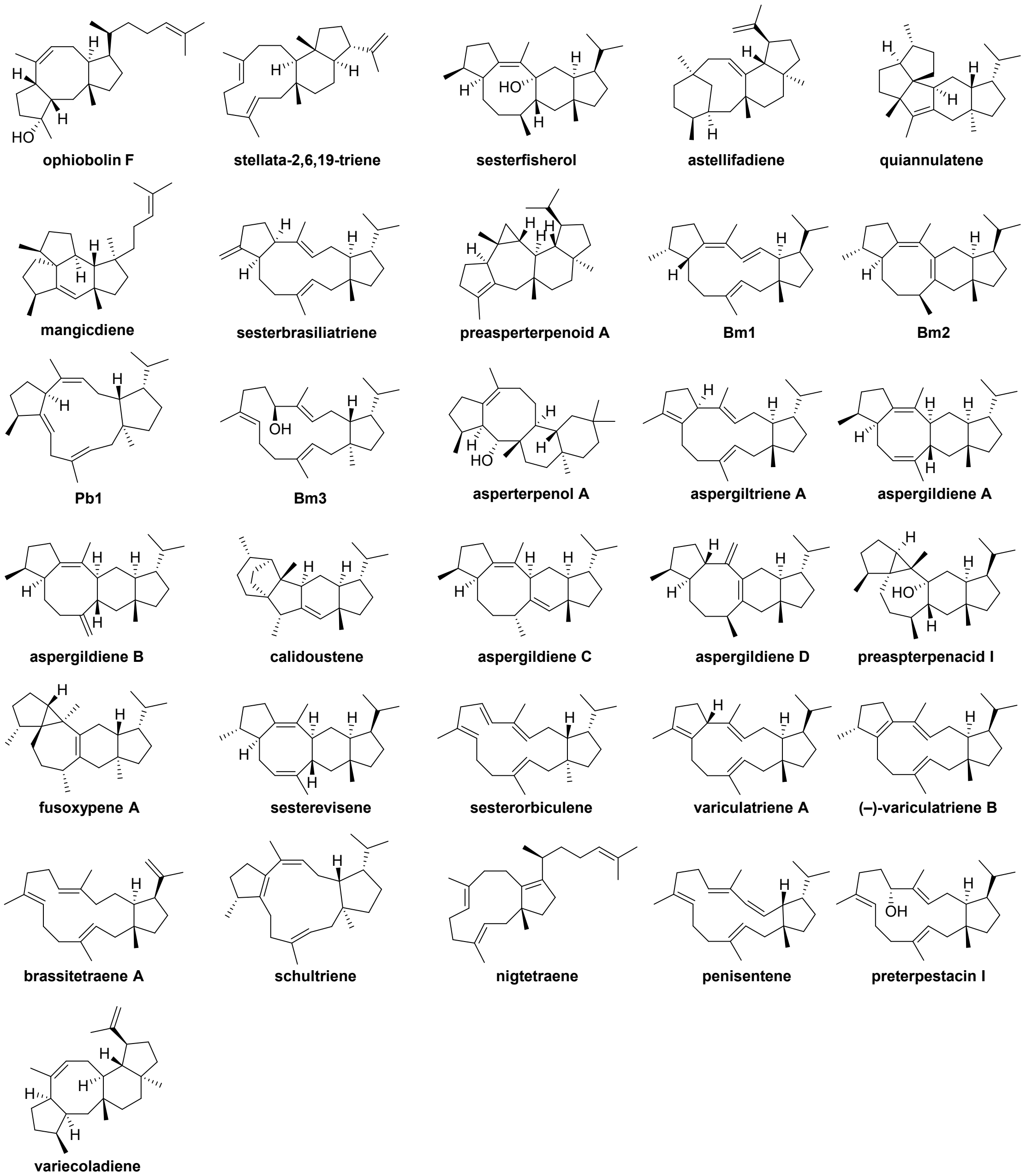
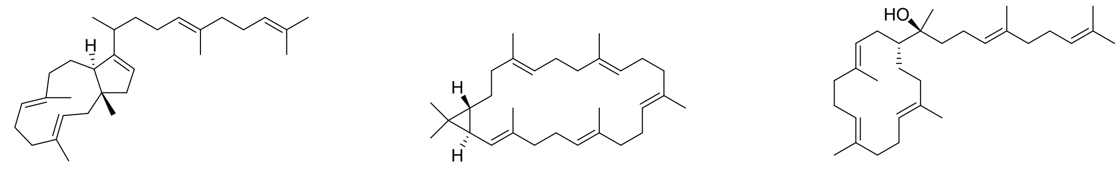


Fig. S4 Structure of class I sesterterpene cyclase products



talaropentaene **macrophomene** **colleterpenol**

Fig. S5 Structure of class I triterpene cyclase products

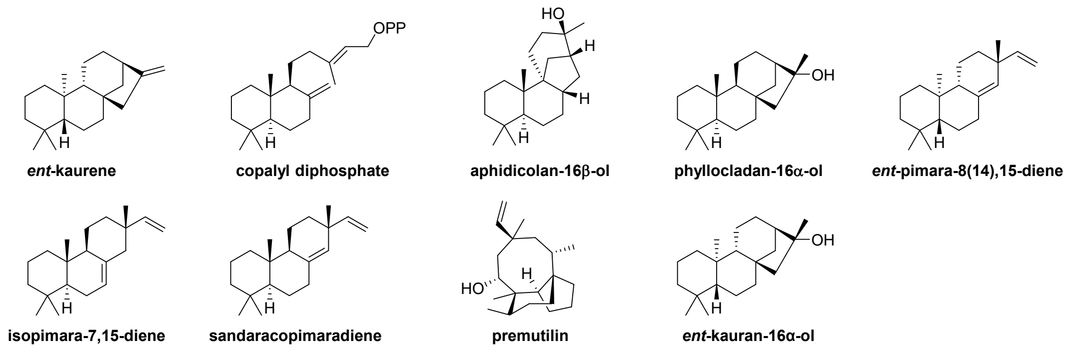


Fig. S6 Structure of class II diterpene cyclase products

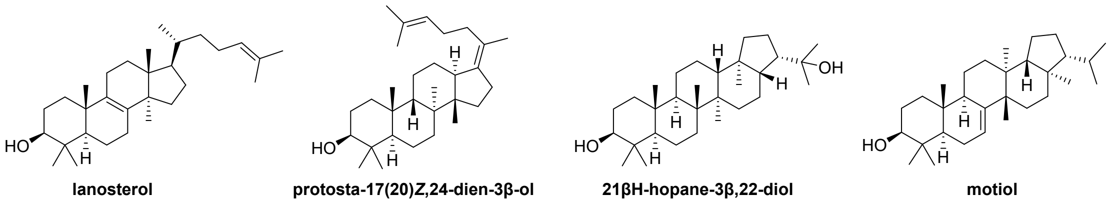


Fig. S7 Structure of class II triterpene cyclase products

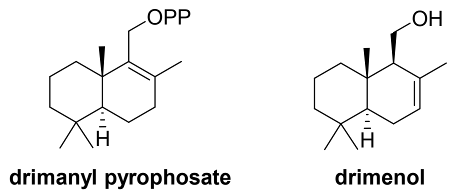


Fig. S8 Structure of class II sesquiterpene cyclase products

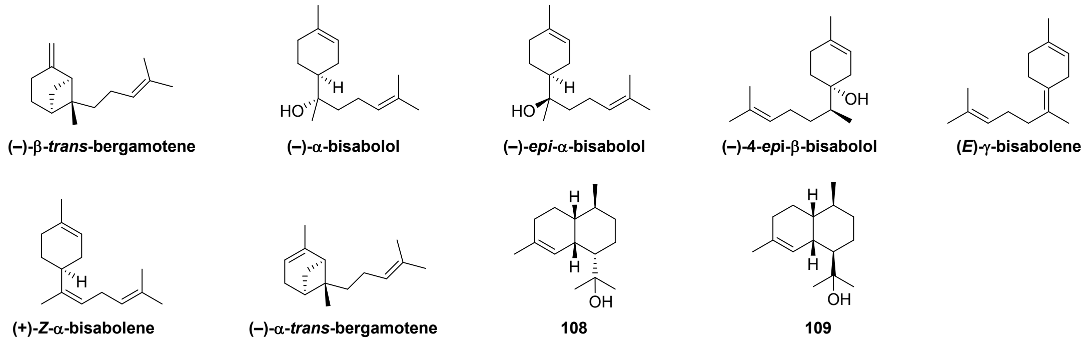
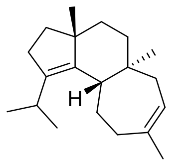


Fig. S9 Structure of UbiA-type sesquiterpene cyclase products



cyatha-3,12-diene

Fig. S10 Structure of UbiA-type diterpene cyclase products

Supplementary References

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