

Supporting information

Natural products from actinomycetes associated with marine animals and plants

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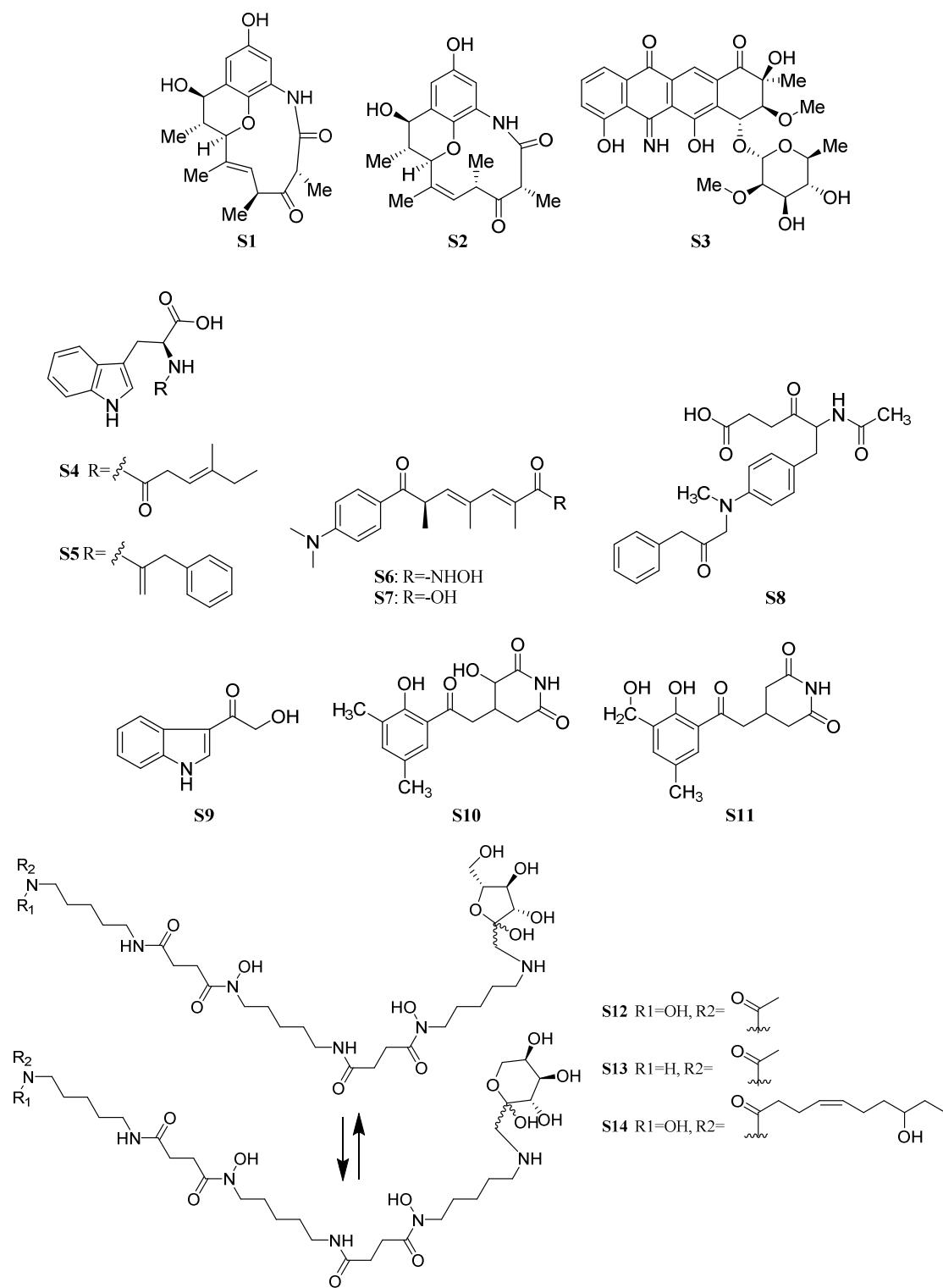
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1. Structures of inactive metabolites listed

A total of 536 metabolites have been reviewed in this article, in which the structures of 340 compounds with various biological activities are listed in the manuscript, while the remaining structures of inactive metabolites are listed in the supporting information. These chemical structures were drawn by ChemBioDraw Ultra 14.0.



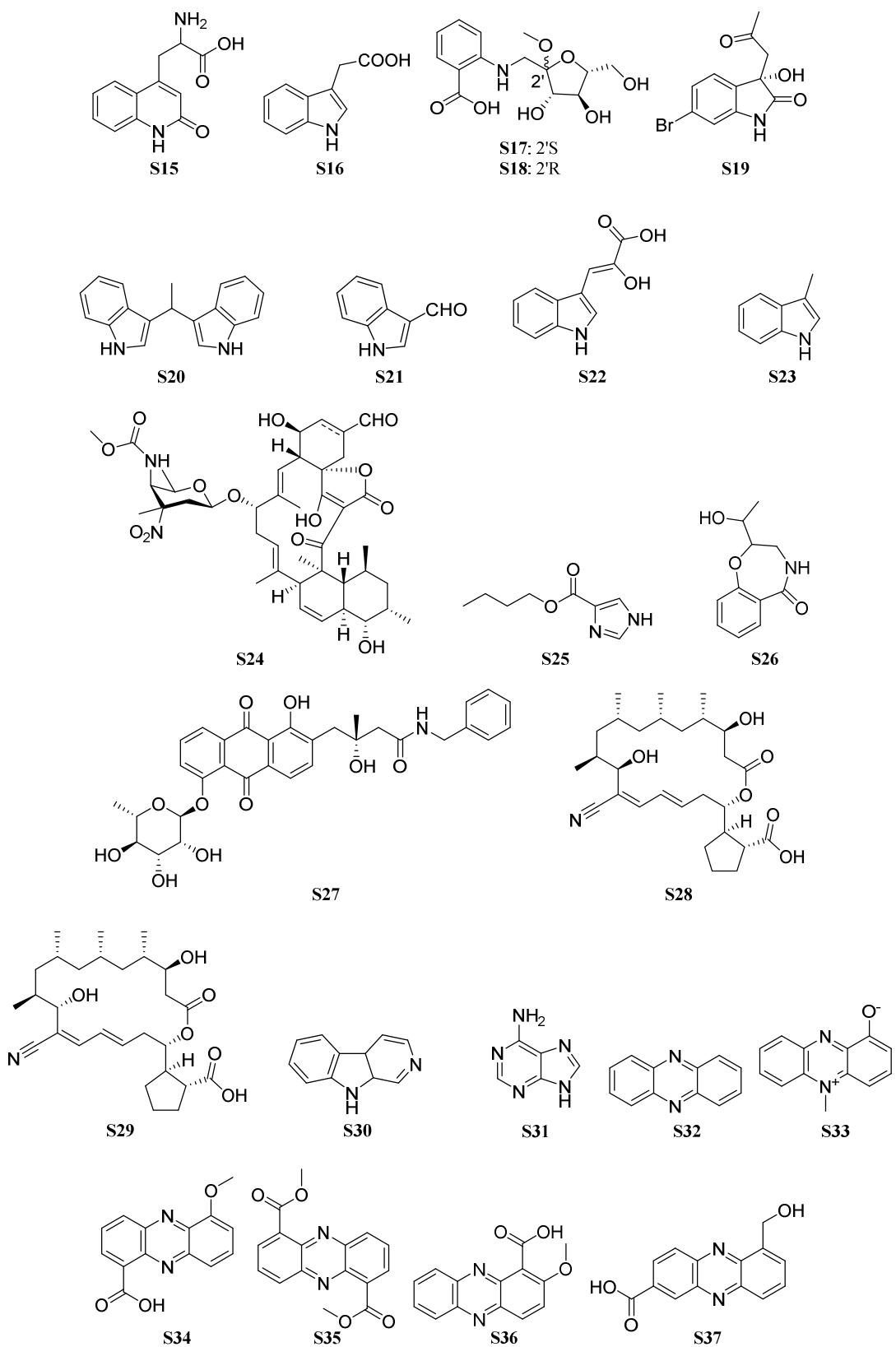


Figure S1. Alkaloids derived from the sponge-associated actinomycetes.

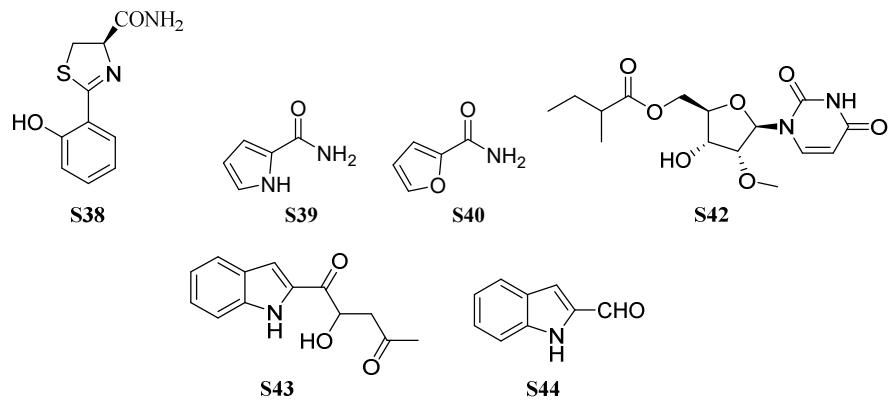


Figure S2. Alkaloids derived from the coral-associated actinomycetes.

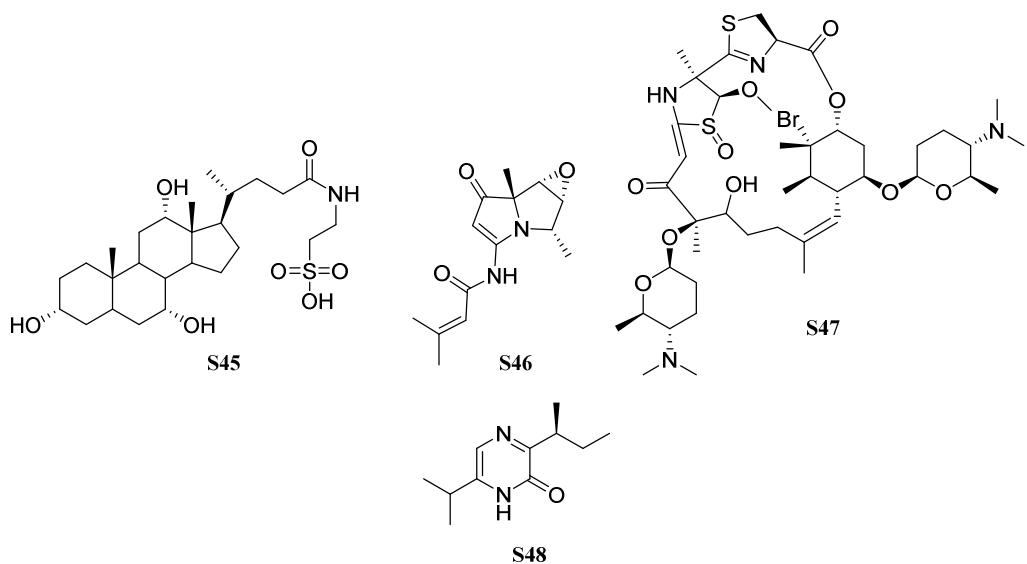
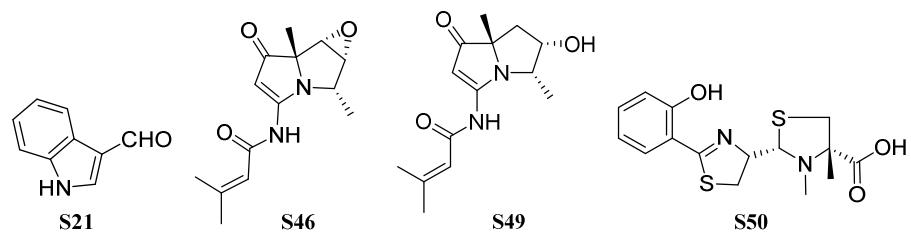


Figure S3. Alkaloids derived from the ascidian-associated actinomycetes.



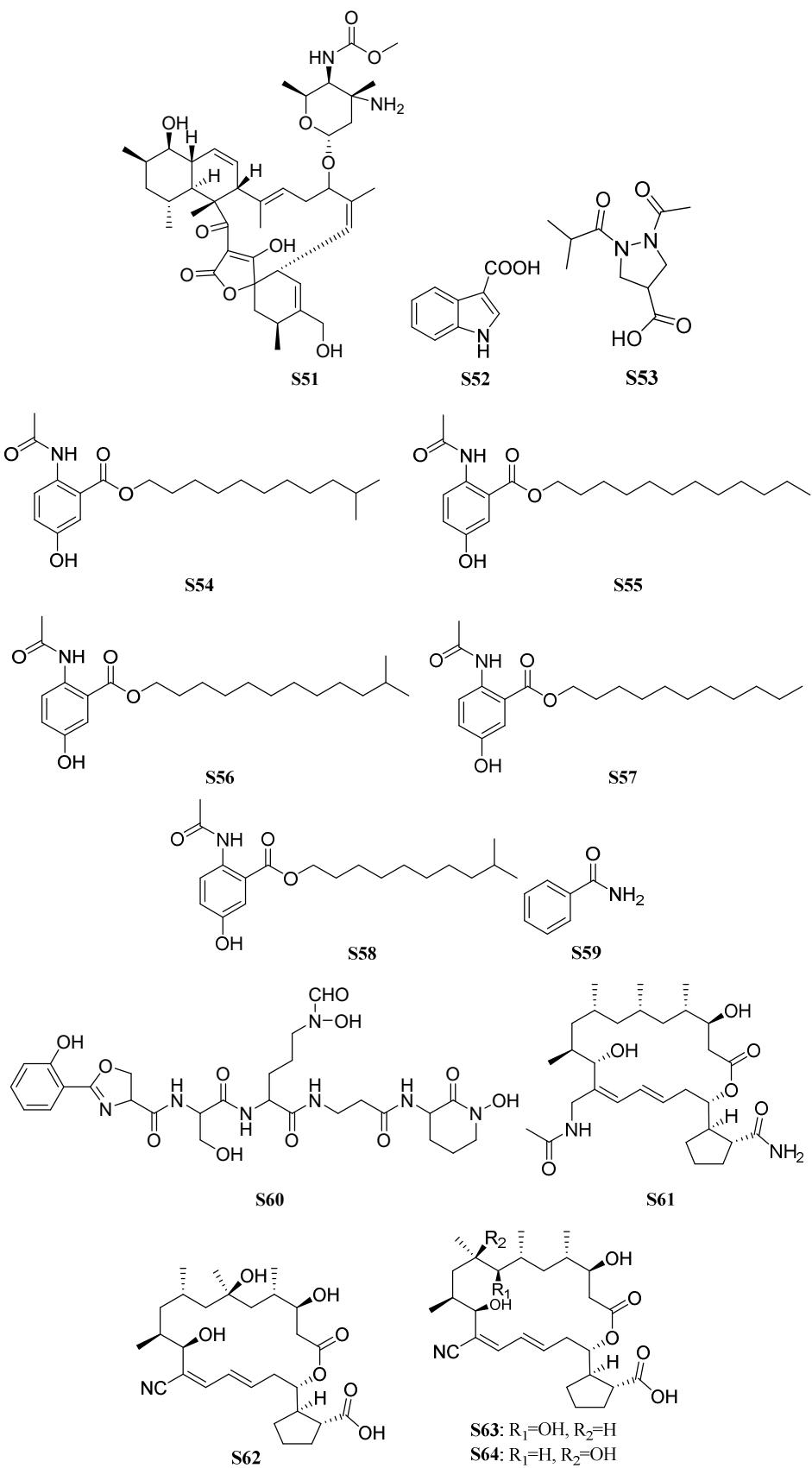


Figure S4. Alkaloids derived from the actinomycetes associated with other marine animals.

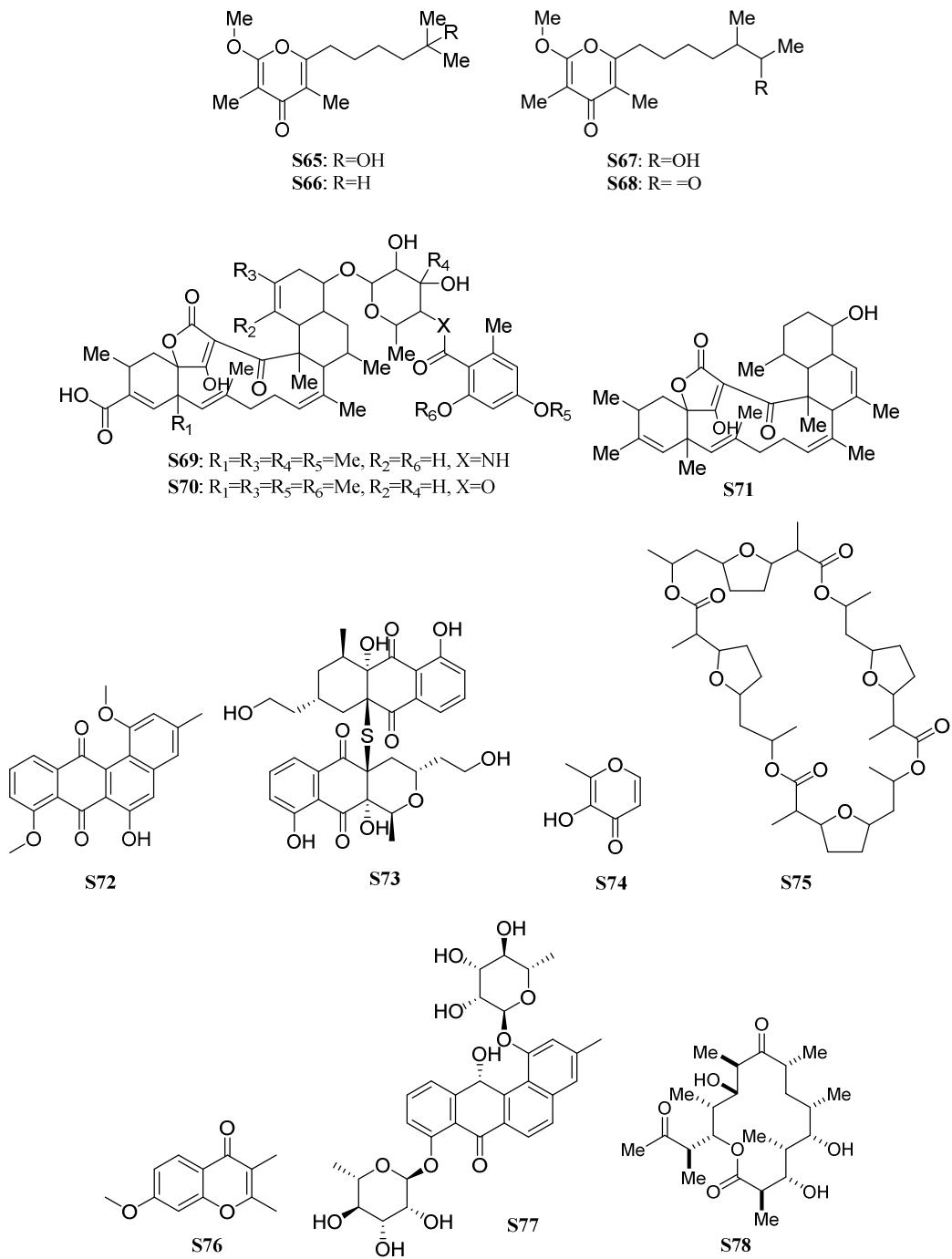


Figure S5. Polyketides derived from the sponge-associated actinomycetes.

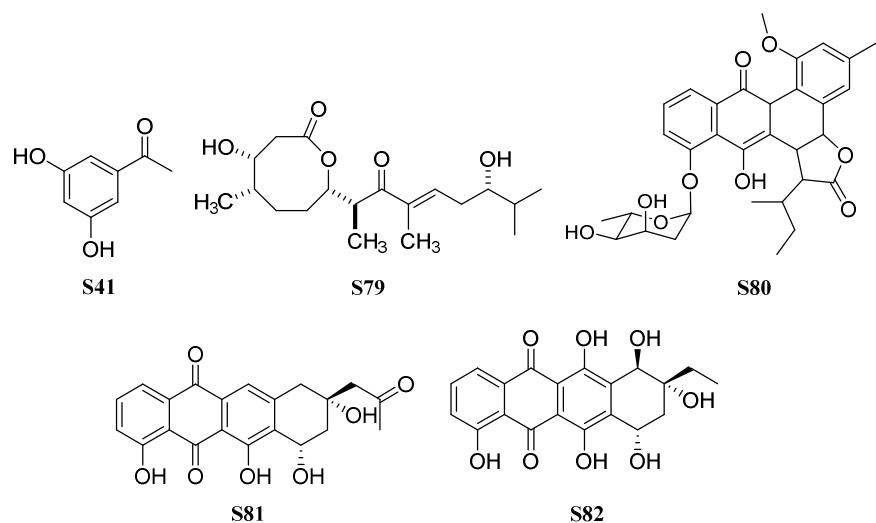


Figure S6. Polyketides derived from the coral-associated actinomycetes.

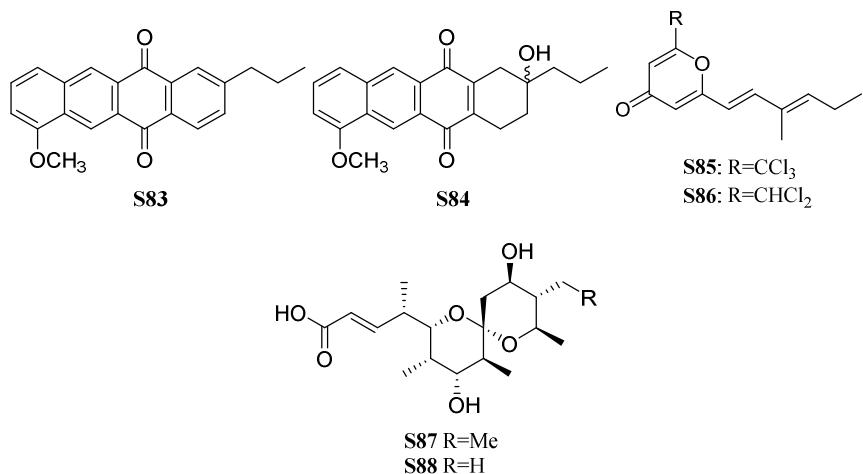
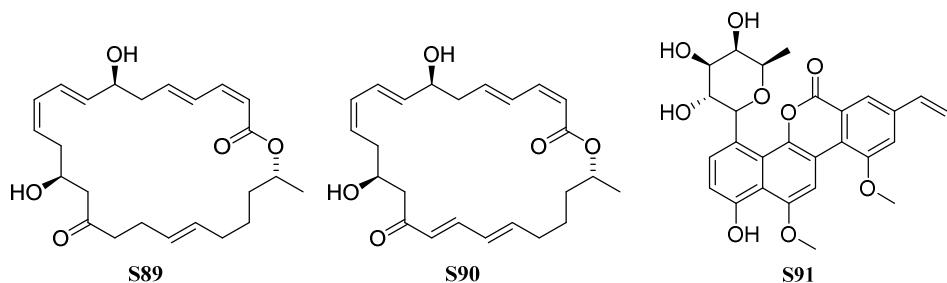


Figure S7. Polyketides derived from the ascidian-associated actinomycetes.



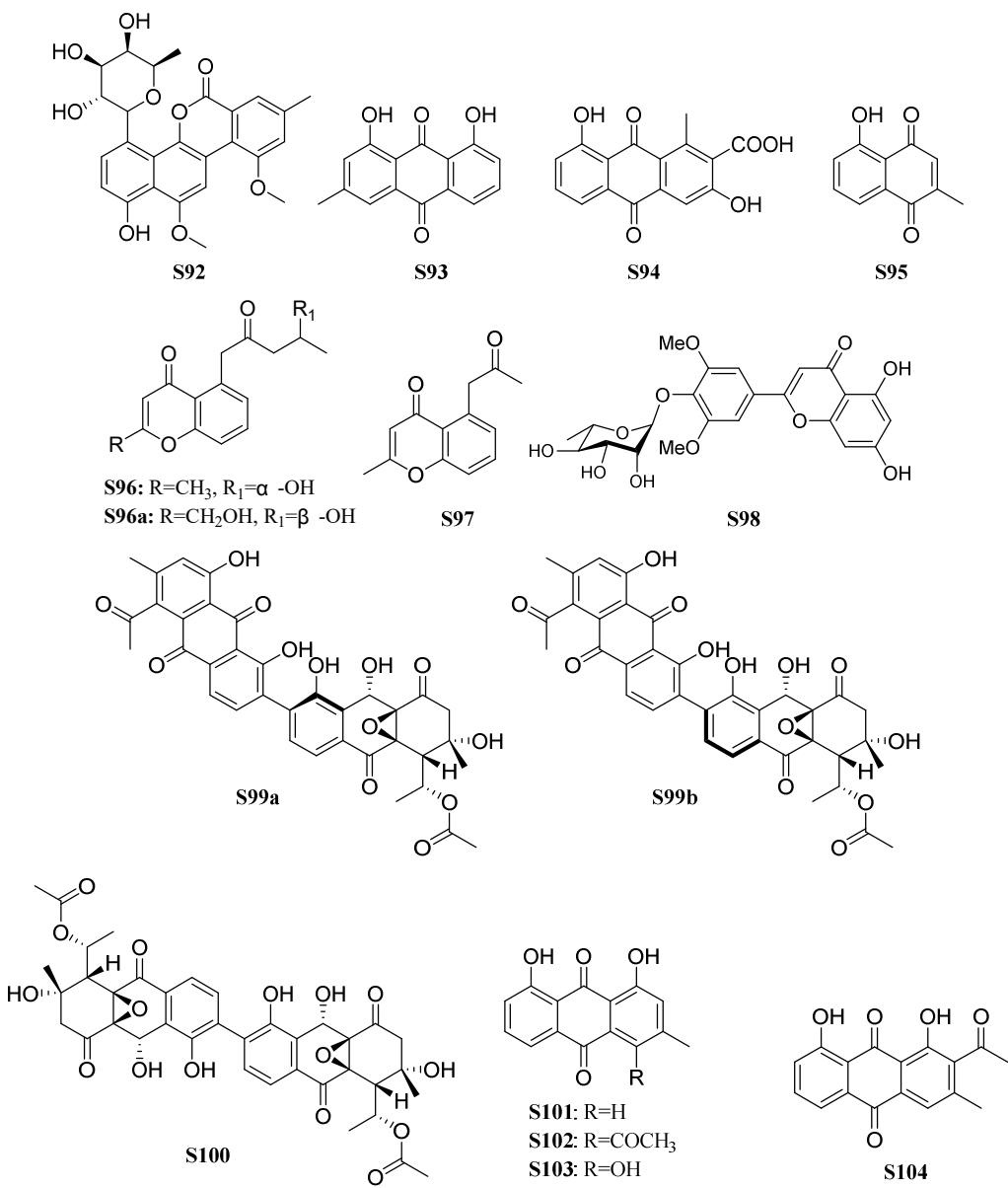
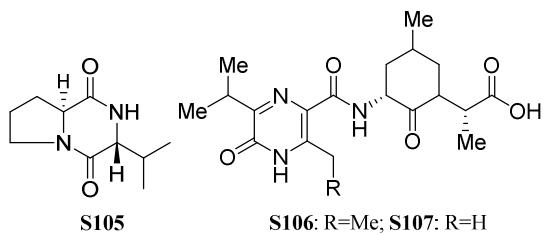


Figure S8. Polyketides derived from the actinomycetes associated with other marine animals.



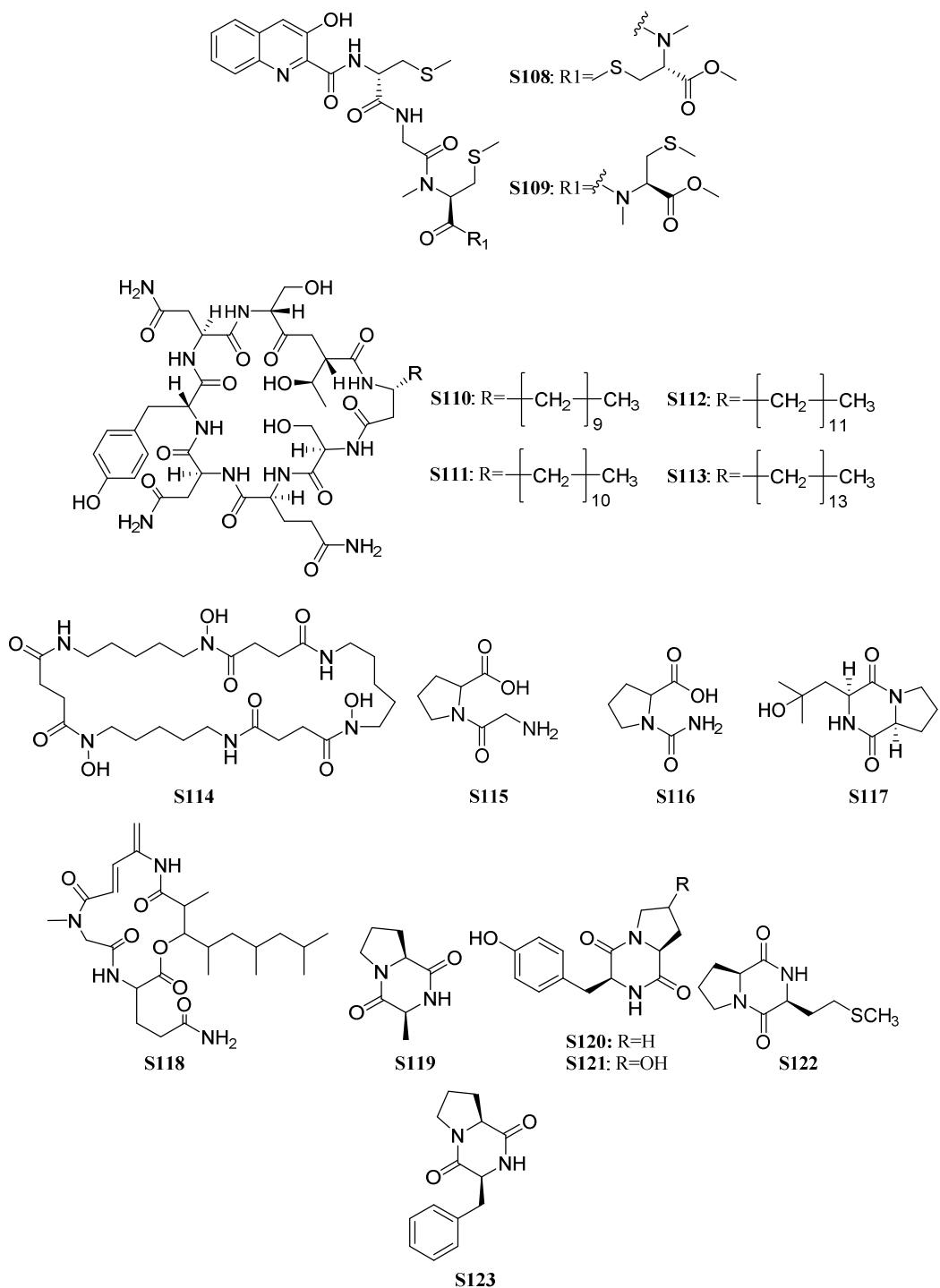
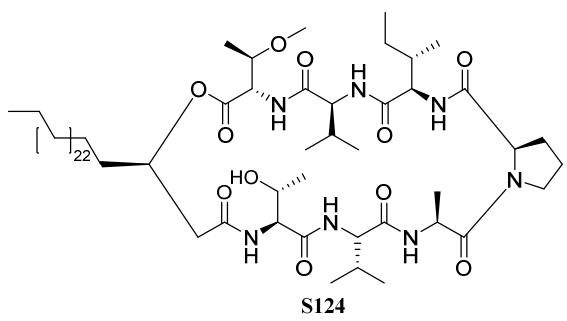
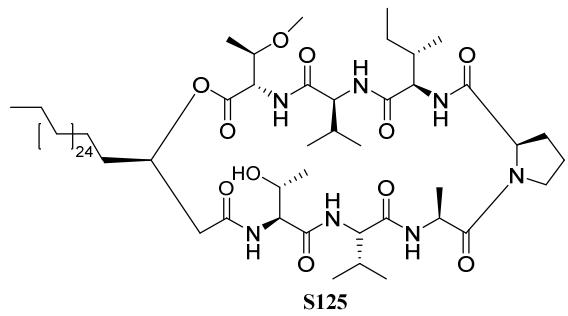


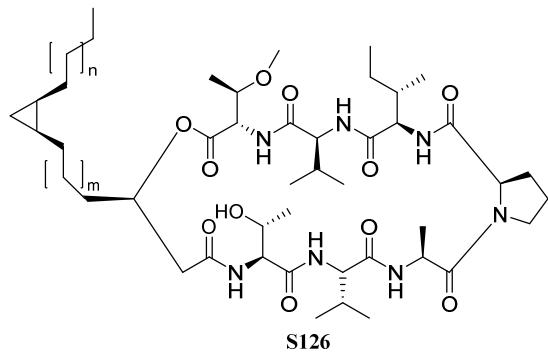
Figure S9. Peptides derived from the sponge-associated actinomycetes.



S124

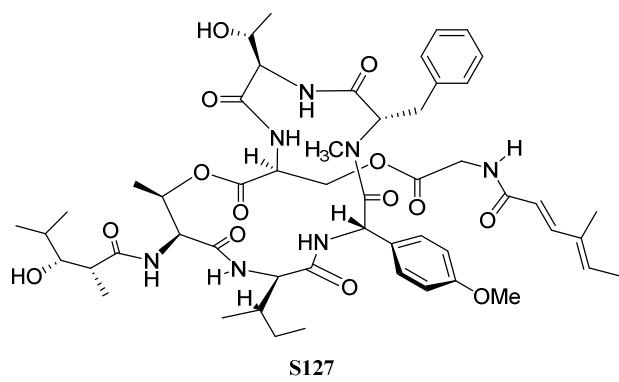


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Figure S10. Peptides derived from the coral-associated actinomycetes.



S127

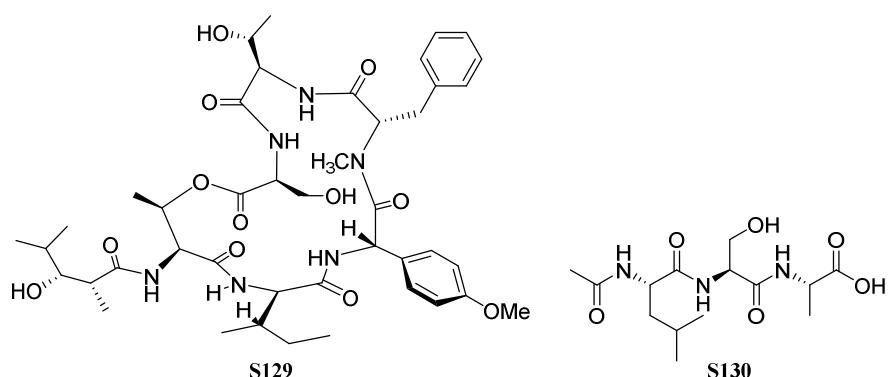
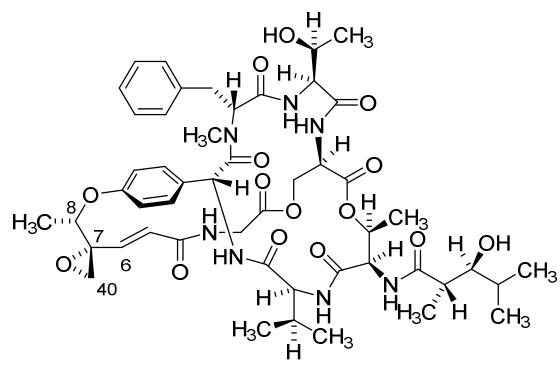


Figure S11. Peptides derived from the actinomycetes associated with other marine animals.

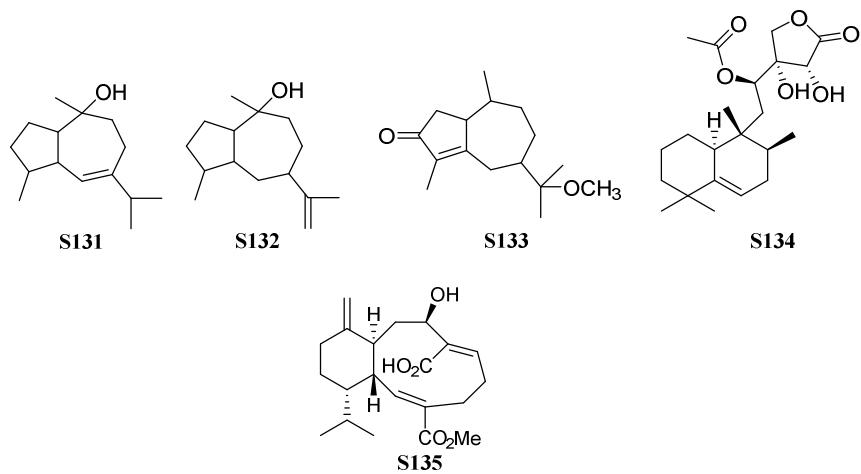


Figure S12. Terpenoids derived from the actinomycetes associated with marine animals.

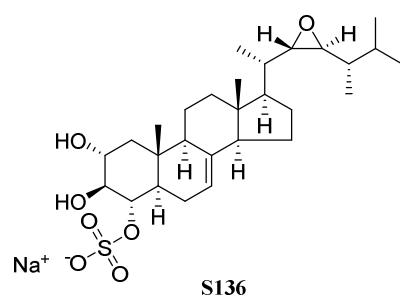
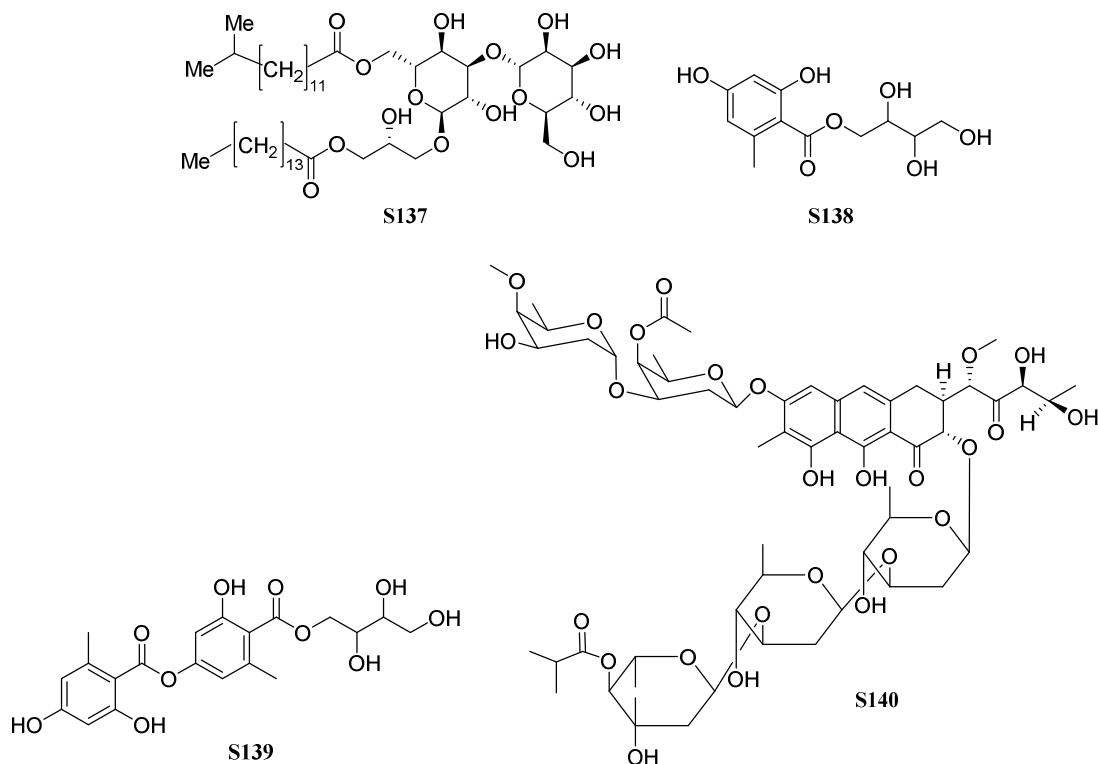
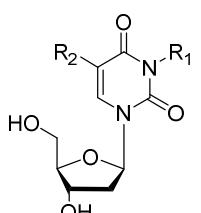
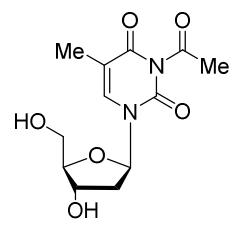
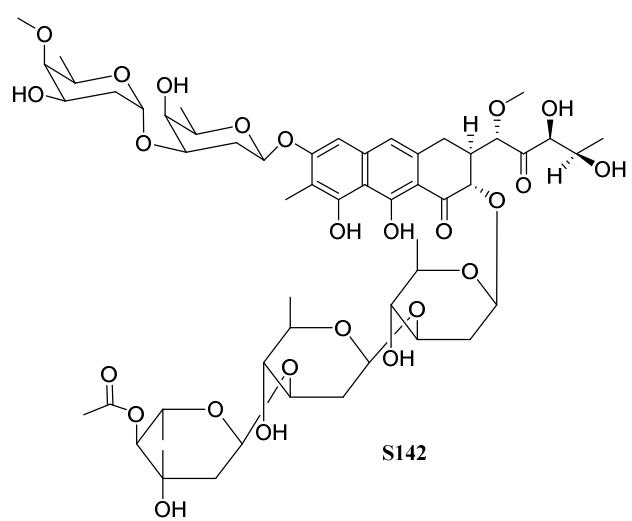
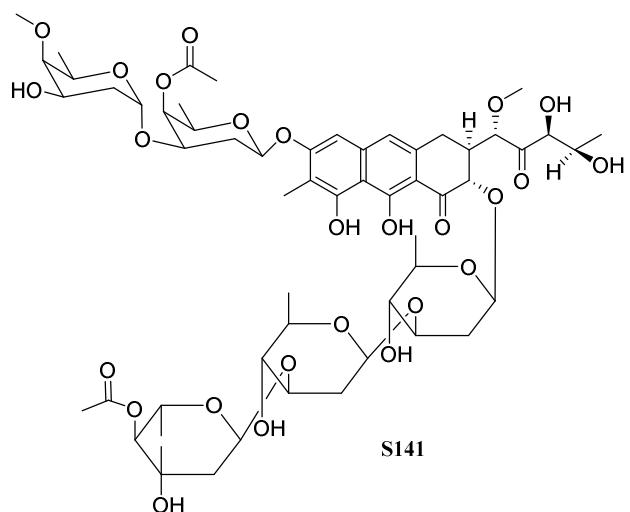
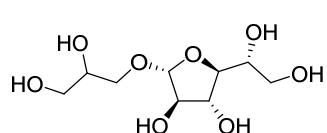
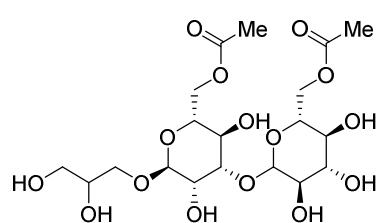
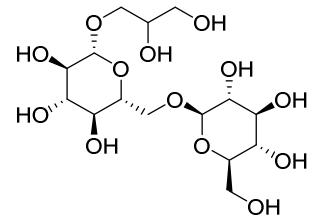
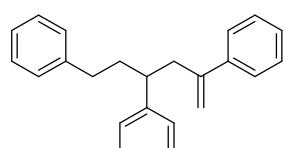


Figure S13. Steroids derived from the actinomycetes associated with marine animals.





S145: $R_1=Me, R_2=H$



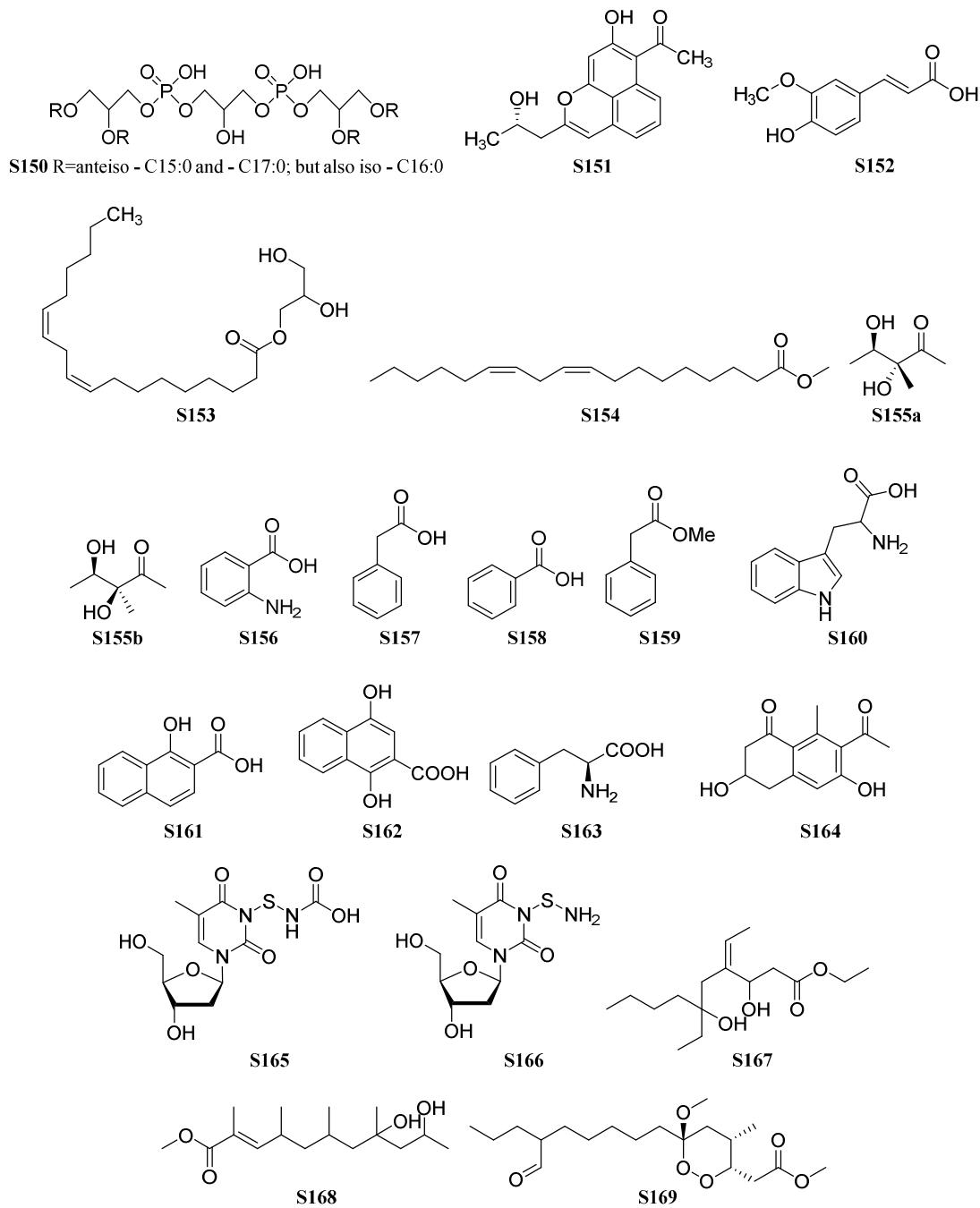
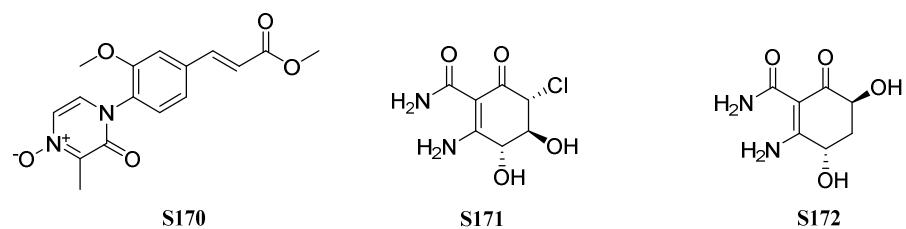


Figure S14. Other classes metabolites derived from the actinomycetes associated with marine animals.



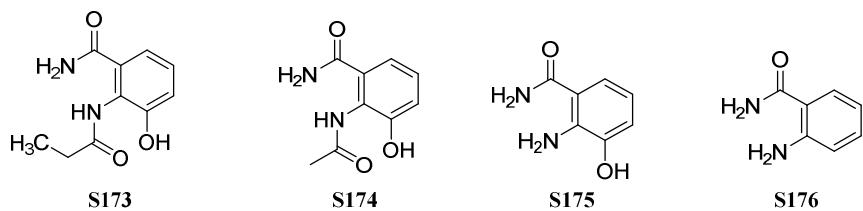


Figure S15. Alkaloids derived from the green algae-associated actinomycetes.

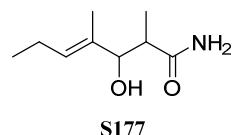


Figure S16. Alkaloids derived from the lichen-associated actinomycetes.

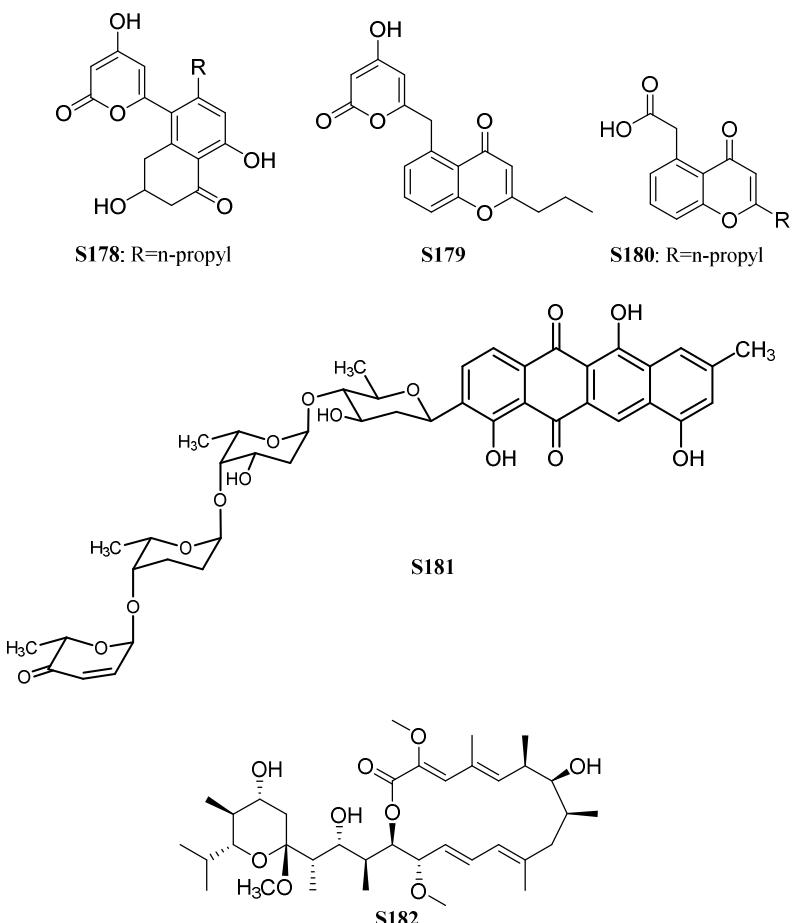


Figure S17. Polyketides derived from the brown algae-associated actinomycetes.

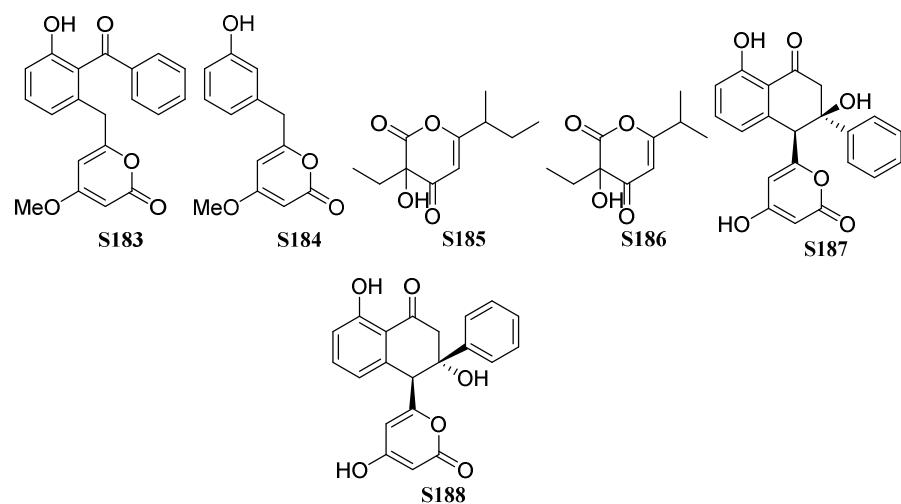


Figure S18. Polyketides derived from the red algae-associated actinomycetes.

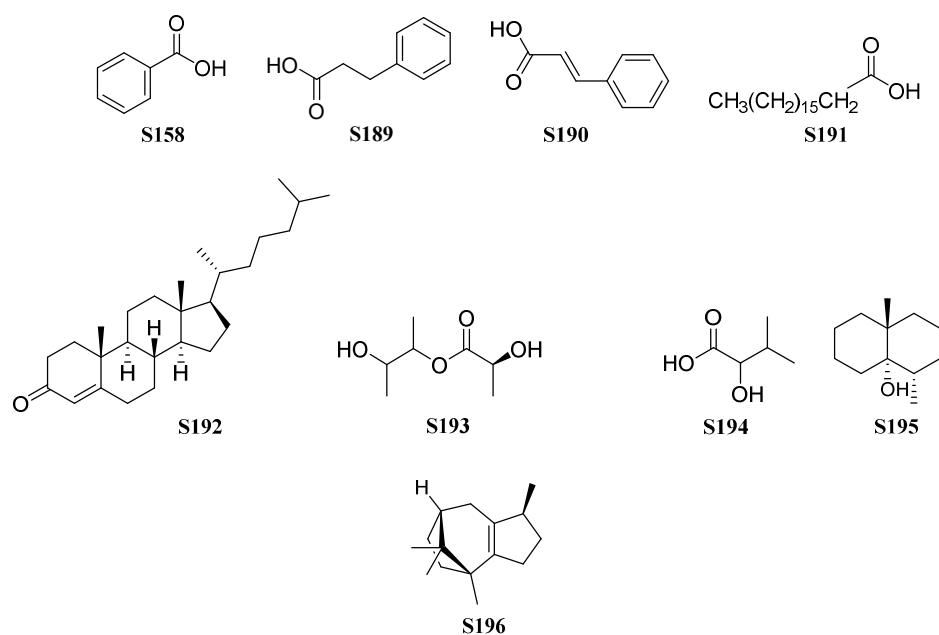


Figure S19. Other classes metabolites derived from the actinomycetes associated with marine plants, macroalgae and lichens.

2 Data analysis

The data were counted according to the corresponding information in the references

(Tables S2-S6). And these tables were done by using Microsoft Office Excel 2007 and Microsoft Office Word 2007.

2.1 Data analysis of **Figure 1**.

Eighty-four available product-producing actinomycetes 16S rRNA sequences were obtained from the NCBI GenBank database in September 2021 (**Table S1**). 16S rRNA sequences were aligned by MEGA 7 software with the command of “Align by ClustalW”. The phylogenetic tree was visualized using the neighbor-joining method with the Bootstrap setting as 10,000 replicates. Bar, 0.020 substitutions per nucleotide position (**Figure S20**). The original tree was saved as Newick format and imported into Interactive Tree Of Life web server (<https://itol.embl.de/>) for beautification (**Figure 1**).

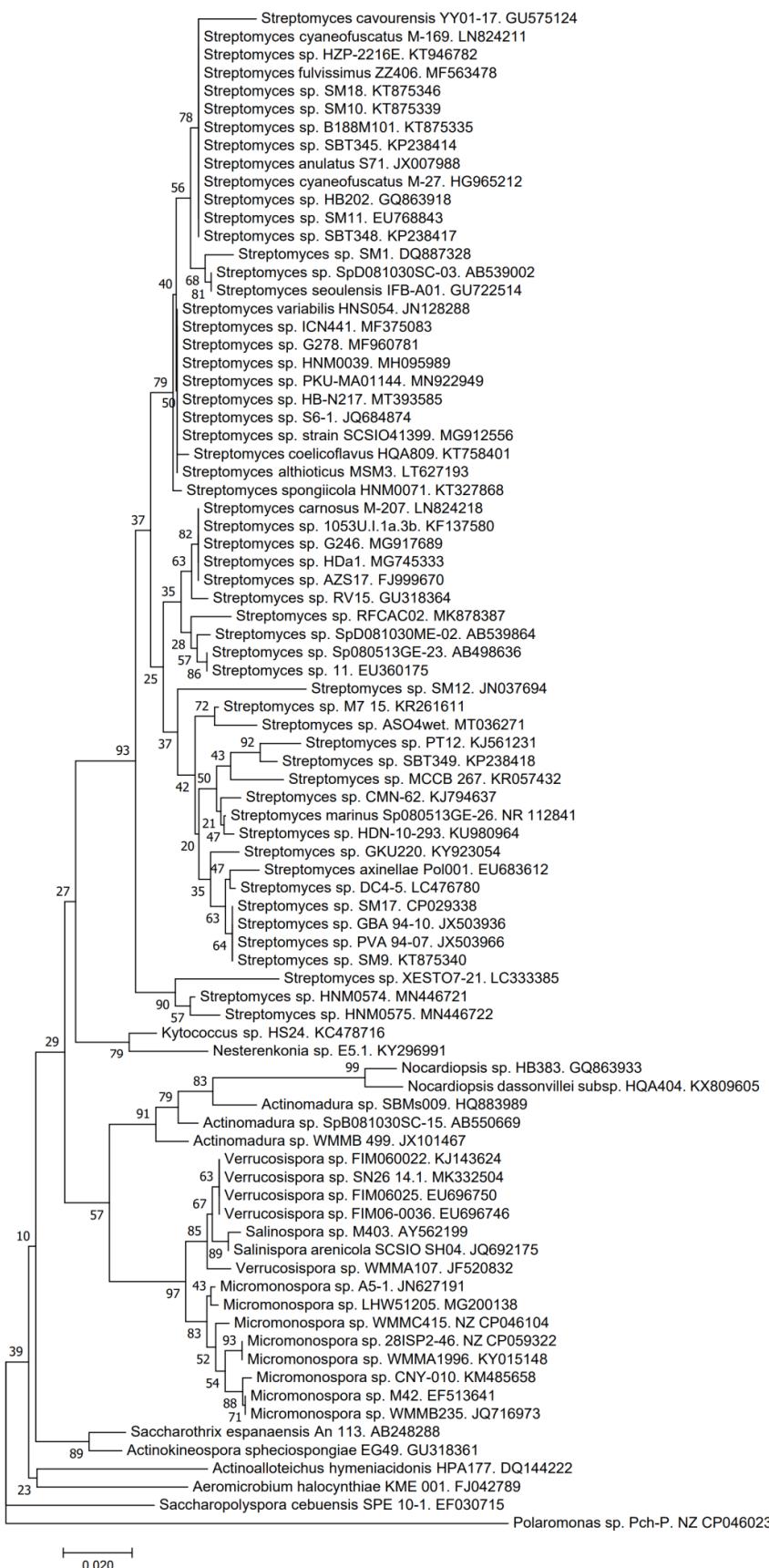


Figure S20. Original Neighbor-Joining phylogenetic tree of natural product-producing actinomycetes associated to various marine hosts.

Table S1. The actinomycetes and their accession number of **Figure 1**.

Actinomycetes	NCBI GenBank accession number
<i>Streptomyces cavourensis</i> YY01-17	GU575124
<i>Streptomyces cyaneofuscatus</i> M-169.	LN824211
<i>Streptomyces</i> sp. HZP-2216E	KT946782
<i>Streptomyces fulvissimus</i> ZZ406	MF563478
<i>Streptomyces</i> sp. SM18	KT875346
<i>Streptomyces</i> sp. SM10	KT875339
<i>Streptomyces</i> sp. B188M101	KT875335
<i>Streptomyces</i> sp. SBT345	KP238414
<i>Streptomyces anulatus</i> S71	JX007988
<i>Streptomyces cyaneofuscatus</i> M-27	HG965212
<i>Streptomyces</i> sp. HB202	GQ863918
<i>Streptomyces</i> sp. RFCAC02	MK878387
<i>Streptomyces</i> sp. SM11	EU768843
<i>Streptomyces</i> sp. HNM0574	MN446721
<i>Streptomyces</i> sp. SBT348	KP238417
<i>Streptomyces</i> sp. HNM0575	MN446722
<i>Streptomyces</i> sp. SpD081030SC-03	AB539002
<i>Streptomyces</i> sp. XESTO7-21	LC333385
<i>Streptomyces seoulensis</i> IFB-A01	GU722514
<i>Kytococcus</i> sp. HS24	KC478716
<i>Streptomyces</i> sp. 11	EU360175
<i>Streptomyces</i> sp. SM1	DQ887328
<i>Nesterenkonia</i> sp. E5.1	KY296991
<i>Streptomyces coelicoflavus</i> HQA809	KT758401
<i>Micromonospora</i> sp. M42	EF513641
<i>Streptomyces althioticus</i> MSM3	LT627193
<i>Micromonospora</i> sp. WMMB235	JQ716973
<i>Streptomyces</i> sp. strain SCSIO41399	MG912556
<i>Micromonospora</i> sp. CNY-010	KM485658
<i>Streptomyces</i> sp. S6-1	JQ684874
<i>Micromonospora</i> sp. 28ISP2-46	NZ CP059322
<i>Streptomyces</i> sp. HB-N217	MT393585
<i>Micromonospora</i> sp. WMMA1996	KY015148
<i>Streptomyces</i> sp. PKU-MA01144	MN922949
<i>Micromonospora</i> sp. WMMC415	NZ CP046104
<i>Streptomyces</i> sp. HNM0039	MH095989
<i>Micromonospora</i> sp. A5-1	JN627191
<i>Streptomyces</i> sp. G278	MF960781
<i>Micromonospora</i> sp. LHW51205	MG200138
<i>Streptomyces</i> sp. ICN441	MF375083
<i>Verrucosispora</i> sp. FIM060022	KJ143624
<i>Streptomyces variabilis</i> HNS054	JN128288

<i>Verrucosispora</i> sp. SN26 14.1	MK332504
<i>Streptomyces spongiicola</i> HNM0071	KT327868
<i>Verrucosispora</i> sp. FIM06025	EU696750
<i>Verrucosispora</i> sp. FIM06-0036	EU696746
<i>Streptomyces</i> sp. PVA 94-07	JX503966
<i>Streptomyces</i> sp. SM9	KT875340
<i>Salinospora</i> sp. M403	AY562199
<i>Streptomyces</i> sp. SpD081030ME-02	AB539864
<i>Streptomyces</i> sp. GBA 94-10	JX503936
<i>Salinispora arenicola</i> SCSIO SH04	JQ692175
<i>Streptomyces</i> sp. SM17	CP029338
<i>Verrucosispora</i> sp. WMMA107	JF520832
<i>Streptomyces axinellae</i> Pol001	EU683612
<i>Nocardiopsis</i> sp. HB383	GQ863933
<i>Streptomyces</i> sp. DC4-5	LC476780
<i>Nocardiopsis dassonvillei</i> subsp. HQA404	KX809605
<i>Streptomyces</i> sp. GKY220	KY923054
<i>Actinomadura</i> sp. SBMs009	HQ883989
<i>Streptomyces marinus</i> Sp080513GE-26	NR_112841
<i>Actinomadura</i> sp. SpB081030SC-15	AB550669
<i>Streptomyces</i> sp. HDN-10-293	KU980964
<i>Actinomadura</i> sp. WMMB 499	JX101467
<i>Streptomyces</i> sp. CMN-62	KJ794637
<i>Saccharothrix espanaensis</i> An 113	AB248288
<i>Streptomyces</i> sp. PT12	KJ561231
<i>Actinokineospora spheciospongiae</i> EG49	GU318361
<i>Streptomyces</i> sp. SBT349	KP238418
<i>Actinoalloteichus hymeniacidonis</i> HPA177	DQ144222
<i>Streptomyces</i> sp. MCCB 267	KR057432
<i>Aeromicrobium halocynthiae</i> KME 001	FJ042789
<i>Streptomyces</i> sp. M7 15	KR261611
<i>Saccharopolyspora cebuensis</i> SPE 10-1	EF030715
<i>Streptomyces</i> sp. ASO4wet	MT036271
<i>Polaromonas</i> sp. Pch-P	NZ CP046023
<i>Streptomyces</i> sp. SM12	JN037694
<i>Streptomyces carnosus</i> M-207	LN824218
<i>Streptomyces</i> sp. 1053U.I.1a.3b	KF137580
<i>Streptomyces</i> sp. G246	MG917689
<i>Streptomyces</i> sp. HDa1	MG745333
<i>Streptomyces</i> sp. AZS17	FJ999670
<i>Streptomyces</i> sp. RV15	GU318364
<i>Streptomyces</i> sp. Sp080513GE-23	AB498636

2.2 Data analysis of **Figure 21**.

The data of **Table S2** (actinomycetes with 8 genera correspond to 4 structure classes) provides the structural distribution of metabolites from actinomycetes divided by genera for **Figure 3**, which was drawn with analytical and graphic software OriginPro 2018C by the function of 3D Bars.

Table S2. The data of **Figure 21**.

Genera \ Structure classes	Alkaloids	Polyketides	Peptides	Other classes
<i>Streptomyces</i>	144	130	60	53
<i>Micromonospora</i>	18	8	4	3
<i>Nocardiopsis</i>	4	9	1	2
<i>Actinomadura</i>	2	5	0	5
<i>Saccharopolyspora</i>	5	6	0	0
<i>Salinispora</i>	6	0	0	0
<i>Micrococcus</i>	0	1	1	5
Other genera	32	28	19	19

2.3 Data analysis of **Figure 22**.

The data of **Table S3** (actinomycetes associated with 12 hosts correspond to 4 structure classes of 536 SMs) provides the structural distribution of metabolites from actinomycetes associated with various hosts for **Figure 22**, which was performed by R version 4.0.5 (R Foundation for Statistical Computing) using the function of geom_point() and geom_jitter() of package ggplot2.

Table S3. The data of **Figure 22**.

Hosts \ Structure classes	Alkaloids	Polyketides	Peptides	Other classes
Sponge	116	68	54	29
Ascidian	21	29	9	6
Coral	15	14	1	19
Sea cucumber	7	8	0	1
Sea anemone	1	7	2	1
Other invertebrates	33	27	14	13
Marine vertebrates	2	4	3	0
Brown algae	7	8	2	11
Cyanobacteria	0	3	0	0
Green algae	8	8	0	0
Red algae	0	10	0	3
Seagrass	1	1	0	4

2.4 Data analysis of **Figure 23**.

There are three types of nodes in **Table S4** -- Host, Genera, and Classes (4 structure classes of SMs from actinomycetes with 9 genera related to 9 hosts), with the Number of SMs as the flow. These data provide the distribution of secondary metabolites produced by actinomycetes with various genera derived from different hosts for **Figure 23** performed by using R version 4.0.5 using the function of `gather_set_data()` and `geom_parallel_sets()` of packages `ggforce` and `ggplot2`, respectively.

Table S4. The data of **Figure 23**.

Host	Genera	Classes	Number
Sponge	<i>Streptomyces</i>	Alkaloid	69
Sponge	<i>Streptomyces</i>	Polyketide	38
Sponge	<i>Streptomyces</i>	Peptide	41
Sponge	<i>Streptomyces</i>	Other classes	14
Sponge	<i>Micromonospora</i>	Alkaloid	15
Sponge	<i>Micromonospora</i>	Polyketide	1
Sponge	<i>Micromonospora</i>	Peptide	0
Sponge	<i>Micromonospora</i>	Other classes	0
Sponge	<i>Saccharopolyspora</i>	Alkaloid	4
Sponge	<i>Saccharopolyspora</i>	Polyketide	2
Sponge	<i>Saccharopolyspora</i>	Peptide	0
Sponge	<i>Saccharopolyspora</i>	Other classes	0
Sponge	<i>Nocardiopsis</i>	Alkaloid	0
Sponge	<i>Nocardiopsis</i>	Polyketide	9
Sponge	<i>Nocardiopsis</i>	Peptide	1
Sponge	<i>Nocardiopsis</i>	Other classes	0
Sponge	<i>Verrucosispora</i>	Alkaloid	4
Sponge	<i>Verrucosispora</i>	Polyketide	0
Sponge	<i>Verrucosispora</i>	Peptide	6
Sponge	<i>Verrucosispora</i>	Other classes	0
Sponge	<i>Actinokineospora</i>	Alkaloid	2
Sponge	<i>Actinokineospora</i>	Polyketide	13
Sponge	<i>Actinokineospora</i>	Peptide	1
Sponge	<i>Actinokineospora</i>	Other classes	0
Sponge	<i>Salinispora</i>	Alkaloid	3
Sponge	<i>Salinispora</i>	Polyketide	0
Sponge	<i>Salinispora</i>	Peptide	0
Sponge	<i>Salinispora</i>	Other classes	0
Sponge	<i>Actinomadura</i>	Alkaloid	0
Sponge	<i>Actinomadura</i>	Polyketide	0
Sponge	<i>Actinomadura</i>	Peptide	0
Sponge	<i>Actinomadura</i>	Other classes	4
Sponge	Other genera	Alkaloid	25

Sponge	Other genera	Polyketide	5
Sponge	Other genera	Peptide	4
Sponge	Other genera	Other classes	11
Ascidian	<i>Streptomyces</i>	Alkaloid	12
Ascidian	<i>Streptomyces</i>	Polyketide	19
Ascidian	<i>Streptomyces</i>	Peptide	4
Ascidian	<i>Streptomyces</i>	Other classes	0
Ascidian	<i>Micromonospora</i>	Alkaloid	1
Ascidian	<i>Micromonospora</i>	Polyketide	4
Ascidian	<i>Micromonospora</i>	Peptide	0
Ascidian	<i>Micromonospora</i>	Other classes	2
Ascidian	<i>Actinomadura</i>	Alkaloid	2
Ascidian	<i>Actinomadura</i>	Polyketide	5
Ascidian	<i>Actinomadura</i>	Peptide	0
Ascidian	<i>Actinomadura</i>	Other classes	1
Ascidian	<i>Salinisporea</i>	Alkaloid	3
Ascidian	<i>Salinisporea</i>	Polyketide	0
Ascidian	<i>Salinisporea</i>	Peptide	0
Ascidian	<i>Salinisporea</i>	Other classes	0
Ascidian	<i>Nocardiopsis</i>	Alkaloid	2
Ascidian	<i>Nocardiopsis</i>	Polyketide	0
Ascidian	<i>Nocardiopsis</i>	Peptide	0
Ascidian	<i>Nocardiopsis</i>	Other classes	0
Ascidian	Other genera	Alkaloid	1
Ascidian	Other genera	Polyketide	1
Ascidian	Other genera	Peptide	5
Ascidian	Other genera	Other classes	3
Coral	<i>Streptomyces</i>	Alkaloid	12
Coral	<i>Streptomyces</i>	Polyketide	13
Coral	<i>Streptomyces</i>	Peptide	0
Coral	<i>Streptomyces</i>	Other classes	16
Coral	<i>Micromonospora</i>	Alkaloid	0
Coral	<i>Micromonospora</i>	Polyketide	1
Coral	<i>Micromonospora</i>	Peptide	1
Coral	<i>Micromonospora</i>	Other classes	0
Coral	Other genera	Alkaloid	3
Coral	Other genera	Polyketide	0
Coral	Other genera	Peptide	0
Coral	Other genera	Other classes	3
Other invertebrates	<i>Streptomyces</i>	Alkaloid	37
Other invertebrates	<i>Streptomyces</i>	Polyketide	28
Other invertebrates	<i>Streptomyces</i>	Peptide	10
Other invertebrates	<i>Streptomyces</i>	Other classes	9
Other invertebrates	<i>Micromonospora</i>	Alkaloid	2

Other invertebrates	<i>Micromonospora</i>	Polyketide	0
Other invertebrates	<i>Micromonospora</i>	Peptide	3
Other invertebrates	<i>Micromonospora</i>	Other classes	1
Other invertebrates	<i>Saccharopolyspora</i>	Alkaloid	1
Other invertebrates	<i>Saccharopolyspora</i>	Polyketide	4
Other invertebrates	<i>Saccharopolyspora</i>	Peptide	0
Other invertebrates	<i>Saccharopolyspora</i>	Other classes	0
Other invertebrates	Other genera	Alkaloid	1
Other invertebrates	Other genera	Polyketide	10
Other invertebrates	Other genera	Peptide	3
Other invertebrates	Other genera	Other classes	6
Marine vertebrates	<i>Streptomyces</i>	Alkaloid	0
Marine vertebrates	<i>Streptomyces</i>	Polyketide	4
Marine vertebrates	<i>Streptomyces</i>	Peptide	3
Marine vertebrates	<i>Streptomyces</i>	Other classes	0
Marine vertebrates	<i>Nocardiopsis</i>	Alkaloid	1
Marine vertebrates	<i>Nocardiopsis</i>	Polyketide	0
Marine vertebrates	<i>Nocardiopsis</i>	Peptide	0
Marine vertebrates	<i>Nocardiopsis</i>	Other classes	0
Marine vertebrates	<i>Micromonospora</i>	Alkaloid	0
Marine vertebrates	<i>Micromonospora</i>	Polyketide	1
Marine vertebrates	<i>Micromonospora</i>	Peptide	0
Marine vertebrates	<i>Micromonospora</i>	Other classes	0
Brown algae	<i>Streptomyces</i>	Alkaloid	4
Brown algae	<i>Streptomyces</i>	Polyketide	7
Brown algae	<i>Streptomyces</i>	Peptide	2
Brown algae	<i>Streptomyces</i>	Other classes	8
Brown algae	<i>Nocardiopsis</i>	Alkaloid	1
Brown algae	<i>Nocardiopsis</i>	Polyketide	0
Brown algae	<i>Nocardiopsis</i>	Peptide	0
Brown algae	<i>Nocardiopsis</i>	Other classes	2
Brown algae	<i>Micromonospora</i>	Alkaloid	0
Brown algae	<i>Micromonospora</i>	Polyketide	1
Brown algae	<i>Micromonospora</i>	Peptide	0
Brown algae	<i>Micromonospora</i>	Other classes	0
Brown algae	Other genera	Alkaloid	2
Brown algae	Other genera	Polyketide	0
Brown algae	Other genera	Peptide	0
Brown algae	Other genera	Other classes	1
Green algae	<i>Streptomyces</i>	Alkaloid	8
Green algae	<i>Streptomyces</i>	Polyketide	8
Green algae	<i>Streptomyces</i>	Peptide	0
Green algae	<i>Streptomyces</i>	Other classes	0
Red algae	<i>Streptomyces</i>	Alkaloid	0

Red algae	<i>Streptomyces</i>	Polyketide	10
Red algae	<i>Streptomyces</i>	Peptide	0
Red algae	<i>Streptomyces</i>	Other classes	3
Other plants	<i>Streptomyces</i>	Alkaloid	1
Other plants	<i>Streptomyces</i>	Polyketide	4
Other plants	<i>Streptomyces</i>	Peptide	0
Other plants	<i>Streptomyces</i>	Other classes	4

2.5 Data analysis of Figure 24.

The data of **Table S5** provides the structural distribution of metabolites from three dominant genera in the main hosts -- sponge and ascidian for **Figure 24**, which was drawn with the Column function of OriginPro 2018C.

Table S5. The data of **Figure 24**.

Host-Genera-Classes	Number of natural products
Sponge - <i>Streptomyces</i> - alkaloid	69
Sponge - <i>Streptomyces</i> - polyketide	38
Ascidian - <i>Streptomyces</i> - alkaloid	12
Ascidian - <i>Streptomyces</i> - polyketide	19
Sponge - <i>Micromonospora</i> - alkaloid	15
Sponge - <i>Micromonospora</i> - polyketide	1
Ascidian - <i>Micromonospora</i> - alkaloid	1
Ascidian - <i>Micromonospora</i> - polyketide	4
Sponge - <i>Saccharopolyspora</i> - alkaloid	4
Sponge - <i>Saccharopolyspora</i> - polyketide	2
Ascidian - <i>Actinomadura</i> - alkaloid	2
Ascidian - <i>Actinomadura</i> - polyketide	5

2.6 Data analysis of Figure 25.

The data of **Table S6** (11 bioactivities correspond to 4 structure classes) provides the diverse distribution of biological activity with different structures for **Figure 25** drawn by the 3D Bars function of OriginPro 2018C software.

Table S6. The data of **Figure 25**.

Structure classes Bioactivities	Alkaloids	Polyketides	Peptides	Other classes
antibacterial	87	69	29	20
anticancer	69	54	28	6
enzyme inhibitory	23	6	9	3
antiparasite	10	12	3	2
antioxidant	3	6	2	2
antichlamydia	5	0	0	0
antiviral	3	0	0	0

antiinflammatory	4	0	2	3
antifouling	1	0	3	4
antiradiation	0	2	0	0
other activies	4	18	0	9

3. Table S7. The summary of all secondary metabolites including information on separation sources, structural types, and biological activities.

Host	Actinomycetes	Metabolites	Classes	Activities	Ref
Sponge		4'-N-methyl-5'-hydroxystaurosporine (1)	alkaloid	cytotoxic activities	9, 10
<i>Micromonospora sp.</i>	L-31-CLCO-002	5' -hydroxystaurosporine (2)	alkaloid	cytotoxic activities	
		Staurosporine (3)	alkaloid	cytotoxic activities	
<i>Saccharopolyspora sp.</i>		Metacycloprodigiosin (4)	alkaloid	cytotoxic activities	13
		Undecylprodigiosin (5)	alkaloid	cytotoxic activities	
<i>Micromonospora sp.</i>	M42	Manzamine A (6)	alkaloid	antibacterial, antiviral activity	9
		8-hydroxy manzamine (7)	alkaloid	antibacterial, antiviral activity	
<i>Salinispora sp.</i>	M403	Rifamycin B (8)	alkaloid	antibacterial activity	9, 14
		Rifamycin SV (9)	alkaloid	antibacterial activity	
<i>Streptomyces sp.</i>	Ni-80	Urauchimycin A (10)	alkaloid	antifungal activity	9, 17
		Urauchimycin B (11)	alkaloid	antifungal activity	
<i>Streptomyces sp.</i>	HB202	Streptophenazines A,C-H (12, 14-19)	alkaloid	antibacterial activity	18, 19
		Streptophenazines B(13)	alkaloid	antibacterial activity and cytotoxicity	
<i>Saccharopolyspora cebuensis</i>	SPE 10-1	Cebulactams A1 and A2 (S1, S2)	alkaloid	unknown	9, 20
<i>Streptomyces sp.</i>	11	Staurosporine (3)	alkaloid	anti-parasitic activity and cytotoxicity	9, 21
<i>Streptomyces sp.</i>	Sp080513GE-26	5-iminoaranciamycin (S3)	alkaloid	unknown	9, 22
		Tetracenoquinocin (127)	polyketide	cytotoxicity	
		Aranciamycin (128)	polyketide	cytotoxicity	
		SM 173B (129)	polyketide	antibiotic	
<i>Streptomyces sp.</i>	SpC080624SC-11	JBIR 46–48 (20-22)	alkaloid	cytotoxic activity	9, 23, 24
<i>Brevibacterium sp.</i>	KMD 003	6-hydroxymethyl-1-phenazine-carboxamide (23); 1,6-phenazinedimethanol (24)	alkaloid	antibacterial activities	9

<i>Streptomyces</i> sp.	SpD081030ME-02	JBIR-58 (25)	alkaloid	cytotoxic activity	9, 25
<i>Streptomyces</i> sp.	DA22	Streptomycindole (S4) N-phenylacetyl-L-tryptophan (S5)	alkaloid alkaloid	unknown unknown	26
<i>Streptomyces carnosus</i>	AZS17	Lobophorins C and D (26, 27)	alkaloid	cytotoxic activity	27
<i>Micromonospora</i> sp.	RV115	Diazepinomicin (28)	alkaloid	cytotoxic activity, antiparasitic activity, antioxidant activity and enzyme inhibitory activity	9, 28
<i>Streptomyces</i> sp.	CMS JV M18_3	WS-9659 A (29) Chloro-Dihydroquinone 1-4 (136-139) Naphthomevalin 1 (SF2415B1) (140) SF2415B3 (141)	alkaloid polyketide polyketide polyketide	enzyme inhibitory activity antibacterial activity and cytotoxic activity antimicrobial activities anti-biofilm activity	3, 29
<i>Nocardiopsis</i> sp.	KMF-002	Nocatriones A and B (142, 143)	polyketide	anti-radiation activity	99
<i>Streptomyces tateyamensis</i>	NBRC 105047	JBIR-107 (S8)	alkaloid	unknown	31
<i>Streptomyces</i> sp.	RM72	JBIR 109 -111 (30-32) Trichostatin A (S6), Trichostatic acid (S7)	alkaloid alkaloid	enzyme inhibitory activity unknown	9, 30
<i>Streptomyces anulatus</i>	S71	2-hydroxy-1-(1H-indol-3-yl)ethan-1-one (S9); 3-hydroxy-4-(2-(2-hydroxy-3,5-dimethylphenyl)-2-oxoethyl)piperidine-2,6-dione (S10); 4-(2-(2-hydroxy-3-(hydroxymethyl)-5-methylphenyl)-2-oxoethyl)piperidine-2,6-dione (S11) 4-(2-(2-hydroxy-5-(hydroxymethyl)-3-methylphenyl)-2-oxoethyl)piperidine-2,6-dione (33)	alkaloid	unknown	32

<i>Salinispora</i> sp.	FS-0034	Rifamycin W (34)	alkaloid	antibacterial activity	33
		Frigocyclinone (35)	alkaloid	cytotoxic activity	34
<i>Streptomyces</i> sp.	M7_15	Monacyclinones A–F (36–41)	alkaloid	cytotoxic activity and antibacterial activity	
		Dimethyldehydrorabelomycin (S72)	polyketide	unknown	
				antibacterial, anti-mycoplasma, anti-chlamydia, and anti-parasite activities	35
<i>Streptomyces</i> sp.	RV15	SF2446 A2 (42)	alkaloid		
		Cyclodysidins A–D (S110–S113)	peptides	unknown	
		Tirandamycin A (43)	alkaloid	enzyme inhibitory activity and antibacterial activity	36
		Tirandamycin B (44)	alkaloid	enzyme inhibitory activity and antiparasite activity	
<i>Streptomyces</i> sp.	LS298	Staurosporine (3)	alkaloid	antifungal activity, protein kinase C inhibitory activity, and cytotoxic activity	
		Quinomycin G (242)	peptides	antibacterial activities and anti-tumor activities	
		Cyclo-(L-Pro-4-OH-L-Leu) (S117)	peptides	unknown	
		Strepoxazine A (45)	alkaloid	cytotoxic activity	40, 41
<i>Streptomyces</i> sp.	SBT345	Ageloline A (46)	alkaloid	antioxidant activity and anti-chlamydia activity	
		Phencomycin (47), Tubermycin B (48)	alkaloid	antibacterial activity	
<i>Streptomyces albus</i>	PVA94-07	Deferoxamine analogues (S12–S14)	alkaloid	unknown	42
		Deferoxamine analogue (49)	alkaloid	antibacterial activity	

		Rhodozepinone (50)	alkaloid	antibacterial, antitrypanosomal and antiparasite activities	43
<i>Rhodococcus sp.</i>	UA13	2-amino-3-[2(1H)-quinolinon-4-yl]propionic acid (S15), indole-3-acetic acid (S16)	alkaloid	unknown	
		3-hydroxy-2-methyl-4H-pyran-4-one (maltool) (S74)	polyketide	unknown	
		Henyl acetic acid methyl ester (S159), Tryptophan (S160)	Others	unknown	
		Dimeric indole derivatives (51-53)	alkaloid	antichlamydia activity	44
<i>Streptomyces sp.</i>	SBT348	2,3-dihydroxybenzamide (54)	alkaloid	cytotoxicity	45
		3-hydroxy-2-methyl-4H-pyran-4-one (maltool) (S74)	polyketide	unknown	
		Petrocidin A (243)	peptides	cytotoxicity	
<i>Streptomyces sp.</i>	CMN-62	Anthranosides A and B (S17, S18)	alkaloid	unknown	46
		Anthranoside C (55)	alkaloid	anti-influenza H1N1 activity	
<i>Saccharomonospora sp.</i>	UR22	Saccharomonosporine A (56); (S)-6-bromo-3-hydroxy-3-(1H-indol-3-yl)indolin-2-one (57)	alkaloid	enzyme inhibitory activity and cytotoxic activity	47
		convolutamydine F (S19); 3,3'-(ethane-1,1-diyl)bis(1H-indole) (S20);			
		1H-indole-3-carbaldehyde (S21); (Z)-2-hydroxy-3-(1H-indol-3-yl)acrylic acid (S22); 3-methyl-1H-indole (S23)	alkaloid	unknown	
		2-(1H-indol-3-yl)ethan-1-ol (58)	alkaloid	antimicrobial activities	
		Compound S75	polyketide	unknown	
		1-hydroxy-2-naphthoic acid (S161);	others	unknown	

		1,4-dihydroxy-2-naphthoic acid (S162)			
<i>Micromonospora carbonacea</i>	LS276	Tetrocarcin Q (59), AC6H (61), Tetrocarcin N (62), Tetrocarcin H (63)	alkaloid	antibacterial activity	48
		Tetrocarcin A (60), Arisostatin A (64)	alkaloid	antibacterial activity and antitumor activity	
		Tetrocarcin F1 (S24)	alkaloid	unknown	
<i>Streptomyces tirandamycinicus sp. nov.</i>	HNM0039T	Tirandamycins A and B (43, 44)	alkaloid	antibacterial activity	49
<i>Verrucosispora sp.</i>	FIM06-0036	2-ethylhexyl-1H-imidazole-4-carboxylate (65)	alkaloid	antimicrobial activities	50
		1H-imidazole-4-carboxylate (S25)	alkaloid	unknown	
<i>Verrucosispora sp.</i>	FIM06025	(2-(hydroxymethyl)-3-methylaziridin-1-yl)(2-hydroxyphenyl)methanone (66)	alkaloid	antimicrobial activity	51
		2-(1-hydroxyethyl)-3,4-dihydrobenzo[f][1,4]oxazepin-5(2H)-one (S26)	alkaloid	unknown	
		Fridamycins I (S27)	alkaloid	unknown	52
<i>Actinokineospora spheciospongiae sp. nov.</i>		Fridamycin H (154)	polyketide	antiparasite activity	
		Actinosporins C, D (144, 145)	polyketide	antioxidant activity	
		Actinosporin G (155)	polyketide	unknown	
<i>Streptomyces zhaozhouensis subsp. mycale. subsp. nov.</i>	MCCB267	Ikarugamycin (67), Clifednamide A (68), 30-oxo-28- N-methylikarugamycin (69), 28-N-methylikarugamycin (70)	alkaloid	cytotoxic activity	53
<i>Streptomyces rochei</i>	MB037	Borreliidine J and K (71, 72)	alkaloid	antibacterial activity	54
		Borrelidin (S28), Borrelidin F (S29)	alkaloid	unknown	

		7-methoxy-2,3-dimethylchromone-4-one (S76)	polyketide	unknown	
<i>Streptomyces sp.</i>	G248	9H-pyrido[3,4-b]indole (S30), 9H-purin-6-amine (S31) (2S,2"S)-6-lavandulyl-7,4'-dimethoxy-5,2'-dihydroxylflavanone (158); (2S,2"S)-6-lavandulyl-5,7,2',4'-tetrahydroxylflavanone (159); (2"S)-5'-lavandulyl-2'-methoxy-2,4,4',6'-tetrahydroxylchalcone (160) (2S,2"S)-6-lavandulyl-7-methoxy-5,2',4'-trihydroxylflavanone (161); 6-prenyl-4'-methoxy-5,7-dihydroxylflavanone (162) Cyclo (L-Pro-L-Leu) (246) Cyclo(L-Pro-L-Tyr) (S120); Cyclo(L-Pro-L-Phe) (S123)	alkaloid polyketide peptide peptide	unknown antimicrobial activity cytotoxic activity unknown	55
<i>Streptomyces sp.</i>	G246	9H-pyrido[3,4-b]indole (S30), indole-3-acetic acid (S16) (S)-2-(2,4-dihydroxyphenyl)-5-hydroxy-7-methoxy-6-((S)-5-methyl-2-(prop-1-en-2-yl)hex-4-en-1-yl)chroman-4-one (156), (S,E)-1-(2,6-dihydroxy-4-methoxy-3-(5-methyl-2-(prop-1-en-2-yl)hex-4-en-1-yl)phenyl)-3-(2,4-dihydroxyphenyl)prop-2-en-1-one (157) (3S,8aS)-3-methylhexahydrodipyrrolo[1,2-a]pyrazine-1,4-dione (S119), Cyclo(L-Pro-L-Tyr)	alkaloid polyketide peptide	unknown antimicrobial activity unknown	56

		(S120), (3S,8aS)-7-hydroxy-3-(4-hydroxybenzyl)hexahydropyrrolo[1,2-a]pyrazine-1,4-dione (S121), (3S,8aS)-3-(2-(methylthio)ethyl)hexahydropyrrolo[1,2-a]pyrazine-1,4-dione (S122)			
		L-tryptophan (S160), L-phenylalanine (S163)	others	unknown	
<i>Micromonospora ferruginea</i> sp.	28ISP2-46 ^T	Quinocycline B (kosinostatin) (73) Isoquinocycline B (74)	alkaloid alkaloid	antibiotic activity, enzyme inhibitory activity antibiotic activity, enzyme inhibitory activity and cytotoxicity	57
<i>Micromonospora</i> sp.	L-25-ES25-008	IB-96212 (124)	polyketide	cytotoxic activity	9, 90
<i>Saccharopolyspora taberi</i>	PEM-06-F23-019B	PM070747 (125), PD116740 (126)	polyketide	antitumor activity	91
<i>Nocardiopsis</i>	HB383	Nocapyrone A-D (S65-S68) (2E/5Z)-2-[(4-methoxyphenyl)methylene]-5-(2-methylpropylidene)-3,6-piperazinedione (231)	polyketide peptide	unknown cytotoxic activity	9, 92
<i>Streptomyces axinellae</i>	Pol001T	Tetromycin 1 (S69) Tetromycin 2 (S70), Tetromycin B (S71) Tetromycins 3 and 4 (130, 131)	alkaloid polyketide polyketide	unknown unknown enzyme inhibitory activity and antibacterial activity	9, 93
<i>Streptomycetes</i> sp.	BCC45596	Urdamycinone E (132), Urdamycinone G (133), Dehydroxyaquayamycin (134), Urdamycin E (135)	polyketide	antiparasite activity, antibacterial activity	94, 95
<i>Actinokineospora</i> sp.	EG49	Actinosporins A,B (146, 147) Actinosporins C,D (144, 145) UK-2B (75) Actinosporins E (163), G (155), and H (164) Actinosporins F (S77)	polyketide polyketide alkaloid polyketide polyketide	anti-trypanosomal antioxidant activity antifungal activity antimalarial activity unknown	59, 100, 101

		Tetrangulol (165)	polyketide	antimalarial activity	
<i>Micrococcus sp.</i>	EG45	Microluside A (148)	polyketide	antibacterial activity	102
<i>Streptomyces sp.</i>	HDN-10-293	Naquihexcin A (149), (-)-BE-52440A (150) Naquihexcin B (S73)	polyketide polyketide	cytotoxicity unknown	103
<i>Nocardiopsis sp.</i>	HB-J378	Nocardiopsisins A-C (151-153) (3R,8aS)-3-benzylhexahydropyrrolo[1,2-a]pyrazine-1,4-dione (227)	polyketide peptide	antibacterial activity antimicrobial activity	104 128
<i>Streptomyces sp.</i>	DA18	(3R,8aR)-3-benzylhexahydropyrrolo[1,2-a]pyrazine-1,4-dione (228) Cyclo (6-OH-D-Pro-L-Phe) (229) (3R,8aS)-3-isopropylhexahydropyrrolo[1,2-a]pyrazine-1,4-dione (S105)	peptide peptide peptide	antimicrobial activity, antifouling activity cytotoxic activity	
<i>Streptomyces sp.</i>	22	Valinomycin (230)	peptide	antiparasite activity and cytotoxic activity	9, 21
<i>Streptomyces sp.</i>	34	Valinomycin (230)	peptide	Antiparasite activity and cytotoxic activity	9, 21
<i>Streptomyces sp.</i>	NBRC 105896	JBIR-31 (232)	peptide	cytotoxic activity	9, 129
<i>Streptomyces sp.</i>	Sp080513GE-23	JBIR-34 (233) and JBIR-35 (234)	peptide	DPPH radical scavenging activity	130
<i>Streptomyces sp.</i>	SpD081030SC-03	JBIR-56 (S106) and JBIR-57 (S107) Thiocoraline (235), 22'-Deoxythiocoraline (236), Thiochondrilline C (237), 12'- -sulfoxythiocoraline (238)	peptide	unknown	9, 131 9, 132
<i>Verrucospora sp.</i>	WMMA107	Thiochondrilline A (S108)and B (S109)	peptide	cytotoxic activity	
<i>Streptomyces</i>	M1087	Nocardamine (S114) 1,12-Dihydroxy-1,6,12,17,23,28-hexaaazacycl otritriaccontane-2,5,13,16,24,27-hexone (239), 1,11,22-Trihydroxy-1,6,11,16,22,27-hexaazac yclodotriaccontane-2,5,12,15,23,26-hexone	peptide	enzyme inhibitory activity	134

(240)					
<i>Kocuria palustris.</i>	F-276,345	Kocurin (241)	peptide	antibacterial activity	136, 137
<i>Streptomyces sp.</i>	GKU 220	Rakicidin F (244) Rakicidin C (S118)	peptide peptide	antibacterial activity unknown	138
<i>Actinokineospora sphecospongiae</i>	DSM45935	Actinokineosin (245)	peptide	antibacterial activity	139
<i>Streptomyces sp.</i>	LHW52447	Actinomycins D1-D4, D (247-251)	peptide	antibacterial activity and cytotoxic activity	140
<i>Streptomyces sp</i>	Call-36	Actinozine A (252), Cyclo(2-OH-D-Pro-L-Leu) (253)	peptide	antibacterial activity	143
		Cyclo(D-Pro-L-Phe) (254)	peptide	cytotoxicity	
		Cyclo(L-Pro-L-Phe) (S123)	peptide	unknown	
		Thymidine-3-mercaptopcarbamic acid (S165) and thymidine-3-thioamine (S166)	nucleoside	unknown	
<i>Actinomadura sp.</i>	SpB081030SC-15	JBIR-65 (275)	terpenoid	protective activity of neuronal hybridoma N18-RE-105 cells from L-glutamate toxicity	9, 154
<i>Actinomadura sp.</i>	SBMs009	Bendigoles E,F (282, 283)	steroid	anti-inflammatory activity, anti-glucocorticoid receptor translocation activity	9, 159
		Bendigole D (281)	steroid	anti-inflammatory activity, anti-glucocorticoid receptor translocation activity and cytotoxicity	
		Lutoside (S137)	others	unknown	9, 160
<i>Micrococcus luteus</i>	R-1588-10	2,4,4'-trichloro-2'-hydroxydiphenylether (286)	others	antimicrobial activity	
<i>Streptomyces sp.</i>	T03	Butenolide (294)	others	antiparasite activity	9, 21
<i>Streptomyces microflavus</i>	HVG29	3-acetyl-1-((2R,4S,5R)-4-hydroxy-5-(hydroxymethyl)tetrahydrofuran-2-yl)-5-methylpyr	others	unknown	161

		imidine-2,4(1H,3H)-dione (S143); 1-((2R,4S,5R)-4-hydroxy-5-(hydroxymethyl) tetrahydrofuran-2-yl)-3,5-dimethylpyrimidi ne-2,4(1H,3H)-dione (S144); 1-((2R,4S,5R)-4-hydroxy-5-(hydroxymethyl) tetrahydrofuran-2-yl)-3-methylpyrimidine- 2,4(1H,3H)-dione (S145)			
<i>Streptomyces</i> sp	NIO 10068	Proline-glycine (S115); N-amido- α - proline (S116)	dipeptide	unknown	135
		Cinnamic acid (296)	aromatic acid	QS antagonist activity, bactericidal activity	
<i>Microbacterium</i> sp.	HP2	1,2-O-diacyl-3-[β -glucopyranosyl-(1- 6)- β -glucopyranosyl]-glycerol (S147); 1-O-acyl-3-[6-O-acetyl- α -glucopyranosyl-(1- 3)-(6-O-acyl- α -mannopyranosyl)]glycerol (S148); 1,2-O-diacyl-3-[β -galactofuranosyl]glycerol (S149); Diphosphatidylglycerol (S150)	others	unknown	9, 163
		1-O-acyl-3-[α -glucopyranosyl-(1- 3)-(6-O-acyl- α -mannopyranosyl)]glycerol,di phosphatidylglycerol (299)	others	antitumor activity	
<i>Streptomyces</i> sp.	RM66	Phencomycin (47)	alkaloid	antibacterial activities	58
		Tubermycin B (48)	alkaloid	antimicrobial activity	
		Phenazine (S32), Pyocyanine (S33), Mycomethoxin B (S34), Phencomycin methyl ester (S35), 2-methoxy-1-phenazinecarboxylic acid (S36), 1-hydroxymethyl-6-carboxyphenazine (S37)	alkaloid	unknown	

		Manadoperoxide H (285)	Steroid	anti-trypanosomal activity	
		Sulfate F (S136)	Steroid	unknown	
		Ethyl plakortide Z (305)	others	antitumour and cytotoxicity	
		Seco-plakortide Z (S167), Actinopolysporin B (S168), and Acanthosterol G (S169)	others	unknown	
<i>Nesterenkonia</i> sp.	MSA31	Nesfactin (255)	peptide	antibacterial activity	144
		Kaimonolide B (166)	polyketide	plant growth inhibitor	59
		8,15-Dideoxylankanolide (S78)	polyketide	unknown	
<i>Rhodococcus</i> sp.	UR59	Rhodopeptins C1, C2, and B5 (256-258)	peptide	antifungal activity	
		Mitomycin K (76)	alkaloid	antitumor activity	
		Piericidin F (77), Migrastatin (78)	alkaloid	anticancer activity	
Coral		Watasemycin A (79), Aerugine (80)	alkaloid	antibacterial activity	60
		Pulicatin G (S38), Pyrrole-2-carboxamide (S39), Furan-2-carboxamide (S40), 1-(3,5-dihydroxyphenyl)ethanone (S41)	alkaloid	unknown	
<i>Streptomyces</i> sp.	OUCMDZ-1703	Strepchloritides A (168) and B (169)	polyketide	cytotoxicity	
<i>Streptomyces</i> sp.	M-207	Lobophorin K (81)	alkaloid	cytotoxic activity and antibacterial activity	61
		Isotirandamycin B (82), Tirandamycins A (43) and B (44)	alkaloid	antibacterial activity	62
<i>Streptomyces</i> sp.	SCSIO 41399	Anthracycline derivatives (83-84)	alkaloid	cytotoxic activities	
		Aranciamycin K (S81), Anthracycline derivative (S82)	polyketide	unknown	
		Anthracycline derivative (170)	polyketide	cytotoxic activities	
<i>Pseudonocardia</i> sp.	SCSIO 11457	11457A (S42), 11457B (S43), 1H-indole-2-carbal-dehyde (S44)	alkaloid	unknown	63
<i>Streptomyces</i> sp.	PG-19	Octalactin A (167)	polyketide	cytotoxicity	105
		Octalactin B (S79)	polyketide	unknown	
<i>Micromonospora</i> sp.	A5-1	7b, 13-dihydro-7-O-methyl jadomycin B	polyketide	unknown	106

(S80)					
<i>Streptomyces cyanofuscatus</i>	M-169	Anthracimycin B (171), Anthracimycin (172)	polyketide	antibacterial activity	107
<i>Streptomyces variabilis</i>		1-hydroxy-1-norresistomycin (HNM) (173)	polyketide	antibacterial activities and cytotoxic activity	108
<i>Streptomyces sp.</i>	DC4-5	Iseolides A-C (174-176)	polyketide	antifungal activity	109
<i>Micromonospora sp.</i>	L-13-ACM2-092	Thiocoraline (235)	peptide	cytotoxic activity, Enzyme inhibitory activity and antibacterial activity	145, 146
<i>Streptomyces sp.</i>	ZJG1	Sesquiterpenes S131-S133	terpenoid	unknown	155
		Sesquiterpenes 276	terpenoid	free radical scavenging and acetylcholinesterase inhibitory activity	
		Sesquiterpenes 277	terpenoid	radical scavenging activity, hemolytic activity and acetylcholinesterase inhibitory activity	
<i>Micrococcus sp</i>		(6E,8Z)- (303) and (6E,8E)-5-oxo-6,8-tetradecadienoic acids (304)	fatty acid	antibacterial activity, agonistic activity against PPARs	166
<i>Streptomyces griseorubens sp.</i>	ASMR4	Oxaphenalenone derivative (S151), Ferulic acid (S152), Glycerol linoleate (S153), Linoleic acid methyl ester (S154), (3R,4R)-3,4-dihydroxy-3-methylpentan-2-one/ (3S,4R)-3,4-dihydroxy-3-methylpentan-2-one (S155), Anthranilic acid (S156), Phenylacetic acid (S157), and benzoic acid (S158)	others	unknown	164
		Nesterenal A (302)	others	RXR α transcriptional	165

halobia (Micrococcus halobius)				activation activity	
<i>Streptomyces</i> sp.	RKBH-B7	Guanahanolide A (279)	terpenoid	cytotoxicity	157
<i>Streptomyces albogriseolus</i>	SY67903	Microeunicellol A (280) Microeunicellol B (S135)	terpenoid	cytotoxicity unknown	158
Ascidian					
<i>Salinispora pacifica</i>	LL-37I366	Lomaiviticin A (85) Lomaiviticin B (86)	alkaloid	DNA-damaging agent, antibacterial activity, cytotoxicity DNA-damaging agent, antibacterial activity	64-66
<i>Micromonospora</i> sp.	DPJ12	Diazepinomicin (28)	alkaloid	antimicrobial activity	67
<i>Streptomyces</i> sp.	YM14-060	Piericidins C7, C8, A1, A2 (87-90)	alkaloid	cytotoxicity	64, 68
<i>Streptomyces</i> sp.	JP90	Organophosphate (S)- cinnamoyl-phosphoramido (91)	alkaloid	enzyme inhibitory activity	64
<i>Salinispora arenicola</i>	CNR-647	Arenimycin (92)	alkaloid	antimicrobial activities and cytotoxicity	64, 69
<i>Streptomyces</i> sp.		Bohemamine (S46)	alkaloid	unknown	64
<i>Actinomadura</i> sp.	WMMB-499	Forazoline A (93) Forazoline B (S47)	alkaloid	antifungal activity unknown	71
<i>Streptomyces</i> sp.	Did-27	(S)-6-(sec-butyl)-3-isopropylpyrazin-2(1H)-one (94), (S)-6-(sec-butyl)-3-isobutylpyrazin-2(1H)-one (95); (1H)-pyrazinones analogues deoxymutaaspergillic acid (96); 3,6-diisobutyl-2(1H)- pyrazinone (97) and 3,6-disec-butyl-2(1H)-pyrazinone (98) (S)-3-(sec-butyl)-6-isopropylpyrazin-2(1H)-one (S48)	alkaloid	cytotoxicity unknown	64, 72

		Cyclo (6-OH-D-Pro-L-Phe) (229); Bacillusamide B (261); Cyclo (L-Pro-L-Leu) (246); Cyclo (L-Pro-L-Ile) (262)	peptide	cytotoxic activities	
<i>Nocardiopsis dassonvillei</i>	HQA404	1,6-dihydroxyphenazine (99)	alkaloid	antimicrobial activity, cytotoxic activity, enzyme inhibiting activity	64
		2-(acetylamino)-phenol (100)	alkaloid	cytotoxic activity	
<i>Nocardia sp.</i>	KMM 3749	Ubiquinone Q9 (177)	polyketide	cytotoxicity	64, 110
<i>Streptomyces sp.</i>	JP95	Griseorhodin A (178)	polyketide	enzyme inhibitory activity	64, 111
<i>Streptomyces sp.</i>	#N1-78-1	Bisanthraquinones 1 (179) and 2 (180)	polyketide	antimicrobial activities and cytotoxic activity	64, 112
		Derivative 3 (181)	polyketide	cytotoxic activity	
<i>Micromonospora sp.</i>		4,6,11-trihydroxy-9-propyltetracene-5,12-di one (182) and 10 β -carbomethoxy- 7,8,9,10-tetrahydro-4,6,7 α ,9 α ,11-pentahydro xy-9-propyltetra-cene-5,12-dione (183)	polyketide	cytotoxic activity	113
		1-methoxy-9-propyltetra-cene-6,11-dione (S83) and 7,8,9,10-tetrahydro-9 -hydroxy-1-methoxy-9-propyltetracene-6,11 -dione (S84)			
		Halomadurones A-B (S85, S86)	polyketide	unknown	64, 114,
	WMMB499	Halomadurones C (184) and D (185)	polyketide	antioxidant activity	115
		Ecteinamycin (186)	polyketide	antibacterial activity	
<i>Streptomyces sp.</i>	SCSGAA 0027	Nahuoic acid A (191)	polyketide	enzyme inhibitory activity and antibiofilm activity	116, 117
		Nahuoic acids B-E (187-190)	polyketide	antibiofilm activity	
		Pteridic acids C (S87) and D (S88)	polyketide	unknown	
		Pteridic acids E-G (192-194)	polyketide	antibacterial activity	
<i>Streptomyces coelicoflavus</i>	HQA809	Germicidin (195) and 6-isopropyl group-3-ethyl-4-hydroxy-2-pyrone (196)	polyketide	cytotoxic activity	64

<i>Streptomyces</i> sp.	PTY087I2	Granaticin (197), Granatomycin D (198), Dihydrogranaticin B (199)	polyketide	antibacterial activity	64, 118	
<i>Nocardia</i> sp.		Peptidolipins B (259) and E (260) peptidolipins C,D,F (S124-S126)	peptide peptide	antimicrobial activities unknown	64, 72	
<i>Micromonospora</i> sp.	WMMC-218	Micromonohalimane A (S134) Micromonohalimane B (278)	terpenoid terpenoid	unknown antibacterial activity	156	
<i>Aeromicrobium halocynthiae</i>	KME 001	Taurocholic acid (S45)	alkaloid	unknown	64, 70	
<i>Actinomadura</i> sp		Ecteinamycin (295)	others	antimicrobial activity	64, 115	
<i>Solvaraspore</i> sp.	WMMB329	Solwaric acids A (297) and B (298) 2,4,6-triphenyl-1-hexene (S146)	aromatic acid others	antibacterial activity unknown	64, 162	
Other invertebr ates	<i>Streptomyces</i> sp.	BL-49-58-005	3,6-disubstituted indoles (102-104)	alkaloid	cytotoxic activity	74
			Bohemamine (S46), Bohemamine B (S49)	alkaloid	unknown	76
	<i>Streptomyces</i> sp.	LA3L2	S-methyl-2,4-dihydroxy-6-isopropyl-3,5-di methylbenzothioate (287)	others	cytotoxic activity	
			Montagnetol (S138), Erythrin (S139)	others	unknown	
	<i>Streptomyces</i> sp.	LA3L1	Chromomycin A2 (S140), Chromomycin A3 (S141), Chromomycin 02-3D (S142)	others	unknown	76
<i>Streptomyces</i> sp.	LA5L4	Thiazostatin B (S50)	alkaloid	unknown	76	
		JBIR-66 (106)	alkaloid	cytotoxic activity	64, 77	
<i>Saccharopolyspora</i> sp.	SS081219 JE-28	Macrolactins E (S89) and F (S90), Gilvocarcins M (S91) and V (S92)	polyketide	unknown		
<i>Streptomyces</i> sp.	1053U.I.1a.3b	Lobophorins I (107), F (108), B (109), C (26) Lobophorin H (S51)	alkaloid alkaloid	antibacterial activity, cytotoxic activity unknown	78	

<i>Micromonospora</i> sp.	29867	MBJ-0003 (110)	alkaloid	cytotoxicity	79
<i>Actinoalloteichus</i> sp.	PM0525875	Caerulomycin A (111)	alkaloid	antifungal activity	80
<i>Micromonospora</i> sp.		Keyicin (112)	alkaloid	antibacterial activity	81
		2,5-bis(5-(tert-butyl)benzo[d]oxazol-2-yl)thiophene (113), 2-methylpyridin-3-ol (114), N-phenylnaphthalen-2-amine (115), 2-(1H-indol-3-yl)ethan-1-ol (58)	alkaloid	antimicrobial activity	82
		(6R,8aS)-6-((1H-indol-3-yl)methyl)hexahydroindolizine-5,8-dione (116)	alkaloid	antibacterial and antifouling activities	
<i>Streptomyces</i> sp.	G278	1H-indole-3-carbaldehyde (S21), 1H-indole-3-carboxylic acid (S52)	alkaloid	unknown	
		Compound 205	polyketide	antibacterial activity	
		7-hydroxy-6-methoxy-2H-chromen-2-one (301)	polyketide	antimicrobial activity	
		Benzyl 2-hydroxybenzoate (300)	others	antimicrobial activity	
		1-acetyl-2-isobutyrylpyrazolidine-4-carboxylic acid (S53)	alkaloid	unknown	83
<i>Streptomyces</i> sp.	ZZ406	5-hydroxy-4-(hydroxymethyl)-9,10-dioxo-9,10-dihydroanthracene-2-carboxylic acid (216), (R)-3-hydroxy-6-(2-methyl-4-oxo-4H-chromen-5-yl)-5-oxohexanoic acid (217)	polyketide	cytotoxic activity	
		Compounds S93-S97	polyketide	unknown	
		Acetyl-L-leucyl-L-seryl-L-alanine (S130)	peptide	unknown	
		Valinomycin (230)	peptide	antiparasite activity and	

					cytotoxic activity
		GTRI-02 (S164)	others	unknown	
<i>Streptomyces sp.</i>	HDa1	Anthocidins A-D, Crassilin (S54-S58) n-lauryl 5-hydroxyanthranilate (118), isolauryl 5-hydroxyanthranilate (119); Benzamide (S59), Oxachelin (S60); PD116740 (126); 3-hydroxy-4-methoxycinnamamide (120); Flavoside A (S98); (3S-cis)-hexahydro-3-[(3,4-dihydroxyphenyl)methyl]pyrrolo[1,2-a]pyrazine-1,4-dione (274)	alkaloid alkaloid alkaloid polyketide alkaloid polyketide peptides	unknown enzyme inhibitory activity unknown unknown antibacterial activity unknown antibacterial activity	85, 86
<i>Streptomyces olivaceus</i>	SCSIO LO13	Borreliidins M (121) and CR1 (122) Borreliidins N,O,E,K (S61-S64) Borrelidin A (123)	alkaloid alkaloid alkaloid	antibacterial activity, cytotoxic activity unknown antibacterial, anti-parasite, cytotoxic activities	87
<i>Pseudonocardia sp.</i>	HS7	Compounds 202 , 203 , 204a and 204c Compounds 200 , 201	polyketide polyketide	anticancer activity anticancer activity and antibacterial activity	119
<i>Saccharothrix espanaensis</i>	An 113	X- 14881 E (206), ochromycinone (207), X-14881 C (208), saccharothrixmicines A (209); (3R,7R,8aS)-7-hydroxy-3-isobutylhexahydr opyrrolo[1,2-a]pyrazine-1,4-dione (269), (3S,7R,8aS)-7-hydroxy-3-isobutylhexahydro pyrrolo[1,2-a]pyrazine-1,4-dione (270), (3S,7R,8aR)-3-benzyl-7-hydroxyhexahydrop	polyketide peptide	antibacterial activity antibiotic activities	120, 121

			yrrolo[1,2-a]pyrazine-1,4-dione (271); X-14881 A (288), X-14881 B (289), Saccharothrixins A-C (290-292), Saccharothrixmices B (293)	others	antibacterial activity	
<i>Streptomyces</i> sp.	112CH148		Violapyrones H (210) and I (211) Violapyrones B (212) and C (213)	polyketide polyketide	cytotoxic activity cytotoxic activity and antibacterial activity	122
<i>Streptomyces caniferus</i>	GUA-06-05-006A	PM100117 (214) and PM100118 (215)		polyketide	cytotoxic activities and antifungal activity	123
<i>Streptomyces seoulensis</i>	A01	Streptoseomycin (117)		alkaloid	antibacterial activities	84
<i>Streptomyces sampsonii</i>	SCSIO 054	Julichromes Q11, Q12, Q10, Q ₆ •6, Q ₆ (218-222) Julichromes Q3•5 (S99), Q3•3 (S100), Chrysophanol (S101), 4-acetylchrysophanol (S102), Islandicin (S103), Huanglongmycin A (S104)		polyketide polyketide	antibacterial activity unknown	124
<i>Streptomyces</i> sp.	CNB-091	Salinamides A (266) and B (267) Salinamides C-E (S127-S1229) Salinamide F (268)		peptide peptide peptide	antibacterial activity and anti-inflammatory activity unknown antibacterial activity and enzyme inhibitory activity	149-151
<i>Micromonospora</i> sp.	ML1	Thiocoraline (235)		peptide	cytotoxic activity, enzyme inhibitory activity and antibacterial activity	152
<i>Streptomyces seoulensis</i>	IFB-A01	Limazepines G (272) and H (273) Streptoseolactone (284)		peptide steroid	enzyme inhibitory activity enzyme inhibitory activity	153
Fish	<i>Nocardiopsis dassonvillei</i>	RG-33B	Tetrodotoxin (105)	alkaloid	nonprotein neurotoxin	75
	<i>Streptomyces</i>	OUPS-N92	Halichomycin (101);	alkaloid	cytotoxicity	73

	<i>hygroscopicus</i>		Halichoblelide A-C (223-225)	polyketide	cytotoxicity	
	<i>Streptomyces sp.</i>	MNU FJ-36	2,5-diketopiperazines (2,5-DKPs) (263-265)	peptide	cytotoxicity	148
Marine mammals	<i>Micromonospora</i>		Phocoenamicin (226)	polyketide	antibacterial activity	127
Brown algae	<i>unidentified</i>	CNC-837	Lobophorins A (306) and B (109)	alkaloid	anti-inflammatory	167
	<i>Streptomyces cyaneofuscatus</i>	M-27	Daunomycin (307), Cosmomycin B (308) Maltophilin (309) Galtamycin B (S181)	alkaloid alkaloid polyketide	antitumor antibiotics antifungal activity unknown	168
			Lobophorine B (310)	alkaloid	anti-inflammatory and antibacterial activity	168
	<i>Streptomyces carnosus</i>	M-40	Germicidins A (314) and B (315)	polyketide	Spore germination and hypha elongation in <i>S. coelicolor</i>	
			Geosmin (S195), Beta-patchoulene (S196)	others	unknown	
			4-amino-6-methylsalicylic acid (311)	alkaloid	antibacterial activity	169
	<i>Nocardiopsis sp.</i>	AS23C	5-methylresorcinol (339), Linoleic acid (340)	others	antibacterial activities	
	<i>Streptomyces sundarbansensis</i>	WR1L1S8	Phaeochromycins B, C and E (S178-S180) 2-hydroxy-5-((6-hydroxy-4-oxo-4H-pyran-2-yl) methyl)-2-propylchroman -4-one (313)	polyketide polyketide	unknown antibacterial activities	174
	<i>Micromonospora sp.</i>	CNY-010	Neaumycin B (316)	polyketide	cytotoxicity	175
	<i>Streptomyces praecox</i>	291-11	BmDKP (330), ImDKP (331)	peptide	antifouling activity	179
	<i>Streptomyces coelescens</i>	PK206-15	Glycoglycerolipids 332-335	others	antifouling activity	180

					181
<i>Streptomyces atrovirens</i>	PK288-21	2-hydroxy-5-(3-methylbut-2-enyl) benzaldehyde (336), 2-hepta-1,5-dienyl-3,6-dihydroxy-5-(3-meth ylbut-2-enyl) benzaldehyde (337)	others	antimicrobial activity	
<i>Kocuria marina</i>	CMG S2	4-[(Z)-2 phenyl ethenyl] benzoic acid (338)	others	antimicrobial activity	177
Green algae		Streptopertusacin A (312) Streptoarylpyrazinone A (S170) 21,22-en-bafilomycin D (318), 21,22-en-9-hydroxybafilomycin D (319) 23-O-butyrylbafilomycin D (317)	alkaloid alkaloid polyketide polyketide	antibacterial activity unknown cytotoxic activity and antibacterial activity cytotoxicity	170, 171
<i>Streptomyces sp.</i>	HZP-2216E	Bafilomycins D (320) and A1 (322) 9-hydroxybafilomycin D (321) Bafilomycin A2 (S182)	polyketide polyketide polyketide	enzyme inhibitory activity, antibacterial, antifungal, insecticidal, herbicidal, and cytotoxic activities antibacterial, antifungal, insecticidal, herbicidal, cytotoxic activities unknown	172
<i>Streptomyces sp.</i>	ZZ502	Compounds S171-S173, 2-acetamido-3-hydroxybenzamide (S174), 2-amino-3-hydroxybenzamide (S175),and 2-aminobenzamide (S176)	alkaloid	unknown	
<i>Streptomyces althioticus</i>	MSM3	Desertomycin G (323)	polyketide	antibiotic activities and anti-tumor activity	176
Red alga		Vulgamycin (324)	polyketide	herbicidal activity and antibacterial activity	177
<i>Streptomyces ambofaciens</i>	BI0048	5-deoxy-enterocin (325) Germicidin A (314)	polyketide polyketide	antibacterial activity autoregulatory inhibitor of	

			Germicidin B (315)	polyketide	spore germination, antibacterial activity	
			Zoumbericins A, B, Germicidins K, L, Wailupemycins D, E (S183-S188)	polyketide	unknown	
			Benzoic acid (S158), Hydrocinnamic acid (S193), (E)-cinnamic acid (S194)	others	unknown	
Cyanobacteria	<i>Streptomyces</i> sp.	N1-78-1	Bisanthraquinones 326, 327	polyketide	antibacterial activity and cytotoxicity	112
			Bisanthraquinone 328	polyketide	cytotoxicity	
Lichens			(E)-3-hydroxy-2,4-dimethylhept-4-enamide (S177)	alkaloid	unknown	173
	<i>Streptomyces</i> <i>cavourensis</i>	YY01-17	3-hydroxybutan-2-yl (2S)-2-hydroxypropanoate (S191)	others	unknown	
			2-hydroxy-3-methylbutanoic acid (S192)	others	unknown	
Marine plants	<i>Streptomyces</i> sp.	FX-58	Anthraquinone 329	polyketide	cytotoxic activities	178
			Octadecanoic acid (S189)	others	unknown	
			Cholest-4-en-3-one (S190)	others	unknown	

4. Table S8. Summarized repetitive compounds identified from multiple actinomycetes.

Compounds	Actinomycetes	Host	References
Structural types			
Staurosporine(3) alkaloid	<i>Streptomyces</i> sp. 11 <i>Micromonospora</i> sp. L-31-CLCO-002 <i>Streptomyces</i> sp. LS298	Sponge	9, 21
Diazepinomicin(28) alkaloid	<i>Micromonospora</i> sp. RV115 <i>Micromonospora</i> sp. DPJ12	Sponge Ascidian	9, 28 67

lobophorin C(26) alkaloid	<i>Streptomyces carnosus</i> AZS17 <i>Streptomyces</i> sp. 1053U.I.1a.3b	Sponge <i>Lienardia Totopotens</i>	27 78
tirandamycin A(43)	<i>Streptomyces</i> sp. LS298	Sponge	36
tirandamycin B(44) alkaloid	<i>Streptomyces tirandamycinicus</i> HNM0039 ^T <i>Streptomyces</i> sp. SCSIO 41399	Sponge Coral	49 62
indole-3-acetic acid(S16) alkaloid	<i>Streptomyces</i> sp. G246	Sponge	56
Tryptophan(S160) amino acid	<i>Rhodococcus</i> sp. UA13	Sponge	43
1H-indole-3-carbaldehyde(S21) alkaloid	<i>Saccharomonospora</i> sp. UR22 <i>Streptomyces</i> sp. G278	Sponge Cucumber	47 82
9H-pyrido[3,4-b]indole(S30) alkaloid	<i>Streptomyces</i> sp. G246	Sponge	56
cyclo(L-Pro-L-Tyr)(S120) peptide	<i>Streptomyces</i> sp. G248	Sponge	55
cyclo (L-Pro-L-Leu)(246) peptide	<i>Streptomyces</i> sp. G248 <i>Streptomyces</i> sp. Did-27	Sponge Ascidian	55 64, 72
cyclo(L-Pro-L-Phe)(S123) peptide	<i>Streptomyces</i> sp. G248 <i>Streptomyces</i> sp. Call-36	Sponge Sponge	55 143
PD116740(126) polyketide	<i>Saccharopolyspora taberi</i> PEM-06-F23-019B <i>Streptomyces</i> sp. HDa1	Sponge Urchin	91 85, 86
cyclo (6-OH-D-Pro-L-Phe)(229) peptide	<i>Streptomyces</i> sp. DA18 <i>Streptomyces</i> sp. Did-27	Sponge Ascidian	128 64, 72
Valinomycin(230) peptide	<i>Streptomyces</i> sp. 22 <i>Streptomyces</i> sp. 34 <i>Streptomyces</i> sp. ZZ406	Sponge Sponge Sea anemones	9, 21 9, 21 83
Thiocoraline(235) peptide	<i>Verrucosispora</i> sp. WMMA107 <i>Micromonospora</i> sp. L-13-ACM2-092	Sponge Coral	9, 132 145, 146
	<i>Micromonospora</i> sp. ML1	Jellyfish	152
Bohemamine(S46) alkaloid	<i>Streptomyces</i> sp. <i>Streptomyces</i> sp. LA3L2	Ascidian Marine invertebrates	64 76

lobophorin B(109)	<i>Streptomyces</i> sp. 1053U.I.1a.3b	Lienardia totopotens	78
alkaloid	unidentified CNC-837	Brown algae	167
2-(1H-indol-3-yl)ethan-1-ol(58)	<i>Saccharomonospora</i> sp. UR22	Sponge	47
alkaloid	<i>Streptomyces</i> sp. G278	Cucumber	82
3-hydroxy-2-methyl-4H-pyran-4-one (maltol)(S74)	<i>Streptomyces</i> sp. SBT348	Sponge	45
polyketide	<i>Rhodococcus</i> sp. UA13	Sponge	43
Germicidins A and B (314, 315)	<i>Streptomyces carnosus</i> M-40	Brown algae	168
polyketide	<i>Streptomyces ambofaciens</i> BI0048	Red algae	177
Phencomycin, tubermycin B (47, 48)	<i>Streptomyces</i> sp. SBT345	Sponge	40, 41
alkaloid	<i>Streptomyces</i> sp. RM66	Sponge	58
Actinosporins C, D, G (144,145,155)	<i>Actinokineospora</i> <i>spheciospongiae</i> sp. nov.	Sponge	52
polyketide	<i>Actinokineospora</i> <i>spheciospongiae</i> EG49	Sponge	59, 100, 101
Benzoic acid (S158)	<i>Streptomyces griseorubens</i> sp. ASMR4	Coral	164
acid	<i>Streptomyces ambofaciens</i> BI0048	Red algae	177