*Supplementary materials for*

# *Fusarium*-derived secondary metabolites with antimicrobial effects

**Meijie Xu, Ziwei Huang, Wangjie Zhu, Yuanyuan Liu, Xuelian Bai * and Huawei Zhang ***

## Contents

Table S1. Detail information for *Fusarium*-derived anti-Gram-positive bacterial SMs.

| No. | Name | Strain | Source | Bioactivity | Ref. |
|---|---|---|---|---|---|
| **1** | fusariumins C | *F. oxysporum* ZZP-R1 | the coastal plant *R. madaio* Makino, China | potent activity against *S. aureus* with an MIC value of 6.25 μM | [1] |
| **2** | fusariumins D | | | moderate inhibitory effect on *S. aureus* with an MIC value of 25.0 μM | |
| **3** | A-108835 | *F. compactu* AB 21941-103 | an ant hill soil sample, Nigeria | only scattered weak Gram-positive activity against some *S. aureus* and *Streptococcus* strains in the range of 6~50 μg/mL | [2] |
| **4** | A-108836 | | | | |
| **5** | enniatin Q | *F. tricinctum* Corda | the fruits of *Hordeum sativum* Jess | mild activity against *S. aureus* | [3] |
| **6** | enniatin E | *Fusarium* sp. FO-1305 | Soil, Japan | weak activity against Gram-positive bacteria such as *S. aureus*, *B. subtilis*, *B. cereus* and *M. luteus* and very weak activity against *C. albicans* and *P. oryzae*. | [4] |
| **7** | enniatin F | | | | |
| **8** | enniatin H | *Fusarium* sp. TP-G1 | the root of *Dendrobium officinale* Kimura et Migo | weak antibacterial activities against *S. aureus* and MRSA with MIC value of 32 μg/mL | [5] |
| **9** | enniatin I | | | weak antibacterial activities against *S. aureus* and MRSA with MICs of 8 μg/mL and 16 μg/mL, respectively | |
| **10** | enniatin MK1688 | | | | |
| **11** | beauvericin A | | | good antibacterial activities against *S. aureus* and MRSA with MIC value of 2.0 μg/mL | |
| **12** | trichosetin | | | | |
| **13** | *epi*-trichosetin | *F. oxysporum* FKI-4553 | - | antimicrobial activity, particularly against Gram-positive bacteria, including methicillin-sensitive and -resistant *S. aureus* | [6] |
| **14** | lateritin | *Fusarium* sp. 2TnP1-2 | The petioles of *Trewia nudiflora* L. (Euphorbiaceae), China | possess antibacterial activity against *Staphylococcus aureus* | [7] |
| **15** | oxysporizoline | *F. oxysporum* | the marine mudflat, Korea | weak antibacterial activity against MRSA and MDRSA, with MICs of 6.25 μg/mL | [8] |
| **16** | bromomethylchlamydosporol A | *F. tricinctum* | the edible marine brown alga *Sargassum ringgoldium*, Korea | an MIC of 15.6 μg/mL against *S. aureus*, MRSA, and MDRSA (mild antibacterial activity) | [9] |
| **17** | bromomethylchlamydosporol B | | | | |
| **18** | chlamydosporol | *F. oxysporum* | the marine mudflat, Korea | weak antibacterial activity against MRSA and MDRSA, with MICs of 31.5 μg/mL | [8] |
| | | *F. tricinctum* | the edible marine brown alga *Sargassum ringgoldium*, Korea | an MIC of 31.5 μg/mL against *S. aureus* and 62.5 μg/mL against MRSA | [9] |
| **19** | 4-methoxy-6-((*E*)-4,6-dimethyloct-2-en-2-yl) -2*H*-pyran-2-one | *F. Petroliphilum* FEP 16 | *Posidonia oceanica* shoots, France | moderate activity against MRSA with an MIC of 32 μg/mL | [10] |
| **20** | trans-Dihydrofusarubin | *F. solani* B3H, B3K, and BP15-8 (NRRL 15980) | fibrous roots of citrus trees | significant activity against *S. aureus* at MIC values <4 μg/mL | [11] |
| **21** | 3-*O*, 9-*O*-Metylfusarubin | | | | |
| **22** | 5-*O*-Methyljavanicin | | | | |
| **23** | anhydrofusarubin | *F. solani* B3H, B3K, and BP15-8 (NRRL 15980) | fibrous roots of citrus trees | significant activity against *S. aureus* at MIC values <4 μg/mL | [11] |
| | | *Fusarium* sp.PSU-F135 | Marine brown alga *Colpomenia sinuosa* | antimycobacterial (against *M. tuberculosis* H37Ra, MIC 87 μM) activities | [12] |

| | | | | | |
|---|---|---|---|---|---|
| **24** | 5,8-Dihydroxy-2-methoxy-6-hydroxymethyl-7-(2-hydroxypropyl)-1,4-naphthalenedione | *F. solani* B3H, B3K, and BP15-8 (NRRL 15980) | fibrous roots of citrus trees | significant activity against *S. aureus* at MIC values <4 μg/mL | [11] |
| **25** | 8-*O*-Methyljavanicin | *F. oxysporum* HC-7-1 (ATCC 64432) | *Hyrtios proteus* sponge | significant activity against *S. aureus* at MIC values <4 μg/mL | [11] |
| **26** | 2,3-Dihydro-5,8-dihydroxy-6-methoxy-2-hydroxymethyl-3-(2-hydroxypropyl)- 1,4-naphthalenedione | *F. solani* B3H, B3K, and BP15-8 (NRRL 15980) | fibrous roots of citrus trees | significant activity against *S. aureus* and *S. pyogenes*, at MIC values <4 μg/mL | [11] |
| **27** | 2,3-Dihydro-5-hydroxy-4-hydroxymethyl-8-methoxy-3-methylnaphtho(1,2-b) furan-6,9-dione | | | significant activity against *Staphylococcus aureus* and *S. pyogenes*, at MIC values <4 μg/mL; | [11] |
| **28** | 9*α*-hydroxyhalorosellinia A | *Fusarium* sp. PSU-F14 | a gorgonian sea fan | antimycobacterial (against *M. tuberculosis* H37Ra, MIC 38.57 μM) activity | [12] |
| **29** | nigrosporin B | | | antimycobacterial (against *M. tuberculosis* H37Ra, MIC 41 μM) activity | [12] |
| **30** | 5-hydroxy-3-methoxydihydrofusarubin A | *Fusarium* sp. BCC14842 | Bamboo leaf, Thailand | anti-TB (*M. tuberculosis*) with MIC of 50 μg/mL | [13] |
| **31** | dihydronaphthalenone diastereomer | | | anti-TB (*M. tuberculosis*) with MIC of 25 μg/mL | [13] |
| **32** | 3-*O*-methylfusarubin | *Fusarium* sp. BCC14842 | - | anti-TB (*M. tuberculosis*) with MIC of 50 μg/mL | [13] |
| | | *F. solani* A2 | | | |
| **33** | 3,6,9-trihydroxy-7-methoxy-4,4-dimethyl-3,4-dihydro-1*H*-benzo[g]isochromene-5,10-dione | *F. solani* A2 | medicinal plant *Glycyrrhiza glabra*, India | moderate activity against *M. tuberculosis strain* H37Rv with MIC value of 64 μg/mL; moderate anti-bacterial activity against *S. aureus* with MIC value of 32 μg/mL; against *B. cereus* and *S. pyogenes* with MIC of <1 μg/mL as compared to ciprofloxacin whose MIC against these strains is 0.15 and 10 μg/mL, respectively | [14] |
| **34** | linoleic acid | *F. equiseti* SCSIO 41019 | Sponge (*Callyspongia* sp.), China | weak antibacterial activities against SA and MRSA with MIC values of 62.5, 125 μg/mL, respectively | [15] |
| **35** | *epi*-equisetin | *F. equiseti* SCSIO 41019 | Sponge (*Callyspongia* sp.), China | strongest antibacterial activities against *S. aureus* and MRSA with an MIC value of 31.2 μg/mL | [15] |
| | | *F. equiseti* AGR12 | the stem of *Rhizophora stylosa* Griff | remarkable antimicrobial activities against *B. subtilis and S. aureus*, with MIC value of 32 μg/mL | [16] |
| **36** | (-)-4, 6′-anhydrooxysporidinone | *F. oxysporum* | the bark of *C. kanehirae*, Taiwan Province | showed weak anti-MRSA activity (MIC=100 μg/mL) and moderate anti-BS (*B. subtilis*) activity (MIC=25 μg/mL). | [17] |
| **37** | fusaroxazin | *F. oxysporum* | *V. faba*, Egypt | significant antibacterial activity towards *S. aureus* (IZD 14.8 mm and MIC 5.3 μg/mL) and *B. cereus* (IZD 18.9 mm and MIC 3.7 μg/mL), in comparison to ciprofloxacin (IZDs 16.9 and 20.5 mm; MICs 3.9 and 2.3 μg/mL, respectively) | [18] |
| **38** | neomangicol B | *Fusarium* sp. CNC-477 | the surface of driftwood collected in the Bahamas Islands | antibacterial activity similar to that of the known antibiotic, gentamycin, against the Gram-positive bacterium *B. subtilus* | [19] |
| **39** | SMA93 | *F. proliferatum* ZS07 | *Longhorned grasshoppers,* | antibacterial effect against *B. subtilis* with MIC value of 6.25 μg/mL | [20] |

| | | | | | |
|---|---|---|---|---|---|
| **40** | 6-*O*-methyl SMA93 | | China | antibacterial effect against *B. subtilis* with MIC value of 12.5 μg/mL | |
| **41** | rhodolamprometrin | | | antibacterial effect against *B. subtilis* with ZOI of 24.8mm and MIC value of 3.13 μg/mL | |
| **42** | cyclonerodiol | *F. avenaceum* SF-1502 | Soil | stronger antibacterial activity against *B. megaterium* than the positive controls, the clinical drugs, ampicillin, erythromycin, and streptomycin | [21] |
| **43** | epicyclonerodiol oxide | | | against *B. megaterium* with ampicillin and erythromycin, and stronger than streptomycin | |
| **44** | 4,5-dihydroascochlorin | *Fusarium* sp. | - | activity against *B. megaterium* | [22] |
| **45** | fusariumnol A | *F. proliferatum* 13294 | wheat tissue | weak antibacterial activity against *S. epidermidis* (MIC = 100 μM). | [23] |
| **46** | fusariumnol B | | | | |
| **47** | fungerin | *Fusarium* sp. | Soil, Qinghai-Tibetan plateau | antibacterial activity against *S. aureus* and *S. pneumoniae* (with $IC_{50}$ values of 33.8 and 34.5 μM, respectively) | [24] |
| **48** | 3-hydroxy-1,2,6,10-tetramethylundecyl hexzadecanoate | *F. oxysporum* YP9B | the tomato plant root in Pazar-Rize, Turkey | against Gram-positive bacteria (*S. aureus*, *E. faecalis*, *S. mutans*, *B. cereus*, and *M. smegmatis*) | [25] |
| **49** | 3-hydroxy-1,2,6,10-tetramethylundecyl (9*E*)-octadecaenoate | | | | |
| **50** | 3-hydroxy-1,2,6,10-tetramethylundecyl-octadecanoate | | | | |

Table S2. Detail information for *Fusarium*-derived anti-Gram-negative bacterial SMs.

| No. | Name | Strain | Source | Bioactivity | Ref. |
|---|---|---|---|---|---|
| **51** | butenolide | *Fusarium* sp. | - | selective inhibitory activity against *E. coli*. | [26] |
| **52** | (3a*S*,6*R*,6a*R*)-3a,6-dihydroxy-6-((2*E*,4*E*,6*E*)-7-(4-(1-hydroxyethyl)-2-methyl-2,5-dihydrofuran-2-yl)-2-methylhepta-2,4,6-trienoyl) hexahydro -5*H*-furo[3,2-b] pyrrol-5-one | *F. solani* JK10 | the roots of *Chlorophora regia* (Moraceae), Asakraka forest in the Eastern Region of Ghana | antibacterial efficacies against the soil bacterium *Acinetobacter* sp., comparable to the reference standard streptomycin; antibacterial activity against the environmental strain of *E. coli*, 5~10 μg/mL | [27] |
| **53** | (1R,4S,5R)-4-hydroxy-4-(2-hydroxyethyl)-1-((2E,4E,6E)-7-(4-(1-hydroxyethyl)-2-methyl-2,5-dihydrofuran-2-yl)-2-methylhepta-2,4,6-trienoyl)-6-oxa-3-azabicyclo[3.1.0]hexan-2-one | | | | |
| **54** | Methyl (2*E*,3*E*,5*E*,7*E*,9*E*)-11-((3a*S*,6*S*,6a*R*)-3a,6-dihydroxy-5-oxohexahydro-2*H*-furo[3,2-b] pyrrol-6-yl)-2-ethylidene-11-hydroxy-4,10-dimethylundeca-3,5,7,9-tetraenoate | | | | |
| **55** | (1*R*,4*S*,5*R*)-4-hydroxy-4-(2-hydroxyethyl)-1-((2*E*,4*E*,6*E*,8*E*,10*E*)-10-(hydroxymethyl)-2,8-dimethyldodeca-2,4,6,8,10-pentaenoyl)-6-oxa-3-azabicyclo[3.1.0] hexan-2-one | | | antibacterial activity against the environmental strain of *E. coli*, 5~10 μg/mL | |
| **56** | (1*R*,4*S*,5*R*)-4-hydroxy-4-(2-hydroxyethyl)-1-((2*E*,4*Z*,6*E*,8*E*,10*E*)-10-(hydroxymethyl)-2,8-dimethyldodeca-2,4,6,8,10-pentaenoyl)-6-oxa-3-azabicyclo[3.1.0] hexan-2-one | | | | |
| **57** | (3a*S*,6*R*,6a*R*)-3a,6-dihydroxy-6-((2*E*,4*E*,6*E*)-7-(4-(1-hydroxyethyl)-2,3-dimethyl-5-oxo-2,5-dihydrofuran-2-yl)-2-methylhepta-2,4,6-trienoyl)-6a-methylhexahydro-5*H*-furo[3,2-b] pyrrol-5-one | | | | |
| **58** | methyl (2*E*,3*E*,5*E*,7*E*,9*E*)-2-ethylidene-11-((3*S*,5*S*)-5-(2-hydroxyethyl)- 2-oxopyrrolidin-3-yl)-4,10-dimethyl-11-oxoundeca-3,5,7,9-tetraenoate | | | | |
| **59** | NG–391 | | | | |
| **60** | NG–393 | | | | |
| **61** | karimunones B | *Fusarium* sp. KJMT.FP.4.3 | a sponge *Xestospongia sp.*, Indonesia | weak activity against multidrug resistant *Salmonella enterica* ser with an MIC value of 125 μg/mL | [28] |
| **62** | 7-*O*-methylrhodolamprometrin | | | | |
| **63** | tricinonoic acid | | | | |
| **64** | fusapyridons A | *Fusarium* sp. YG-45 | *Maackia chinensis*, China | antimicrobial activity against *P. aeruginosa* (MIC 6.25 μg/mL) and *S. aureus* (MIC 50 μg/mL) | [29] |

Table S3. Detail information for *Fusarium*-derived both anti-Gram-positive and anti-Gram-negative bacterial SMs

| No. | Name | Strain | Source | Bioactivity | Ref. |
|---|---|---|---|---|---|
| **65** | anhydrojavanicin | *F. solani* B3H, B3K, and BP15-8 (NRRL 15980) | fibrous roots of citrus trees | significant activity against *S. aureus* at MIC values <4 µg/mL | [11] |
| **66** | methyl ether fusarubin | *F. proliferatum* AF-04 | - | selective antibacterial activities against *B. megaterium*, *B. subtilis*, *C. perfringens*, *E. coli*, MRSA | [21] |
| **67** | 5-*O*-methylsolaniol | | | | |
| **68** | 5-*O*-Methyljavanicin | *F. Solani* B3H, B3K, and BP15-8 (NRRL 15980) | fibrous roots of citrus trees | significant activity against *S. aureus* at MIC values <4 µg/mL | [11] |
| **69** | 6-hydroxy-astropaquinone B | *F. napiforme* | the mangrove plant, *Rhizophora mucronata* | moderate antibacterial activity against *Staphylococcus aureus* and *Pseudomonas aeruginosa* | [30] |
| **70** | astropaquinone D | | | | |
| **71** | bostrycoidin (bostricoidin) | *F. solani* | - | moderate antibiotic activity against Gram-positive bacteria (*S. aureus*, *S. pyogenes*) | [11] |
| | | *F. solani* | fresh healthy roots of *Cassia alata* Linn. | exhibited prominent inhibition against the above tested pathogenic bacteria | [31] |
| | | *Fusarium* sp. | - | antimicrobial activity against *Pseudomonas aeruginosa* | [32] |
| **72** | fusariumin A | *Fusarium* sp. YD-2 | twigs of the *Santalum album*, China | significant activities against *S. aureus* and *P. aeruginosa* with an MIC value of 6.3 µg/mL | [33] |
| **73** | asperterpenoid A | | | moderate activities against *S. enteritidis* and *M. luteus* with MIC values of 6.3 and 25.2 µg/mL, respectively | |
| **74** | fusarielin B | *F. tricinctum* Salicorn 19 | The aerial parts of *S. bigelovii*, China. | a broader spectrum antimicrobial activity against *M. smegmati*, *B. subtilis*, *M. phlei* and *E. coli* with MIC values 19, 19, 10 and 10 µM, respectively | [34] |
| **75** | sambacide | *F. sambucinum* B10.2 | - | significant antibacterial activities against *S. aureus* and *E. coli* | [35] |
| **76** | (2*S*,2'*R*,3*R*,3'*E*,4*E*,8*E*)-1-O-b-D-glucopyranosyl-2-N-(2'hydroxy-3'octadecenoyl)-3-hydroxy-9-methyl-4,8- sphingadienine | *Fusarium* sp. IFB-121 | *Quercus variabilis* | strong antibacterial activities against *B. subtilis*, *E. coli*, and *P. fluorescens*, with MICs of 3.9, 3.9, and 1.9 µg/mL, respectively | [36] |
| **77** | (2*S*,2'*R*,3*R*,3'*E*,4*E*,8*E*,10*E*)-1-O-b-D-glucopyranosyl-2-N-(2'hydroxy-3'octadecenoyl)-3-hydroxy-9-methyl-4,8,10-sphingatrienine | | | strong antibacterial activities against *B. subtilis*, *E. coli*, and *P. fluorescens*, with MICs of 7.8, 3.9, and 7.8 µg/mL, respectively | |
| **78** | enniatin $J_1$ | *F. tricinctum* | - | antimicrobial activity against *C. perfringens*, *E. faecium*, *E. coli*, *S. dysenteriae*, *S.aureus*, *Y. enterocolitica* and lactic acid bacteria except *B.* | [37] |
| **79** | enniatin $J_3$ | | | | |

| | | | | | |
|---|---|---|---|---|---|
| | | | | *adolescentis* | |
| **80** | halymecin A | *Fusarium* sp. FE-71-1 | Marine Algae, Japan | activity against *E. faecium*, *K. pneumoniae* and *P. vulgaris* MIC 10 (µg/mL) | [38] |
| **81** | fusaequisin A | *F. equiseti* SF-3-17 | The medicinal plant, *Ageratum conyzoides* L., Cameroon | moderate antimicrobial activity against *S. aureus* NBRC 13276 and *P. aeruginosa* ATCC 15442 | [39] |

Table S4. Detail information for *Fusarium*-derived antifungal SMs

| No. | Name | Strain | Source | Bioactivity | Ref. |
|---|---|---|---|---|---|
| **82** | fusacandin A | *F. sambucinum* AB 1900A-1314 | a polypore fruitbody, U.S.A. | antifungal activity against *C. albicans* | [40] |
| **83** | fusacandin B | | | | |
| **84** | saricandin | *Fusarium sp.* AB 2202W-161 | a soil sample, Nepal | good activity against *C. albicans* | [41] |
| **85** | CR377 | *Fusarium* sp. CR377 | the interior of a *Selaginella pallescens* stem, Costa Rica | significant activity against *C. albicans* | [42] |
| **86** | zearalenone | *Fusarium sp.* PSU-ES73 | leaves of *T. hemprichii* seagrass, Thailand | weak activity against *C. neoformans* with an MIC value of 50.26 µM | [43] |
| **87** | 5'*β*-hydroxyzearalenone | *Fusarium* sp. PSU-ES123 | a seagrass, *Enhalus acoroides,* Thailand | weak antifungal activity against *C. neoformans* with an MIC value of 128 µg/mL | [44] |
| **88** | neofusapyrone | *Fusarium* sp. FH-146 | driftwood, Japan | moderate activity against *A. clavatus* F318a | [45] |
| **89** | beauvericin K | *Fusarium* sp. | seawater collected from the Bohai Sea, China | significant activity against the yeast *C. albicans* with an IC50 value of 6.25 µg/mL | [46] |
| **90** | beauvericin D | | | | |
| **91** | cyclosporins A, B and C | *Fusarium* sp. S-435 | - | activity against filamentous pathogenic and saprophytic fungi | [47] |
| **92** | | | | | |
| **93** | | *F. solani* | soil, Japan | *V. ceratosperma* and *H. oryzae* | [48] |
| **94** | fusaripeptide A | *Fusarium* sp. | the roots of *Mentha longifolia* L. (Labiatae), Saudi Arabia | potent antifungal activity toward *C. albicans*, *C. glabrata*, *C. krusei*, and *A. fumigates* with $IC_{50}$ values of 0.11, 0.24, 0.19, and 0.14 µM, respectively | [49] |
| | | *F. larvarum* F-155,597 | - | parnafungin A had in vivo efficacy in a murine model of disseminated candidiasis. | [50] |
| **95**<br>**96** | parnafungin A<br>parnafungin B | *F. larvarum* MF7022 and MF7023 | an unidentified lichen thallus, Spain | broad spectrum activity against the ascomycetous yeasts, *C. albicans* (MIC 0.014 µg/mL), *C. krusei* (0.014 µg/mL), *C. glabrata* (1.1 µg/mL), *C. tropicalis* (3.3 µg/mL), *C. lusitaniae* (1.1 µg/mL), *C. parapsilosis* (1.1 µg/mL) and *S. cereVisiae* (3.3 µg/mL). Under identical assay conditions, the MIC of caspofungin (Cancidas) against *C. albicans* was 0.01 µg/mL. The parnafungins also were active in an agar assay against *A. fumigatus*. | [51] |
| **97** | parnafungin C | *F. larvarum* F-155,597 | - | less potent against all of the *Candida* species tested, but in some cases, such as against *C. tropicalis* and *C. lusitaniae*, these analogs had comparable antifungal activity | [50] |
| **98** | parnafungin D | | | | |
| **99** | fusaricide | *Fusarium* sp. | Flowers of sourwood *(Oxydendron arboreum),* Georgia State Botanical Garden in Athens | antifungal activity against *Candida albicans* and *Penicillium chrysogenum* (MICs 16 and 8 µg/mL, respectively). | [52] |
| **100** | indole acetic acid | *F. fujikuroi* | the aerial parts of *Paepalanthus chiquitensis* (Eriocaulaceae), | moderate antimicrobial activity for all the bacterial strains (*S. aureus, E. coli, S. setubal*) evaluated and activity against the fluconazole-resistant *C. albicans.* | [53] |

| | | | | | |
|---|---|---|---|---|---|
| | | | Brazil | | |
| **101** | fusaribenzamide A | *Fusarium* sp. | the internal tissue of *Mentha longifolia* roots | possessed a significant antifungal activity towards *C. albicans* with MIC 11.9 μg/disc compared to nystatin (MIC 4.9 μg/disc). However, it showed moderate activity toward *S. aureus* and *E. coli* with MIC values 62.8 and 56.4 μg/disc, respectively in comparison to ciprofloxacin (MICs 12.5 and 10.4 μg/disc, respectively). | [54] |
| **102** | sambutoxin | *Fusarium* sp. FKI-7550 | Soil, Japan | significant activities against multidrug-sensitive *S. cerevisiae* 12geneΔ0HSR-iERG6 with an MIC value of 0.064 μg/mL | [55] |
| **103** | *N*-demethylsambutoxin | | | significant activities against multidrug-sensitive *S. cerevisiae* 12geneΔ0HSR-iERG6 with an MIC value of 0.32 μg/mL | |
| **104** | 6-deoxyoxysporidinone | | | significant activities against multidrug-sensitive *S. cerevisiae* 12geneΔ0HSR-iERG6 with an MIC value of 2.0 μg/mL | |
| **105** | oxysporidinone | *F. oxysporum* N17B | a grassy area in Lakselv, Norway | selective potent activity against *C. albicans* | [56] |
| **106** | 6-*epi*-oxysporidinone | | | selective fungistatic activity against *A. fumigatus* | |
| **107** | wortmannin | | | | |
| **108** | culmorin | *Fusarium* sp. | - | both marine (*S. marina*, *M. pelagica*) and medically relevant fungi (*A. fumigatus*, *A. niger*, *C. albicans*, *Rhizopus species*, *T. mentagrophytes*) as being in the 1 μM range | [57,58] |

Table S5. Detail information for *Fusarium*-derived both antibacterial and antifungal SMs.

| No. | Name | Strain | Source | Bioactivity | Ref. |
|---|---|---|---|---|---|
| **109** | javanicin | *Fusarium* sp. BCC14842 | Bamboo leaf, Thailand | antifungal (*C. albicans*) activity with $IC_{50}$ of 6.16 µg/mL; anti-TB (*M. tuberculosis*) with MIC of 25 µg/mL | [13] |
| | | *F. solani* A2 | plant '*Glycyrrhiza glabra*', India | against *B. cereus* and *S. pyogenes* with MIC of <1 µg/mL as compared to ciprofloxacin whose MIC against these strains is 0.15 and 10 µg/mL, respectively | [14] |
| | | *F. javanicum* | - | - | [59] |
| | | *F. solani* B3H, B3K, and BP15-8 (NRRL 15980) | fibrous roots of citrus trees | significant activity against *S. aureus* at MIC values <4 µg/mL | [11] |
| **110**<br>**111** | fusarubin<br>dihydrofusarubin | *F. martii* | - | moderate antibiotic activity against Gram-positive bacteria and fungi. (*C. albicans, S. cerevisiae, S. pneumoniae, S. pyogenes, Bacillus subtilis, S. aureus*) | [60] |
| **112** | 5,10-dihydroxy-3,7-dimethoxy-3-methyl-3,4-dihydro-1*H*-benzo[*g*]isochromene-6,9-dione | | | | |
| **113** | 3-ethoxy-5,10-dihydroxy-7-methoxy-3-methyl-3,4-dihydro-1*H*-benzo[*g*]isochromene-6,9-dione | | | | |
| **114** | (3*S*,4a*R*,10a*S*)-6,9-dihydroxy-3,7-dimethoxy-3-methyl-3,4,4a,10a-tetrahydro-1*H*-benzo[*g*]isochromene-5,10-dione | | | | |
| **115** | (3*S*,4a*R*,10a*S*)-3-ethoxy-6,9-dihydroxy-7-methoxy-3-methyl-3,4,4a,10a-tetrahydro-1*H*-benzo[*g*]isochromene-5,10-dione | | | | |
| **116** | bikaverin | *Fusarium* sp. HKF15 | Soil, India | bikaverin inhibits *E. coli* growth significantly in the growth curve study in a microtiter plate reader | [61] |
| | | *Fusarium* sp. | - | partially inhibited the growth on agar of *Penicillium notatum*, *Alternaria humicola*, and *Aspergillus flavus* | [46,62] |
| **117** | lateropyrone | *Fusarium* sp. BZCB-CA | *Bothriospermum chinense*, China | significant inhibitory activity against MRSA and vancomycin-resistant of *E. faecalis* and *E. faecium*, with MIC values of 3.1, 12.5 and 25 µM, respectively | [63] |
| | | *F. tricinctum* | healthy rhizomes of *Aristolochia paucinervis*, Morocco | good antibacterial activity against *B. subtilis, S. aureus, S. pneumoniae, and E. faecalis,* with MIC values ranging from 2 to 8 µg/mL | [64] |
| | | *F. lateritium* Nees | *Tsuga heterophylla* (Raf.) Sarg. Trees, Canada | significant inhibitory activity towards the growth of the gram-positive bacterium *S. aureus* and the yeast *C. albicans*, but did not affect the | [65] |

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| | | | | gram-negative bacterium *E. coli* | |
| | | *F. acuminatum* TC2-084 | The medicinal plant *Geum macrophyllum*, Canada | good activity against *M. tuberculosis* H37Ra ATCC 25177, *S. aureus* ATCC 29213, MRSA, *E. faecium* ATCC 35667, VRE, *C. albicans* ATCC 14053 | [66] |
| **118** | BE-29602 | *Fusarium sp*. AB 2202W-161 | a soil sample, Nepal | good activity against *C. albicans* | [41] |
| | | *Fusarium* sp. F29602 | a soil sample, Japan | good activity against *C. albicans, S. cerevisiae, S. pombe, P. chrysogenum*, *B. subtilis*, *B. cereus*, *M. luteus* | [67] |
| **119** | fusarielin A | *Fusarium* sp. K432 | soil | moderate antifungal activities against *P. fumigatus*, *A. kikuchiana*, *C. lindemuthianum, F. nivale*, *E. oryzae*, *P. oryzae* | [68] |
| | | *F. tricinctum* | the edible marine brown alga *Sargassum ringgoldium*, Korea | activities against *S. aureus,* MRSA and MDRSA | [9] |
| **120** | helvolic acid methyl ester | *Fusarium* sp. JX119038 | *Ficus carica*, China | potent antifungal and antibacterial activities (*B. subtilis*, *S. aureus*, *E. coli*, *B. cinerea*, *F. Graminearum* and *P. capsica*) | [69] |
| **121** | helvolic acid | | | | |
| **122** | hydrohelvolic acid | | | | |
| **123** | fusartricin | *F. tricinctum* Salicorn 19 | The aerial parts of *S. bigelovii*, China. | significant antimicrobial activities against *E.aerogenes*, *M. tetragenu* and *C. albicans* with the MIC values 19, 19 and 19 µM, respectively | [34] |
| **124** | gibepyrone A | *F. fujikuroi* | - | antimicrobial activity against Gram-positive bacteria (*Bacillus subtilis*, *Staphylococcus aureus*) and yeasts (*Saccharomyces cerevisiae*, *Candida albicans*) | [70] |
| **125** | gibepyrone B | | | | |
| **126** | fusolanone B | *F. solani* HDN15-410 | the root of *Rhizophora apiculata Blume*, China | activity with MIC value 6.25 µg/mL on *V. parahaemolyticus*. antimicrobial activity against *M. albican*, *P. aeruginosa*, *B. subtilis* and *V. parahaemolyticus* | [71] |
| **127** | fusapyrone | *Fusarium* sp. FH-146 | driftwood, Japan | weak activity against *A. clavatus* F318a and *P. aeruginosa* ATCC 15442 with MICs of 25 µg/mL and 50 µg/mL, respectively | [45] |
| | | *F. semitectum* | infected maize stalk tissues collected in southern Italy | Fusapyrone inhibits *G. Candidum* | [72] |
| | | *F. semitectum* ITEM-393 | - | antifungal activity against filamentous fungi and difficult-to-treat human pathogenic fungi such as *Aspergillus* spp.; *C. kefyr*, an emergent opportunistic pathogen, showed a remarkable sensitivity only to fusapyrone | [73] |
| **128** | deoxyfusapyrone | *Fusarium* sp. FH-146 | driftwood, Japan | moderate activity against *A. clavatus* F318a, *P. aeruginosa* ATCC 15442 | [45] |
| | | *F. semitectum* | infected maize stalk tissues collected in southern Italy | deoxyfusapyrone inhibits *G. Candidum* | [72] |
| | | *F. semitectum* ITEM-393 | - | antifungal activity against filamentous fungi and difficult-to-treat human pathogenic fungi such as *Aspergillus* spp. | [73] |

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| **129** | fusaric acid | *Fusarium* sp. TP-G1 | the Root of *Dendrobium officinale* Kimura et Migo | antibacterial activity against *A. baumannii*, with an MIC of 64μg /mL | [5] |
| | | *F. oxysporum* EF119 | a healthy root of red pepper (*Capsicum annuum* L.), Korean | fusaric acid effectively suppressed the mycelial growth of two oomycetes, such as *P. capsici* and *P. infestans* with $IC_{50}$ values less than 1 μg/mL. Fusaric acid suppressed completely the growth of all bacteria tested at concentrations less than 100 μg/mL. The $IC_{50}$ values ranged from 0.2 to 12 μg/mL. | [74] |
| | | *F. fujikuroi* | the Aerial parts of *Paepalanthus chiquitensis* (Eriocaulaceae), Brazil | moderate antimicrobial activity for all the bacterial strains evaluated. | [53] |
| | | *F. verticillioides* RRC 408 and MRC 826 | - | inhibitory to the growth of most *Bacillus* species | [75] |
| | | *F. oxysporum* PR-33 | Torres-Rio Grande do Sul, Brazil | inhibit the growth of most *Bacillus* species | [76] |
| **130** | equisetin | *F. equiseti* NRRL 5537 | - | against several strains of Gram-positive bacteria *B. subtilis, M. phlei* and *S. aureus* and the Gram-negative bacteria *N. perflava,* at concentrations of 0.5-4.0 μg/mL of growth substrate | [77] |
| | | Coculture of *S. erythraea* with *F. pallidoroseum* | - | minimum inhibitory concentrations were <1.25 μg against *S. aureus* and 2.5 μg against *S. erythraea*. | [78] |
| | | *Fusarium* sp. | *Opuntia dillenii* | antibacterial activities against the Gram-positive bacteria *B. subtilis, S. aureus* and MRSA with MICs of 8–16 μg/ mL | [79] |
| | | *F. equiseti* AGR12 | the stem of *Rhizophora stylosa* Griff | remarkable antimicrobial activities against *B. subtilis* and *S. aureus*, with MIC value of 32 μg/mL | [16] |
| | | *F. equiseti* SCSIO 41019 | Sponge (*Callyspongia* sp.), China | strongest antibacterial activities against *S. aureus* and MRSA with MIC values of 2.0 and 3.9 μg/mL, respectively | [15] |
| **131** | fusarithioamide A | *F. chlamydosporium* | the inner tissue of *A. garcinii* leaves | antibacterial potential towards *B. cereus*, *S. aureus*, and *E. coli* with inhibition zone diameters (IZDs) of 19.0, 14.1, and 22.7 mm, respectively and MICs values of 3.1, 4.4, and 6.9 μg/mL, respectively; the most potent antifungal activity towards *C. albicans* (IZD 16.2 mm) comparable to clotrimazole (IZD 18.5 mm, positive control) | [80] |
| **132** | fusarithioamide B | *F. chlamydosporium* | *Anvillea garcinii* (Burm.f.) DC. (Asteraceae), Egypt | selective antifungal activity towards *C. albicans* (MIC 1.9 μg/mL and IZD 14.5 mm), comparing to clotrimazole (MIC 2.8 μg/mL and IZD 17.9 mm); possessed high antibacterial potential towards *E. coli*, *B. cereus*, and *S. aureus* compared to ciprofloxacin. | [81] |
| **133** | beauvericin | *F. redolens* Dzf2 | rhizomes of *Dioscorea zingiberensis* | strong activity in vitro against *E. coli*, *A. tumefaciens*, *P. lachrymans*, *X. vesicatoria*, *B. subtilis* and *S. haemolyticus* | [82] |
| | | *F. proliferatum* CECT 20569 | CECT Valencia, Spain | activity against *C. perfringens* CECT 4647, *S. enterica* | [83] |
| | | *F. oxysporum* | the bark of *C. kanehirae*, | anti-bacterial activity towards MRSA and *B. subtilis* (MIC= 3.125 | [17] |

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| | | | Taiwan Province | μg/mL). | |
| | | *Fusarium* sp. TP-G1 | the Root of *Dendrobium officinale* Kimura et Migo | good antibacterial activities against *S. aureus* and MRSA with MIC value of 4.0 μg/mL | [5] |
| **134** | | *Fusarium* sp. MOBCOF-1 | The surface of the alga *Codium fragile*, the east coast of Scotland | activity against *S. aureus* and vancomycin resistant *enterococci* VRE788 | [84] |
| | | *F. tricinctum* | healthy rhizomes of *Aristolochia paucinervis*, Morocco | antibacterial activity against *B. subtilis, S. aureus, S. pneumoniae*, and *E. faecalis* with MIC values in the range 2−8 μg/mL | [64] |
| **135** | enniatin A, A1, B and B1 | *F. tricinctum* CECT 20150 | Spain | antibacterial activity against *C. perfringens* and *S. aureus* CECT 976 | [85] |
| | | *F. oxysporum* (N17B) | a grassy area in Lakselv, Norway | moderate activity against *C. albicans, C. neoformans,* and *M. intracellulare* | [56] |
| **136** | | *F. dimerum* | the plant tissue of *Magnolia x soulangeana* Soul. - Bod., Slovakia | effective against *B. subtilis* CCM 1999, *C. albicans* CCY 29391, *T. cutaneum* CCY 30510 and *C. neoformans* CCY 1716 | [86] |
| **137** | | *F. tricinctum* Salicorn 19 | The aerial parts of *S. bigelovii*, China | powerful antimicrobial activities toward *B. subtilis*, *E. aerogenes* and *M. tetragenus* with MIC values 13, 13 and 6 μM | [34] |
| | | *F. lateritium* Nees | - | strong antifungal activity against *E. armeniaca* | [87] |
| **138** | fusaramin | *Fusarium* sp. FKI-7550 | soil, Japan | growth inhibition against some Gram-positive bacteria (*S. aureus*, *B. subtilis* and *K. rhizophila*), one Gram-negative bacterium (*X. oryzae* pv. oryzae) and multidrug-sensitive *S. cerevisiae* 12geneΔ0HSR-iERG6 | [55] |
| **139** | 2-oxo-8-azatricyclo [9.3.1.13,7]-hexadeca-1(15),3(16),4,6,11,13-hexaen-10-one | *F. oxysporum* YP9B | the tomato plant root in Pazar-Rize, Turkey | a significant antimicrobial effect at concentrations of 0.8-6.3 μg/mL against bacterial and fungi. | [25] |
| **140** | (1-benzyl-2-methoxy-2-oxoethyl)-2-hydroxy-3-methylbutanoate | | | a strong antimicrobial effect at concentrations of 0.47-1.8 μg/mL against Gram-positive bacteria (*S. aureus*, *E. faecalis*, *S. mutans*, *B. cereus*, and *M. smegmatis*) and a moderate antimicrobial effect against Gram-negative bacteria and fungi at concentrations of 60 μg/mL | |
| **141** | 2,3-dihydroxypropanoic (11*Z*)-octadecenoic anhydride | | | a moderate antimicrobial effect at concentrations of 3.8-30.6 μg/mL against bacterial and fungi | |
| **142** | 2,3-dihydroxypropanoic, (9*E*,12*E*)-octadecadienoic anhydride | | | | |
| **143** | chrysophanol | *F. equiseti* | the brown alga *Padina pavonica*, the Red Sea | antibacterial and antifungal activity. w-hydroxyemodin and cordycepin were potent against *B. subtilis*, *S. aureus* and *C. albicans*. Cyclo (L-Pro-L-Val) was the most potent against *B. megaterium* while, 17-demethyl-2,11- dideoxy-rhizoxin was more active against *C. albicans*. chrysophanol was more active against *S. aureus* | [88] |
| **144** | ω-hydroxyemodin | | | | |
| **145** | 17-Demethyl-2,11-dideoxy-rhizoxin | | | | |
| **146** | perlolyrine | | | | |
| **147** | cordycepin | | | | |
| **148** | cyclo-(*L*-Ala-*L*-Leu) | | | | |
| **149** | cyclo(*L*-Pro-*L*-Val) | | | | |

Table S6. Detail information for *Fusarium*-derived antiviral SMs.

| No. | Name | Strain | Source | Bioactivity | Ref. |
|---|---|---|---|---|---|
| **64** | fusapyridon A | *Fusarium* sp. CPCC 400857 | the stem of tea plant | antiviral activity against the coronavirus (HCoV-OC43) with IC50 values of 13.33 and 6.65 μM, respectively | [89] |
| **99** | fusaricide | *Fusarium* sp. | Flowers of sourwood *(Oxydendron arboreum)*, Georgia State Botanical Garden in Athens | anti-HIV | [52] |
| **105** | oxysporidinone | *Fusarium* sp. CPCC 400857 | the stem of tea plant | antiviral activity against the coronavirus (HCoV-OC43) with IC50 values of 13.33 and 6.65 μM, respectively | [89] |
| **135** | enniatin A1 | *Fusarium* sp. | - | The compounds protected human lymphoblastoid cells from HIV-1 induced cell killing with an in vitro"therapeutic index" of approximately 200 ($IC_{50}$ = 1.9 μg $ml^{-1}$, $EC_{50}$ = 0.01 μg $ml^{-1}$) | [90] |
| **136** | enniatin B | | | | |
| **137** | enniatin B1 | | | | |
| **140** | (1-benzyl-2-methoxy-2-oxoethyl)-2-hydroxy-3-methylbutanoate | *F. oxysporum* YP9B | the tomato plant root in Pazar-Rize, Turkey | antiviral activity against HSV type-1 was determined to be 0.312 μM | [25] |
| **141** | 2,3-dihydroxypropanoic (11*Z*)- octadecenoic anhydride | *F. oxysporum* YP9B | the tomato plant root in Pazar-Rize, Turkey | antiviral activity against HSV type-1 was determined to be 1.25 μM | [25] |
| **142** | 2,3-dihydroxypropanoic, (9*E*,12*E*)-octadecadienoic anhydride | | | | |
| **144** | ω-hydroxyemodin | *F. equiseti* | the brown alga *Padina Pavonica,* the Red Sea | Cordycepin showed less potency, 17-demethyl-2,11-dideoxy-rhizoxin and perlolyrine were moderately potent. Cyclo (*L*-Pro-*L*-Val) showed good potency against HCV NS3/4A protease while, ω- hydroxyemodin was the most potent HCVPR inhibitors | [88] |
| **145** | 17-Demethyl-2,11-dideoxy-rhizoxin | | | | |
| **146** | perlolyrine | | | | |
| **147** | cordycepin | | | | |
| **149** | cyclo(*L*-Pro-*L*-Val) | | | | |
| **150** | fusaindoterpene B | *Fusarium sp.* L1 | the inner tissue of the sea star *Acanthaster planci*, China | inhibitory activity against the Zika virus (ZIKV) in a standard plaque assay with $EC_{50}$ values of 7.5, 4.2, and 5.0 μM, respectively. | [91] |
| **151** | JBIR-03 | | | | |
| **152** | 1,2-bis(1*H*-indol-3-yl) ethane-1,2-dione | | | | |
| **153** | ara-A | *F. equiseti* | the brown alga *Padina Pavonica,* the Red Sea | ara-A showed less potency, cyclic tetrapeptidecyclo-[Phenylalanyl-proleu-pro], 5-chloro-3,6-dihydroxy-2-methyl-1,4-benzoquinone and were moderately potent; griseoxanthone C showed good potency against HCV NS3/4A protease while, and cyclo (*L*-Tyr-*L*-Pro) was the most potent HCVPR inhibitors | [88] |
| **154** | cyclic tetrapeptidecyclo-[Phenylalanyl-proleu-pro] | | | | |
| **155** | cyclo (*L*-Tyr-*L*-Pro) | | | | |
| **156** | 5-chloro-3,6-dihydroxy-2-methyl-1,4-benzoquinone | | | | |
| **157** | griseoxanthone C | | | | |
| **158** | coculnol | coculture of *F. solani* FKI-6853 and *Talaromyces* sp. FKA-65 | soil, Japan | an inhibitory effect (with $IC_{50}$ value of 283 μg $ml^{-1}$) against A/PR/8/34 (H1N1) | [92] |

Table S7. Detail information for *Fusarium*-derived antiparasitic SMs.

| No. | Name | Strain | Source | Bioactivity | Ref. |
|---|---|---|---|---|---|
| **23** | anhydrofusarubin | *Fusarium* sp.PSU-F135 | marine brown alga *Colpomenia sinuosa* | weak antimalarial (*P. falciparum* K1) activity, with $IC_{50}$ values in the range 9.8-14 μM. | [12] |
| **28** | 9$\alpha$-hydroxyhalorosellinia A | *Fusarium* sp. PSU-F14 | a gorgonian sea fan | | |
| **29** | nigrosporin B | | | | |
| **59** | NG-391 | *Fusarium* sp. RK97-94 | - | antimalarial activity ($IC_{50}$ = 1.8 μM) (*P. falciparum* 3D7) | [93] |
| **104** | fusaripeptide A | *Fusarium* sp. | the roots of *Mentha longifolia* L. (Labiatae), Saudi Arabia | significant antiplasmodial activity toward *P. falciparum* (D6 clone) with an $IC_{50}$ value of 0.34 μM | [49] |
| **109** | javanicin | *Fusarium* sp. PSU-F135 | marine brown alga *Colpomenia sinuosa* | weak antimalarial (*P. falciparum* K1) activity, with $IC_{50}$ values in the range 9.8-14 μM. | [12] |
| **117** | bikaverin | *F. fujikuroi* | - | specifically effective against *Leishmania brasiliensis* | [94] |
| **133** | beauvericin | *Fusarium sp.* WC9 | *Caesalpinia echinata* Lam. (Brazilwood), Brazil | inhibit *T. cruzi* with $IC_{50}$ 2.43 μM | [95] |
| | | *F. oxysporum* SS46 | medicinal plant *Smallanthus sonchifolius* (Poepp.) H. Rob. | promising activity against *Leishmania braziliensis* | [96] |
| **134** | enniatin A | *F. tricinctum* Corda | the fruits of *Hordeum sativum* Jess | mild antileishmanial activities (displayed inhibition of the activity of thioredoxin reductase enzyme of *Plasmodium falciparum*) | [3] |
| **135** | enniatin A1 | | | | |
| **136** | enniatin B | | | | |
| **137** | enniatin B1 | | | | |
| **159** | bostrycin | *Fusarium* sp. PSU-F14 | a gorgonian sea fan | weak antimalarial (*P. falciparum* K1) activity, with $IC_{50}$ values in the range 9.8-14 μM. | [12] |
| **160** | solaninaphthoquione | *F. solani* PSURSPG227 | Soil, Thailand | weak antimalarial (*P. falciparum* K1) activity ($IC_{50}$ of 26.1 μM) | [97] |
| **161** | integracides F | *Fusarium* sp. | the roots of *Mentha longifolia* L., Saudi Arabia | significant anti-leishmanial activity towards *Leishmania donovani* with $IC_{50}$ values of 3.74 and 2.53 μg/mL, respectively and $IC_{90}$ values of 5.11 and 8.89 μg/mL, respectively. | [98] |
| **162** | integracides G | | | | |
| **163** | integracides H | | | Significant anti-leishmanial activity towards *Leishmania donovani* with $IC_{50}$ values of 4.75 and 3.29 μM, respectively compared to pentamidine ($IC_{50}$ 6.35 μM). | [99] |
| **164** | integracides J | | | | |
| **165** | dihydroNG391 | *Fusarium* sp. RK97-94 | - | antimalarial activity ($IC_{50}$ = 62.1 μM) (*P. falciparum* 3D7) | [93,100] |
| **166** | dihydrolucilactaene | | | potent antimalarial activity ($IC_{50}$ = 0.0015 μM) (*P. falciparum* 3D7 and K1) | |
| **167** | lucilactaene | | | potent antimalarial activity ($IC_{50}$ = 0.15 μM) (*P. falciparum* 3D7) | |
| **168** | 13$\alpha$-hydroxylucilactaene | | | potent antimalarial activity ($IC_{50}$ = 0.68 μM) (*P. falciparum* 3D7) | |
| **169** | demethyllucilactaene | | | antimalarial activity ($IC_{50}$ = 43.9 μM) (*P. falciparum* 3D7) | |
| **170** | (8*Z*)-demethyllucilactaene | | | weak antimalarial activity (*P. falciparum* 3D7) | |
| **171** | prelucilactaene G | | | antimalarial activity ($IC_{50}$ = 13.3 μM) (*P. falciparum* 3D7) | |

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| **172** | prelucilactaene H | | | antimalarial activity ($IC_{50}$ = 15.6 μM) (*P. falciparum* 3D7) | [101] |
| **173** | prelucilactaene A | | | antimalarial activity ($IC_{50}$ = 15.2 μM) (*P. falciparum* 3D7) | |
| **174** | prelucilactaene B | | | antimalarial activity ($IC_{50}$ = 26.9 μM) (*P. falciparum* 3D7) | |
| **175** | prelucilactaene E | | | antimalarial activity ($IC_{50}$ = 3.5 μM) (*P. falciparum* 3D7) | |
| **176** | prelucilactaene F | | | antimalarial activity ($IC_{50}$ = 4.3 μM) (*P. falciparum* 3D7) | |
| **177** | apicidin | *F. pallidoroseum*<br>*F. fujikuroi* | - | antimalarial activity (*Plasmodium berghei*) | [102]<br>[103]<br>[104] |
| **178** | apicidin A | | | | |
| **179** | apicidin B | | | | |
| **180** | apicidin C | | | | |
| **181** | apicidin $D_1$ | | | | |
| **182** | apicidin $D_2$ | | | | |
| **183** | apicidin $D_3$ | | | | |
| **184** | apicidin E | | | | |
| **185** | apicidin F | | | The determined $IC_{50}$ value of 0.67 μM (average of two replicates) is about 3-fold higher compared to the IC50 value of apicidin, which is about 0.2 μM. | [105] |

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