New aromatic polyketides from the marine-derived fungus *Pseudopithomyces maydicus* PSU-AMF350 and their antimicrobial activity

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**ABSTRACT**

Four new aromatic polyketides including two diphenyl ethers (pseudopithoethers A–B, 1–2), one benzofuranone (pseudopitho-none, 3) and one xanthone (pseudopithoxanthone, 4), along with two known compounds (5–6) and one new naturally occurring hydroquinone (\(\alpha,2,5\)-trihydroxyacetophenone, 7) were isolated from the marine-derived fungus *Pseudopithomyces maydicus* PSU-AMF350. Their structures were identified by analysis of spectroscopic data. All isolated compounds were tested for antimicrobial activity. Only compound 7 displayed antibacterial activity against methicillin-resistant *Staphylococcus aureus* with the MIC value of 128 \(\mu\)g/mL and against *S. aureus*, *Acinetobacter baumannii* NPRC005 and *A. baumannii* NPRC007 with the same MIC value of 200 \(\mu\)g/mL.

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1. Introduction

Natural products from marine organisms have been recognized as a promising source of useful metabolites due to their rich chemical diversity providing almost all types of organic structures and their ability to generate unique new lead compounds (Bhadury et al. 2006). In our ongoing search for bioactive secondary metabolites from marine-derived fungi in Thailand, *Pseudopithomyces maydicus* PSU-AMF350, isolated from a bryozoan in the genus *Schizoporella* which was collected from Phuket Province, Thailand, was investigated. The broth ethyl acetate extract of this fungus displayed antibacterial activity against *Staphylococcus aureus* and methicillin-resistant *S. aureus* with the MIC values of 128 and 200 μg/mL, respectively. Secondary metabolites isolated from *P. maydicus* have never been reported. However, a number of depsipeptides were isolated from *Pithomyces maydicus* (Bishop et al. 1965; Bishop and Russell 1967; Riches et al. 1967; Russell et al. 1976; Das et al. 1979) which is the synonym of *P. maydicus* (Ariyawansa et al. 2015). We report herein the isolation and structural elucidation of secondary metabolites from the marine derived fungus *P. maydicus* PSU-AMF350 as well as the evaluation of antimicrobial activity of the isolated compounds.

2. Results and discussion

Chemical investigation of the broth and mycelial extracts of *P. maydicus* PSU-AMF350 by various chromatography techniques led to the isolation of two new diphenyl ethers, pseudopithoethers A–B (1-2), one new benzoferanone, pseudopithonone (3), one new xanthone, pseudopithoxanthone (4), and two known compounds consisting of one xanthone, 1-hydroxy-6-methyl-8-hydroxymethylxanthone (5) (Hein et al. 1998), and one mellein derivative, isosclerone (6) (Klaiklay et al. 2012) (Figure 1). In addition, one hydroquinone, α,2,5-trihydroxyacetophenone (7) (Kloetzel et al. 1955), was obtained as a natural product for the first time. Their structures were identified using spectroscopic data including IR, UV, NMR and MS. Furthermore, the absolute configuration of 6 was determined to be S based on the similar specific rotation of 6, [α]_{D}^{25} +17.2 (c 0.34, CHCl₃), to that of isosclerone, [α]_{D}^{15} +19.0 (c 0.34, CHCl₃) (Morita and Aoki 1974).

![Figure 1. Structures of compounds 1–7 isolated from *Pseudopithomyces maydicus* PSU-AMF350.](image-url)
Pseudopithoether A (1) was obtained as a colorless solid, melting at 149-151 °C. The molecular formula was determined as C_{16}H_{16}O_{5} on the basis of HRESIMS (m/z 311.0890 [M + Na]^{+}). In the IR spectrum, absorption bands at 3423 and 1638 cm^{-1} suggested the presence of hydroxy and carbonyl groups, respectively. The $^1$H NMR spectroscopic data (Table S1) consisted of signals for two meta-coupled aromatic protons (δH 6.52 and 6.22, each d, J = 2.1 Hz, 1H), three aromatic protons of a 1,3,5-trisubstituted benzene [δH 6.45 (s, 1H), 6.31 (s, 1H) and 6.26 (t, J = 2.1 Hz, 1H)], one methoxy group (δH 3.74, t, 3H), two methyl groups (δH 2.27 and 2.23, each s, 3H) and two hydroxy protons (δH 8.79 and 8.44, each s, 1H). The $^{13}$C NMR spectrum (Table S1) displayed signals for one ester carbonyl carbon (δC 168.2), seven quaternary carbons (δC 160.1, 159.4, 159.2, 157.0, 141.3, 139.8 and 118.8), five methine carbons (δC 113.2, 112.3, 111.5, 104.6, 104.2), one methoxy carbon (δC 52.0) and two methyl carbons (δC 21.5 and 19.9). The aromatic proton resonating at δH 6.26 was assigned as H-1 and displayed the HMBC correlations with C-2 (δC 159.4), C-3 (δC 112.3), C-5 (δC 111.5) and C-6 (δC 159.2). The remaining aromatic protons, resonating at δH 6.45 and 6.31, were therefore attributed to H-3 and H-5, respectively, according to the coupling constants and multiplicities as well as the $^1$H-$^1$H COSY and HMBC correlations (Table S1). The attachment of the methyl group at C-4 was established by the HMBC correlations from H3-9 (δH 8.79) with C-3, C-4 (δC 114.3) and C-5. In addition, the substituent at C-2 was a hydroxy group according to its chemical shift and the HMBC correlations from 2-OH (δH 8.44) to C-1 (δC 104.2), C-2 and C-3. Based on the chemical shift of C-6, the substituent was an oxy group. Signal enhancement of H-1 and H-3 upon irradiation of 2-OH and that of H-3 and H-5 upon irradiation of H3-7 in the NOEDIFF experiments confirmed this assigned structure (Figure S35). Two meta-coupled aromatic protons were assigned as H-3′ (δH 6.52) and H-5′ (δH 6.22). H-3′ displayed the HMBC correlations with C-1′ (δC 118.8), C-4′ (δC 160.1) and C-5′ (δC 104.6) whereas H-5′ exhibited the same correlations with C-1′, C-3′ (δC 113.2), C-4′ and C-6′ (δC 157.0). The HMBC correlations of H3-9′ (δH 2.27) with C-1′, C-2′ (δC 139.8) and C-3′ and those of 4′-OH (δH 8.79) with C-3′, C-4′ and C-5′ suggested the attachment of the methyl and hydroxy groups at C-2′ and C-4′, respectively. Meanwhile, the methoxy protons, H3-8′ (δH 3.74), exhibited the HMBC correlation with the ester carbonyl carbon, C-7′ (δC 168.2), revealing the presence of a methyl ester unit. This moiety was attached at C-1′ according to the HMBC correlations from both H-3′ and H-5′ to C-7′. This assignment was confirmed by signal enhancement of H-3′ and H-5′ upon irradiation of 4′-OH and that of H-3′ and H3-8′ upon irradiation of H3-9′ in the NOEDIFF experiments. Based on these data and the chemical shift of C-6′, an oxy group was attached at this carbon. Finally, an ether linkage between C-6 and C-6′ was established according to their chemical shifts and the molecular formula. Hence, pseudopithoether A had the structure 1.

Pseudopithoether B (2) was obtained as a colorless gum with the molecular formula C_{17}H_{16}O_{7} by HRESIMS (m/z 355.0788 [M + Na]^{+}). The UV spectrum showed absorption bands at 213, 248, and 294 nm while the IR spectrum displayed similar absorption bands to those of 1. The $^1$H NMR spectroscopic data (Table S2) were similar to those of 1 except for the replacement of three aromatic protons of a 1,3,5-trisubstituted benzene in 1 with two meta-coupled aromatic protons of a 1,2,3,5-tetrasubstituted benzene in 2. The hydroxy proton signals were not observed due to the use of
CD$_3$OD as an NMR solvent for 2 instead of acetone-$d_6$ in 1. In addition, the $^{13}$C NMR spectrum (Table S2) displayed the replacement of signal for one aromatic methine carbon in 1 with that for one quaternary $sp^2$ carbon ($\delta_C$ 115.1) and an additional signal of a carboxyl carbon ($\delta_C$ 176.4) in 2. The $^1$H-$^1$H COSY and HMBC correlations (Table S2) indicated that both 1 and 2 had an identical A ring. The aromatic proton at C-5 in B ring in 1 was replaced by a carboxyl group in 2 according to the HMBC correlations from H-1 ($\delta_H$ 6.16), H-3 ($\delta_H$ 6.19) and H$_3$-7 ($\delta_H$ 2.56) to the carboxyl carbon, C-8 ($\delta_C$ 176.4). The location of the methyl group was confirmed by signal enhancement of only H-3 upon irradiation of H$_3$-7 in the NOEDIF experiment (Figure S35). Thus, 2 was identified as a new 5-carboxyl derivative of 1.

Pseudopithonone (3) was obtained as a colorless gum with the molecular formula C$_{10}$H$_{10}$O$_4$ by HRESIMS ($m/z$ 217.0471 [M + Na]$^+$), indicating that 3 had six degrees of unsaturation. It exhibited UV absorption bands at 257 and 1641 cm$^{-1}$ for hydroxy and ketone carbonyl groups, respectively. The $^1$H NMR spectrum (Table S3) revealed the presence of signals for three aromatic protons of a 1,2,4-trisubstituted benzene ($\delta_H$ 7.24 ($dd$, $J = 2.7$ and 9.0 Hz, 1H), 6.96 ($d$, $J = 9.0$ Hz, 1H) and 6.95 ($d$, $J = 2.7$ Hz, 1H)), one hydroxy proton ($\delta_H$ 8.64, $s$, 1H) and a 1-hydroxypropyl unit ($\delta_H$ 6.45 ($s$, 1H), 1.90 ($qd$, $J = 7.5$ and 15.3 Hz, 1H)/1.89 ($qd$, $J = 7.5$ and 15.3 Hz, 1H) and 0.89 ($t$, $J = 7.5$ Hz, 3H)). The $^{13}$C NMR spectrum (Table S3) contained signals for one carbonyl ($\delta_C$ 200.3), four quaternary ($\delta_C$ 165.6, 153.2, 120.9 and 106.9), three methine ($\delta_C$ 128.2, 114.6 and 108.5), one methylene ($\delta_C$ 29.9) and one methyl ($\delta_C$ 7.3) carbons. The aromatic proton resonating at $\delta_H$ 6.95 was assigned as H-5 and exhibited the HMBC correlations with C-6 ($\delta_C$ 153.2), C-7 ($\delta_C$ 128.2), C-9 ($\delta_C$ 165.6) and C-10 ($\delta_C$ 120.9) (Table S3). Thus, the remaining aromatic protons resonating at $\delta_H$ 7.24 and 6.96 were attributed to H-7 and H-8, respectively, on the basis of their multiplicities, coupling constants, the $^1$H-$^1$H COSY correlations and the HMBC correlations. The ketone carbonyl group ($\delta_C$ 200.3, C-1) was located at C-10 according to the HMBC correlation of H-5 with C-1. In addition, the substituents at C-6 and C-9 were oxy groups due to their chemical shifts. Meanwhile, the 1-hydroxypropyl unit was constructed on the basis of the $^1$H-$^1$H COSY correlations of H$_{ab}$-3 ($\delta_H$ 1.90 and 1.89) and H$_3$-4 ($\delta_H$ 0.89) as well as the HMBC correlations of H$_{ab}$-3 and H$_3$-4 with C-2 ($\delta_C$ 106.9) and those of 2-OH ($\delta_H$ 6.45) with C-2 and C-3 ($\delta_C$ 29.9). The HMBC correlations from both 2-OH and H$_{ab}$-3 to C-1 attached C-2 to C-1. An ether linkage between C-2 and C-9 was formed on the basis of the chemical shifts of C-2 and C-9 as well as the degrees of unsaturation. Based on the molecular formula, the substituent at C-6 was a hydroxy group. The observed specific rotation of 3, [a]$^25_D$ 0 (c 1.0, EtOH), indicated that this compound was a racemic mixture. Therefore, 3 was identified as 2,5-dihydroxy-2-ethyl-3(2$H$)-benzofuranone.

Pseudopithoxanthone (4) was obtained as yellow needles, melting at 150-152°C. The molecular formula was determined as C$_{16}$H$_{14}$O$_5$ on the basis of HRESIMS ($m/z$ 309.0733 [M + Na]$^+$). The UV and IR spectra were almost identical to those of compound 5 (Hein et al. 1998). The $^1$H and $^{13}$C NMR spectroscopic data (Table S4) were also similar to those of 5 (Hein et al. 1998) except for the replacement of signals for the meta-coupled aromatic protons in 5 with that for one aromatic proton of a penta-substituted benzene ($\delta_H$ 7.31, $q$, $J = 0.6$ Hz, 1H; $\delta_C$ 119.8) and the presence of an
additional signal of a methoxy group ($\delta_H 3.86, s, 3H; \delta_C 62.8$) in 4. The aromatic proton resonating at $\delta_H 7.31$ was attributed to H-5 based on the HMBC correlations with C-7 ($\delta_C 153.9$), C-8a ($\delta_C 118.3$), C-9 ($\delta_C 184.6$), C-10a ($\delta_C 154.3$) and C-13 ($\delta_C 17.5$) (Table S4). The methoxy group (H$_3$-12, $\delta_H 3.86$) was placed at C-7 according to the HMBC correlation of the methoxy protons with C-7 and the chemical shift of C-7. This assignment was confirmed by signal enhancement of H$_2$-11 ($\delta_H 5.08$) and H$_3$-13 upon irradiation of H$_3$-12 in the NOEDIFF experiment (Figure S35). Therefore, 4 was identified as a 7-methoxy derivative of 5.

$\alpha,2,5$-Trihydroxyacetophenone (7) was obtained as a yellow solid, melting at 125-127°C. The molecular formula C$_8$H$_8$O$_4$ was assigned based on HRESIMS ($m/z$ 191.0315 [M + Na]$^+$). The UV spectrum showed absorption bands at 245 and 300 nm while the IR spectrum exhibited absorption bands at 3422 and 1646 cm$^{-1}$ for hydroxy and ketone carbonyl groups, respectively. The $^1$H NMR spectrum (Table S5) contained signals for one chelated hydroxy proton ($\delta_H 11.16, s, 1H$), three aromatic protons of a 1,2,4-trisubstituted benzene ($\delta_H 7.21 (d, J = 3.0 Hz, 1H), 7.12 (dd, J = 3.0 and 9.0 Hz, 1H)$ and $6.86 (d, J = 9.0 Hz, 1H)$), one hydroxymethyl group ($\delta_H 4.89 (s, 2H)$ and 4.09 ($br s, 1H$)) and one hydroxy proton ($\delta_H 8.33, br s, 1H$). The $^{13}$C NMR spectrum (Table S5) contained eight carbon resonances for one carbonyl ($\delta_C 204.9$), three quaternary ($\delta_C 156.0, 150.5$ and 118.1), three methine ($\delta_C 126.1, 119.6$ and 114.3) and one methylene ($\delta_C 66.0$) carbons. The chelated hydroxy proton (4-OH, $\delta_H 11.16$) which was located at C-4 ($\delta_C 156.0$), a peri position to the ketone carbonyl group ($\delta_C 204.9, C-1$), exhibited the HMBC correlations with C-3 ($\delta_C 118.1$), C-4, C-5 ($\delta_C 119.6$) (Table S5). The aromatic proton resonating at $\delta_H 6.86$ was located at C-5 according to its HMRC cross peak with C-5. Hence, the remaining aromatic protons resonating at $\delta_H 7.21$ and 7.12 were assigned as H-8 and H-6, respectively, on the basis of their multiplicities, the $^1$H-$^1$H COSY correlations and the HMBC correlations (Table S5). Meanwhile, H$_2$-2 ($\delta_H 4.89$) exhibited the $^1$H-$^1$H COSY correlation with the hydroxy proton, 2-OH ($\delta_H 4.09$), supporting the presence of the hydroxymethyl unit. This moiety was attached at C-1 on the basis of the HMBC correlation from H$_2$-2 to C-1. In addition, the substituent at C-7 ($\delta_C 150.5$) was a hydroxy group ($\delta_H 8.33$) according to its chemical shift. Consequently, 7 was a new naturally occurring compound which was previously synthesized from 2,5-diacetoxy-$\alpha$-diaoacetophenone (Kloetzel et al. 1955).

All the isolated compounds (1-7) were tested for antimicrobial activities against gram-positive bacteria ($S. aureus$ and methicillin-resistant $S. aureus$), gram-negative bacteria ($Pseudomonas aeruginosa$ ATCC27853, $Escherichia coli$ ATCC25922, $Acinetobacter baumannii$ NPR005 and A. baumannii NPR007), yeast ($Candida albicans$ NCPF3153, $Cryptococcus neoformans$ ATCC90112 flucytosine–resistant and $C. neoformans$ ATCC90113 flucytosine–resistant) and pathogenic fungi ($Microsporum gypseum$ SK-MU4 and $Talaromycetes marneffei$ PSU-SKH1). Only compound 7 displayed antibacterial activities against methicillin-resistant $S. aureus$ with the MIC value of 128 $\mu$g/mL and against $S. aureus$, A. baumannii NPR005 and A. baumannii NPR007 with the same MIC values of 200 $\mu$g/mL. The remaining compounds were inactive against all tested microorganisms.

In this study, four new compounds (1-4) and two known ones (5-6) along with one new naturally occurring compound (7) were purified from the $P. maydica$ PSU-
AMF350 extracts. To the best of our knowledge, diphenyl ether, xanthone, benzofuranone and hydroquinone derivatives are obtained from this genus for the first time. In addition, this is the first report of the antimicrobial activity of compound 7.

3. Experimental

3.1. General experimental procedures

Melting points were determined on Electrothermal 9100. Infrared (IR) spectra were recorded with a Perkin-Elmer spectrum BX FT-IR spectrometer. Ultraviolet (UV) spectra were obtained using a Shimadzu UV-2600 UV-Vis spectrophotometer in MeOH. $^1$H and $^{13}$C Nuclear Magnetic Resonance ($^1$H and $^{13}$C NMR) spectra were recorded on 300 MHz Bruker FTNMR Ultra Shield$^{\text{TM}}$ spectrometer. Specific rotations were measured with a JASCO P-2000 polarimeter. ESI-TOF mass spectra were obtained using a TOF/Q-TOF Mass spectrometer. Thin-layer chromatography (TLC) and preparative TLC were performed on silica gel 60 GF$_{254}$ (Merck). Column chromatography (CC) was conducted on silica gel (Merck) type 100 (70-230 mesh ASTM) and type 60 (230-400 mesh ASTM), Sephadex LH-20 or reverse phase C$_{18}$ silica gel.

3.2. Fungal material

The marine-derived fungus PSU-AMF350 (BCC84332) was isolated from a bryozoan in the genus Schizoporella collected from Phuket Province, Thailand. This isolate was identified based on molecular characteristics. The molecular analysis of the internal transcribed spacers (ITS) ribosomal DNA (GenBank accession number MF919624) revealed that PSU-AMF350 had affinity within the order Pleosporales. Additional DNA analysis of partial large subunit (LSU) ribosomal DNA (GenBank accession number MF919633) showed that PSU-AMF350 sequence were well nestled within a clade comprising strains of Pseudopithomyces maydicius KX034666, HG933822, HG933820 and HG933821 (99% sequence identity). Hence, this isolate can be identified as Pseudopithomyces maydicius.

3.3. Fermentation, extraction and isolation

The crude broth ethyl acetate (BE, 1.7 g) and the mycelial hexane (CH, 1.7 g) extracts were obtained as a dark brown gum using the same procedure as previously described (Trisuwan et al. 2010). The crude BE extract was subjected to CC over Sephadex LH-20 using MeOH/CH$_2$Cl$_2$ (1:1) to afford seven fractions (A-G). Fraction C (109.5 mg) was dissolved in chloroform to afford a chloroform soluble part and a chloroform insoluble one. The chloroform soluble part (97.3 mg) was purified by CC over silica gel using MeOH/CH$_2$Cl$_2$ (3:97) to obtain three subfractions (C1-C3). Subfraction C1 (24.5 mg) was purified by preparative TLC using 100% CH$_2$Cl$_2$ to afford 4 (6.8 mg). Fraction D (371.0 mg) was separated by CC over silica gel using a gradient of MeOH/CH$_2$Cl$_2$ to give eight subfractions (D1-D8). Subfraction D2 (28.9 mg) was purified by CC over silica gel using 100% CH$_2$Cl$_2$ to afford five subfractions (D21-D25).
Subfraction D22 (6.4 mg) was purified using the same method as subfraction C1 to obtain 6 (2.7 mg). Subfraction D3 (14.1 mg) was purified using the same method as subfraction C1 to obtain 1 (6.1 mg). Subfraction D4 (9.8 mg) was separated by preparative TLC using MeOH/CH2Cl2 (3:97) to give 3 (5.6 mg). Subfraction D8 (183.4 mg) was purified by CC over reverse phase C18 silica gel using MeOH/H2O (1:1) to give four subfractions (D81-D84). Subfraction D82 (53.5 mg) was purified by CC over reverse phase C18 silica gel using MeOH/H2O (2:3) to obtain 2 (28.1 mg). Fraction E (50.5 mg) was separated by CC over silica gel using MeOH/CH2Cl2 (3:97) to afford four subfractions (E1-E4). Subfraction E2 (9.8 mg) was purified by preparative TLC using MeOH/CH2Cl2 (2:98) to afford 7 (2.3 mg). The crude CH extract was subjected to CC over Sephadex LH-20 using MeOH/CH2Cl2 (1:1) to give three fractions (A-C). Fraction C (104.8 mg) was purified by CC over silica gel using MeOH/CH2Cl2 (1:99) to obtain 5 (14.2 mg).

Pseudopithoether A (1): colorless solid; m.p.149-151°C; UV (MeOH) \( \lambda_{\text{max}} \) (log e) 202 (4.54), 283 (4.52) nm; IR (neat) \( \nu_{\text{max}} \) 3423, 1638 cm\(^{-1}\); \(^1\)H and \(^{13}\)C NMR (acetone-\(d_6\)) see Table S1; HRESIMS m/z 311.0890 [M + Na]\(^+\) (calcd for C\(_{16}\)H\(_{16}\)O\(_5\)Na, 311.0890).

Pseudopithoether B (2): colorless gum; UV (MeOH) \( \lambda_{\text{max}} \) (log e) 213 (4.72), 248 (4.34), 294 (3.84) nm; IR (neat) \( \nu_{\text{max}} \) 3422, 1638 cm\(^{-1}\); \(^1\)H and \(^{13}\)C NMR (CD\(_3\)OD) see Table S2; HRESIMS m/z 355.0788 [M + Na]\(^+\) (calcd for C\(_{17}\)H\(_{16}\)O\(_7\)Na, 355.0788).

Pseudopithonone (3): colorless gum; \([\alpha]_{D}^{25}\) 0 (c 1.0, EtOH); UV (MeOH) \( \lambda_{\text{max}} \) (log e) 257 (3.50), 382 (3.19) nm; IR (neat) \( \nu_{\text{max}} \) 3422, 1641 cm\(^{-1}\); \(^1\)H and \(^{13}\)C NMR (CD\(_3\)OD) see Table S3; HRESIMS m/z 217.0471 [M + Na]\(^+\) (calcd for C\(_{10}\)H\(_{10}\)O\(_4\)Na, 217.0471).

Pseudopithoxanthone (4): yellow needles; m.p. 150-152°C; UV (MeOH) \( \lambda_{\text{max}} \) (log e) 233 (3.40), 290 (3.00), 372 (2.72); IR (neat) \( \nu_{\text{max}} \) 3400, 1635 cm\(^{-1}\); \(^1\)H and \(^{13}\)C NMR (CDCl\(_3\)) see Table S4; HRESIMS m/z 309.0733 [M + Na]\(^+\) (calcd for C\(_{16}\)H\(_{14}\)O\(_5\)Na, 309.0733).

\(\alpha,2,5\)-Trihydroxyacetophenone (7): colorless solid; m.p. 125-127°C; UV (MeOH) \( \lambda_{\text{max}} \) (log e) 256 (2.93), 361 (2.67) nm; IR (neat) \( \nu_{\text{max}} \) 3422, 1646 cm\(^{-1}\); \(^1\)H and \(^{13}\)C NMR (acetone-\(d_6\)) see Table S5; HRESIMS m/z 191.0315 [M + Na]\(^+\) (calcd for C\(_8\)H\(_8\)O\(_4\)Na, 191.0315).

3.4. Antimicrobial assay

Antimicrobial activity was evaluated according to the Clinical and Laboratory Standards Institute (Phongpaichit et al. 2006). Minimum Inhibitory Concentration (MIC) values were recorded by determining the lowest extract concentration that inhibited visible growth. Vancomycin was used as positive control against S. aureus and methicillin-resistant S. aureus and displayed the MIC values of 0.25 and 1 \(\mu\)g/mL, respectively, while colistin was used as positive control against A. baumannii NPRC005 and A. baumannii NPRC007 with the equal MIC values of 8 \(\mu\)g/mL. The tested compounds with MIC value of >200 \(\mu\)g/mL are considered to be inactive.

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Disclosure statement
No potential conflict of interest was reported by the authors.

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