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SHORT REPORT

Two new flavonoid glycosides from *Cissus trilobus* (Lour.) Merr.

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Abstract: Two new flavonoid glycosides, 5-ethoxy-6-[(*E*)-2-carboxyethenyl]-acacetin-7-*O*-α-L-rhamnopyranoside (**1**) and acacetin-8-*C*-*β*-D-canaropyranoside (**2**), together with two known compounds, apigenin-7-*O*-*β*-D-glucopyranoside (**3**) and acacetin-8-*C*-*β*-D-glucopyranoside (**4**), were isolated from the aerial part of *C. trilobus*. Their structures were elucidated through a comprehensive analysis of spectroscopic data (1D- and 2D-NMR and HR-ESI-MS). Bioactivity evaluation revealed compound **1** has cytotoxicity against A549 cells (IC_{50} 41.04 ± 2.86 μM) and MDA-MB-231 cells (IC_{50} 33.49 ± 4.28 μM).

Keywords: *Cissus trilobus*, flavonoid glycoside, cytotoxicity

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1 Plant Source

The aerial parts of *Cissus trilobus* (Lour.) Merr. were collected in November 2022 from Tra Vinh Province, Vietnam. The plant material was authenticated by Prof. Tran Thi Van Anh at the University of Medicine and Pharmacy at Ho Chi Minh city. A voucher specimen (No. CV-TV-072022) was deposited at the Department of Pharmacognosy and Traditional Medicine, School of Pharmacy, University of Medicine and Pharmacy at Ho Chi Minh city.

2 Previous Studies

Cissus trilobus (Lour.) Merr. (synonym: *Cissus modeccoides* Planch.), belonging to the Vitaceae family, is a climbing vine commonly cultivated or found growing wild in Vietnam. This species is also distributed across Thailand and other Southeast Asian countries (El-Shiekh et al., 2025). In Vietnamese folk medicine, *C. trilobus* is used for the treatment of joint pain, headaches, rheumatism, and swelling; it is also considered a diuretic and detoxifying agent (Do et al., 2006). In Thailand, this plant is used as an antidiabetic agent (Pradit et al., 2019).

Previous phytochemical investigations revealed that *C. trilobus* contains anthraquinones (chrysophanol, emodin, and physcion), phenolic compounds (lasiodiplodin, trans-4-hydroxymellein, and 4-hydroxybenzoic acid), megastigmanes (blumenol A, blumenol B), alkaloids, and flavonoid glycosides (Ho et al., 2024; Nguyễn et al., 2022). Regarding pharmacological activity, *C. trilobus* was assessed for hypoglycemic potential in alloxan-induced diabetic rats; however, the hot aqueous extract failed to exhibit any antidiabetic effect and, instead, exhibited adverse effects (Pradit et al., 2019).

3 Present Study

The dried aerial parts of *C. trilobus* (7.0 kg) were exhaustively extracted by percolation with 96% ethanol. The combined filtrates were concentrated under reduced pressure and subsequently suspended in water, then partitioned with solvents of increasing polarity. After solvent removal, the respective fractions obtained were *n*-hexane (151.2 g), dichloromethane (40.15 g), ethyl acetate (27.66 g), *n*-butanol (55.07 g), and a residual aqueous fraction (120.18 g). The dichloromethane fraction (38.55 g) was subjected to silica gel column chromatography, eluted with a gradient system of CH_2Cl_2–EtOAc (98:2–30:70, v/v), followed by EtOAc–MeOH (90:10, v/v), to afford 22 fractions (B.1–B.22). Fraction B.10 (2.35 g) was further separated by silica gel column chromatography using a gradient solvent system of *n*-hexan–EtOAc (50:50–0:100, v/v) and subsequently eluted with EtOAc–MeOH (100:0–20:80) to yield 27 subfractions (B.10.1–B.10.27). Compound **1** (22.0 mg) was obtained as a precipitate from subfraction B.10.21 (270.7 mg) upon the addition of methanol.

The EtOAc fraction (26.63 g) was subjected to silica gel CC, eluting with a gradient of $CHCl_3$–MeOH (100:0–50:50, v/v), to obtain 18 fractions (C.1–C.18). Fraction C.3 (204.0 mg) was subjected to a Sephadex LH-20 column, eluting with 100% MeOH, to yield 6 subfractions. Subfraction C.3.3 was further purified by silica gel CC using $CHCl_3$-EtOAc (80:20, v/v) to obtain compound **2** (8.3 mg). Fraction C.5 (235.0 mg) was applied to a Sephadex LH-20 CC and eluted with 100% MeOH to obtain 9 subfractions. Subfraction C.5.8 (20.4 mg)

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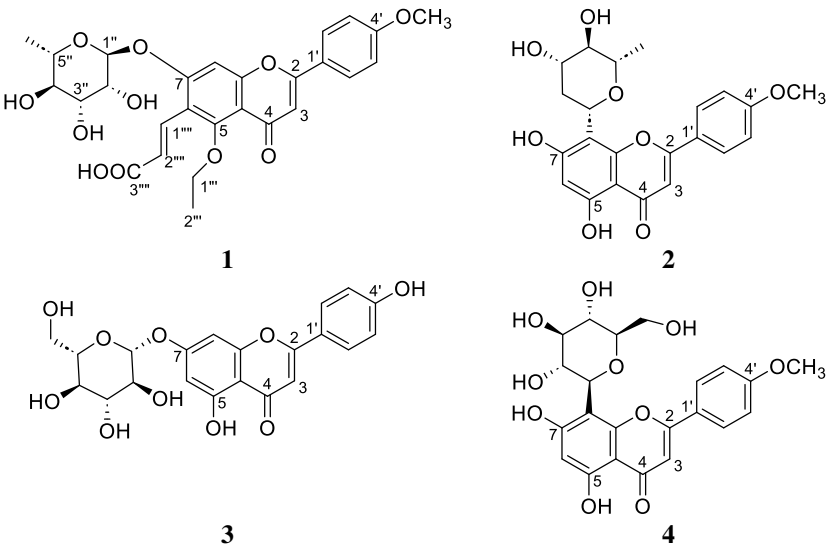

Figure 1. Structures of isolated compounds **1**–**4**

was purified by RP-18 silica gel CC, eluting with MeOH: H_2O (5:5), to afford compound **3** (5.9 mg). Fraction C.9 (336.0 mg) was fractionated over a Sephadex LH-20 column using 100% methanol, and subfraction C.9.6 (51.4 mg) was further purified by silica gel CC, eluted with $CHCl_3$–MeOH (92:8, v/v) to yield compound **4** (5.2 mg) (Figure 1).

5-ethoxy-6-[(*E*)-2-carboxyethenyl]-acacetin-7-*O*-α-L-rhamnopyranoside (**1**): Yellow amorphous powder, $[\alpha]_D^{20}$ –18.0 (c 0.06, MeOH), UV (MeOH) λ_{max} 319 nM. IR ν_{max} (cm^{-1}): 3437, 2250, 2125, 1660, 1053, 1025, 1006, 821, 759. HR-ESI-MS: m/z 529.17105 $[M + H]^+$ (calc. for $C_{27}H_{29}O_{11}^+$ 529.1709). ^{1}H-NMR (DMSO-d_6, 600 MHz) and ^{13}C-NMR (DMSO-d_6, 150 MHz), see Table 1.

Acacetin-8-*C*-*β*-D-canaropyranoside (**2**): Yellow amorphous powder, $[\alpha]_D^{20}$ –10.0 (c 0.05, MeOH) UV (MeOH) λ_{max} 271, 326 nM. FT-IR ν_{max} (cm^{-1}): 3350, 2477, 2217, 2072, 1644, 1120, 973, 823, 486. HR-ESI-MS: m/z 415.13958 $[M - H]^+$ (calc. for $C_{22}H_{21}O_8^-$ 415.13929). ^{1}H-NMR (methanol-d_4, 600 MHz) and ^{13}C-NMR (methanol-d_4, 150 MHz), see Table 1.

Compound **1** was obtained as the amorphous yellow powder. Its molecular formula was determined to be $C_{27}H_{28}O_{11}$ based on the HR-ESI-MS peak at m/z 529.17105 $[M + H]^+$ (calcd. for $C_{27}H_{29}O_{11}^+$, 529.1709), indicating 14 degrees of unsaturation. The IR spectrum of **1** showed a broad band at 3437 cm^{-1} (O-H stretching) and a strong signal at 1660 cm^{-1} characteristic of a conjugated carbonyl group. The ^{13}C-NMR and ^{1}H-NMR (DMSO-d_6, 600/150 MHz) spectra exhibited signals typical of an acacetin skeleton. These included a carbonyl carbon at δ_C 182.3 (C-4) and two aromatic proton doublets at δ_H 8.12 (d, J = 8.5 Hz, H-2′/6′) and 7.13 (d, J = 8.5 Hz, H-3′/5′) for ring B. Two singlet protons at δ_H 7.05 (1H, s) and 7.10 (1H, s) were assigned to H-3 and H-8, respectively. The presence of a methoxy group at C-4′ was confirmed by HMBC correlation. The sugar moiety was assigned as an *O*-glycoside. The NMR signals at δ_C 98.9 (C-1″) and δ_H 5.71 (1H, d, J = 1.8 Hz, H-1″) together with the oxygenated carbons between δ_C 67.7–71.6 and a methyl group at δ_C 17.9 (C-6″) suggested the presence of an α*M*-L-rhamnopyranoside moiety. An HMBC correlation from H-1″ (δ_H 5.71) to C-7 (δ_C 160.1) established the attachment point at C-7. Additionally, an ethoxyl group was identified by aliphatic carbons at δ_C 59.9 (C-1‴) and 14.2 (C-2‴); its attachment at C-5 was confirmed by an HMBC correlation from H-1‴ (δ_H 4.20) to C-5 (δ_C 167.0). Finally, a 2-carboxyethenyl moiety was evidenced by carbon signals at δ_C 133.2 (C-1⁗), 120.1 (C-2⁗), and 167.8 (C-3⁗), along with two trans-olefinic protons at δ_H 7.91 (1H, d, J = 16.2 Hz, H-1⁗) and 6.86 (1H, d, J = 16.2 Hz, H-2⁗). The large coupling constant confirmed the *E*-geometry; HMBC correlations from δ_H 7.91 to C-5 (δ_C 167.0) and C-7 (δ_C 160.1) placed this group at C-6. The sugar moiety was identified as α-L-rhamnopyranoside through hydrolysis followed by derivatization with 2,3-naphthalenediamine. Analysis of the hydrolyzed product alongside a standard sample using HPLC-PDA and LC-MS, combined with the comparison of retention times and MS spectra, confirmed that the sugar linked at C-7 is α-L-rhamnopyranoside. Consequently, the structure of **1** was elucidated as 5-ethoxy-6-[(*E*)-2-carboxyethenyl]-acacetin-7-*O*-α-L-rhamnopyranoside (Figure 2).

Compound **2** was obtained as a yellow powder. A molecular formula of $C_{22}H_{22}O_8$ was determined by HR-ESI-MS m/z 415.13958 $[M + H]^+$ (calcd. for $C_{22}H_{22}O_8^+$ 415.13929), indicating 12 degrees of unsaturation. IR spectroscopic analysis of compound **2** revealed a weak, broad band at 3350 cm^{-1}, consistent with O-H stretching vibrations. The spectrum also exhibited a weak peak at 1644 cm^{-1}, suggesting the presence of conjugated carbonyl group. The ^{13}C-NMR and ^{1}H-NMR spectra showed signals characteristic of an acacetin skeleton, including a carbonyl carbon at δ_C 184.1 (C-4), two aromatic methines at δ_C 104.3 (C-3) and 100.0 (C-6), 7 quaternary carbons (δ_C 105.7–124.8), and 5 oxygenated carbons (δ_C 160.8–165.9). A para-disubstituted B-ring was indicated by two symmetric doublets at δ_H 8.08 and 7.14 (each 2H,

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Table 1. ^{1}H-NMR (600 MHz) and ^{13}C-NMR (150 MHz) of **1** and **2**

Position	1 (DMSO-d_6)		2 (Methanol-d_4)	
	δ_H, mult, (J in Hz)	δ_H	δ_H, mult, (J in Hz)	$\delta_{H,}$
2	–	164.1	–	165.9
3	7.05, s	103.8	6.68, s	104.3
4	–	182.3	–	184.1
5	–	167.0	–	162.5
6	–	106.7	6.28, s	100.0
7	–	160.0	–	160.2
8	7.10, s	93.7	–	107.1
9	–	157.5	–	160.6
10	–	105.0	–	105.7
1′	–	122.3	–	124.8
2′ (6′)	8.12, d (8.5)	128.6	8.08, d (9.0)	129.6
3′ (5′)	7.13, d (8.5)	114.6	7.14, d (9.0)	115.6
4′	–	162.7	–	164.5
4′-OCH_3	3.88, s, 3H	55.6	3.93, s, 3H	56.1
1″	5.71, d (1.8)	98.9	5.28, dd (2.2, 12.0)	72.1
2″	3.97, m	69.7	2.25, dt (13.0, 11.5)2.06, ddd (13.0, 5.0, 2.2)	39.2
3″	3.69, t (4.2)	70.6	3.70, ddd (11.5, 8.8, 5.0)	73.9
4″	3.36, m	71.6	3.25, t (9.0)	78.8
5″	3.42, m	70.4	3.51, dq (6.0, 9.0)	78.6
6″	1.15, d (6.0), 3H	17.9	1.43, d (6.0), 3H	18.7
1‴	4.20, q (7.1), 2H	59.9		
2‴	1.27, t (7.1), 3H	14.2		
1⁗	7.91, d (16.2)	133.2		
2⁗	6.86, d (16.2)	120.1		
3⁗	–	167.8		

d, J = 9.0 Hz). There is a methoxy group (δ_C 56.1, δ_H 3.93) at C-4′ since the proton of methoxy (δ_H 3.93) has an HMBC correlation to C-4′ (δ_C 164.5). The δ_H 6.28 (s) proton signal at H-6 exhibited an HMBC correlation with the quaternary C-8 (δ_C 107.1). The relatively upfield chemical shift of the anomeric carbon (δ_C 72.1) confirmed the presence of a *C*-glycosidic linkage at C-8. The sugar moiety was identified as a 2,6-dideoxy configuration, characterized by signals for an anomeric carbon (δ_C 72.1), three oxygen-bearing carbons (δ_C 73.9, 78.6 and 78.8), one methylene carbon (δ_C 39.2) and one methyl group (δ_C 18.7). The anomeric proton of the sugar (δ_H 5.28) shows COSY correlations with the two protons of the -CH_2- group (δ_H 2.25 and 2.06), indicating the absence of an -OH group at the C-2″ position. The sugar carbon positions were assigned based on the COSY correlations of their corresponding protons. The coupling constants of anomeric proton δ_H 5.28 (dd, J = 2.4, 12.0 Hz, H-1″) indicated an *axia*l orientation for H-1″. Furthermore, the H-4″ proton (δ_H 3.25) appeared as a triplet with J = 9.0 Hz, suggesting that H-3″ and H-5″ are both in *axial* positions (Ferrige & Lindon, 1980). The stereochemistry was further supported by ROESY spectral analysis; correlations between H-1″ (δ_H 5.28) and H-2$_a$″ (δ_H 2.25), H-3″(δ_H 3.70), and H-5″ (δ_H 3.51) as well as between H-2$_b$″ (δ_H 2.06) and H-4″(δ_H 3.25) identified the sugar moiety as β-canaropyranoside. The sugar moiety was identified as β-D-glucopyranose by comparing its spectroscopic data with literature values (Yu & Zhao, 2015) and further confirmed by ECD analysis. Consequently, the structure of compound **2** was identified as acacetin-8-C-β-D-canaropyranoside (Figure 2).

The other compounds were identified to be apigenin-7-*O*-β-D-glucopyranoside (**3**) (Peng et al., 2016) and acacetin-8-*C*-β-D-glucopyranoside (4′-methoxy vitexin) (**4**) based on comparison with the NMR data from the reference (Velozo et al., 2009).

3.1 Biological Activity

The cytotoxicity of the four isolated compounds was evaluated against A549 and MDA-MB-231 cancer cell lines. Cell viability was assessed using the MTT assay, where the reduction of MTT to formazan by mitochondrial SDH was measured spectrophotometrically at 570 nM to determine the percentage of living cells (Tuoi Do et al., 2024). Doxorubicin, a positive control, exhibited IC_{50} values of 0.164 ± 0.024 µM and 1.60 ± 0.86, respectively. Among isolates, only compound **1** showed significant activity, with IC_{50} values of 41.04 ± 2.86 µM (A549 cell line) and 33.49 ± 4.28 µM (MDA-MB-231 cell line). These results suggested that the presence of ethoxy and (*E*)-2-carboxyethenyl substituents on the A-ring may play a crucial role in modulating the cytotoxicity of the acacetin skeleton.

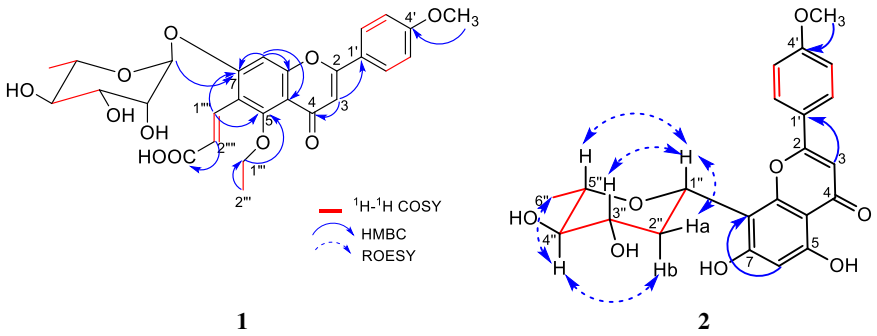

Figure 2. Key ^{1}H-^{1}H COSY, HMBC and ROESY

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Author Contributions

Conceptualization D.H.T, T.V.A.T; methodology T.T.T, T.V.A.T, D.H.T; investigation T.T.T., D.T.H, D.H.T., resources, T.T.T, D.T.H; data curation T.T.T, D.H.T, T.V.A. T; data curation T.T.T, T.V.A. T; writing-original draft preparation T.T.T, T.V.A; writing-review and editing all authors. All authors have read and agreed to the published.

Availability of Data and Materials

The authors declare that the data supporting the findings of this study are available within the paper and its Supplementary Information files. Should any raw data files be needed in another format they are available from the corresponding author upon reasonable request. Source data are provided with this paper.

Conflicts of Interest

The authors declare that they do not have any conflict of interest.

Supporting Information

Supplementary data to this article can be found online at http://www.acgpubs.org/journals/records-of-natural-products.

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References

Do, H. B., Dang, Q. C., Bui, X. C., Nguyễn, T. D. & Do, T. D. (2006). *Medicinal Plants and Animals in Vietnam* (vol. 1). Hanoi, Vietnam: Science and Technology Publishing House.

El-Shiekh, R. A., Shalabi, A. & Abdel-Sattar, E. (2025). A comprehensive review on Cissus L. species (family Vitaceae). *Natural Product Research*, 1–8 In Press. DOI: 10.1080/14786419.2025.2595529.

Ferrige, A. G. & Lindon, J. C. (1980). Application of resolution enhancement in FT NMR to the structural determination of deoxy sugars. *Spectroscopy Letters*, *13*(6), 339–345. DOI: 10.1080/00387018008064026.

Ho, D. T., Tran, D. H. & Tran, T. V. A. (2024). Megastigmane, alkaloid, flavonoid, and phenolic compounds from Cissus trilobus (Lour.) Merr. *Journal of Medicinal Materials*, *29*(3), 149–153.

Nguyễn, N. T., Nguyễn, T. B., Trần, H. D. & Nguyễn, T. A. T. (2022). Anthraquinones and phenolic compounds from Cissus modeccoides. *Ho Chi Minh City University of Education Journal of Science*, *19*(3), 524. DOI: 10.54607/hcmue.js.19.3.3392(2022).

Peng, H.-Y, Zhang, X.-H & Xu, J.-Z (2016). Apigenin-7-O-β-d-glycoside isolation from the highly copper-tolerant plant Elsholtzia splendens. *Journal of Zhejiang University-Science B*, *17*(6), 447–454. DOI: 10.1631/jzus.B1500242.

Pradit, W., Khumpook, T., Saenphet, K., Saenphet, S. & Chomdej, S. (2019). Evaluation the effects of cissus modeccoides hot aqueous extract on alloxan-induced diabetic rats. *Journal of Reports in Pharmaceutical Sciences*, *8*(1), 85–90. DOI: 10.4103/jrptps.jrptps_19_18.

Tuoi Do, T. H., Oanh Nguyễn, T. K., Nguyễn, L. T. T., Le, T. T. V., Le, T. K. A., Li, J., Chi Truong, H. P., Tran, M. H. & Van Le, T. H. (2024). Investigation of in vitro cytotoxic activity and in vivo anti-tumor activity in tumor-causing mice with 7,12-Dimethyl-benz[1]anthracene of Vietnamese processed panax notoginseng. *Natural Product Communications*, *19*(6), 1934578X241259830. DOI: 10.1177/1934578x241259830.

Velozo, L. S. M., Ferreira, M. J. P., Santos, M. I. S., Moreira, D. L., Guimarães, E. F., Emerenciano, V. P. & Kaplan, M. A. C. (2009). C-glycosyl flavones from Peperomia blanda. *Fitoterapia*, *80*(2), 119–122. DOI: 10.1016/j.fitote.2008.11.005.

Yu, J.-Q. & Zhao, L. (2015). Two new glycosides and one new neolignan from the roots of Cynanchum stauntonii. *Phytochemistry Letters*, *13*, 355–359. DOI: 10.1016/j.phytol.2015.07.015.