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# Phenolic constituents and biological activity of *Melanocenchris abyssinica*

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## Abstract

Five compounds were isolated from the ethyl acetate soluble portion of the alcoholic extract of *Melanocenchris abyssinica* aerial parts and identified on the basis of their spectroscopic data as p-coumaric acid (1), tricin (2), a diastereoisomer of tricin 4`-O-[*threo*-β-guaiacyl-(9``-O-acetyl)-glyceryl] ether [9``-acetylsalcolin A] and tricin 4`-O-[*erythro*-β-guaiacyl-(9``-O-acetyl)-glyceryl] ether [9``-acetylsalcolin B] (3), a diastereoisomer of tricin 4`-O-(*threo*-β-4-hydroxyphenylglyceryl) ether [Aegicin A] and tricin 4`-O-(erythro-β-4-hydroxyphenylglyceryl) ether [Aegicin B] (4) and tricin 4`-O-(*erythro*-β-guaiacylglyceryl) ether [Salcolin A] (5). To our knowledge this compounds were isolated for the first time from the genus Melanocenchris. The n-hexane fraction exhibited higher cytotoxic activities against Human Hepatocellular carcinoma (HepG-2), Colon carcinoma (HCT-116) and Breast carcinoma (MCF-7) cell lines. The ethyl acetate extract was the most active antimicrobial against *Candida albicans* and *Escherichia coli*. Compound (4) showed higher antimicrobial activities against both *Bacillis subtilis* and Escherichia coli more than that of the standards. The ethyl acetate extract showed weak antiviral effect against HAV-10, HSV-1 and HSV-2, while n-butanol extract showed weak antiviral effect against HAV-10.

**Keywords:** *Melanocenchris abyssinica*, Phytoconstituents, Biological activities.

## INTRODUCTION

Poaceae (Graminae) is one of the most ecologically and economically important plant families[1]. Some plants of Poaceae used in folk medicine as antimicrobial, antimalarial, antidiabetic, anti-inflammatory, anticonvulsant, cytotoxic, anthelmintic, antiulcer, diuretic, antioxidant and for hypertension[2,3]. Poaceae contains a very wide range of secondary metabolites such as volatile oils, alkaloid, saponins, cyanogenetic substances, phenolic acids, flavonoids, lignans, phenylethanoids and terpenoids [4-6]. *Melanocenchris abyssinica* which belongs to family Poaceae is distributed throughout the arid tropical and sub-tropical regions of Africa and Asia[7,8]. One species of *Melanocenchris abyssinica* represented in the flora of Egypt, under the local name (Elteriab)[9]. It worth noting that nothing was reported about the phytochemical and biological investigation of *Melanocenchris abyssinica.* In the present work, five compounds (**1**-**5**) were first isolated from genus *Melanocenchris* and identified using different spectroscopic methods. The antimicrobial, antiviral and cytotoxic activities of the *n*-hexane, ethyl acetate and *n*-butanol fractions were evaluated. The antimicrobial activities of compounds (**2**-**5**) were also evaluated.

## MATERIAL AND METHODS

### Experimental

General experimental procedures. UV spectra were determined with Pye Unicam spp. 1750 spectrophotometer. IR spectra were carried out on a Nicolet 205 FT IR spectrometer connected to a Hewlett-Packard Color Pro. Plotter. EIMS was carried on Scan EIMS-TIC, VG-ZAB-HF, X-mass (158.64, 800.00) mass spectrometer (VG Analytical, Inc.). The $^{1}H$ and $^{13}C$ NMR measurements were obtained with a Bruker Avance III (400) NMR spectrometer operating at 400 MHz (for $^{1}H$) and 100 MHz (for $^{13}C$) in *$CD_3OD$* or DMSO-*$d_6$* or a mixture of $CDCl_3$/*$CD_3OD$* (3:1) solution, and chemical shifts were expressed in δ (ppm) with reference to TMS, and coupling constant (*J*) in Hertz. Si gel (Si gel 60, Merck) and Sephadex LH-20 (Pharmacia) were used for open column chromatography. TLC was carried out on precoated silica gel 60 $F_{254}$ (Merck) plates. Developed chromatograms were visualized by

spraying with 1% vanillin-$H_2SO_4$, followed by heating at $100^0$C for 5 min, or spraying with ammonia or aluminum chloride solutions.

**Plant material**

*Melanocenchris abyssinica* aerial parts were collected from the Garden of Al-Azhar University, Nasr City, Cairo, Egypt during May 2013. The plant was kindly identified by Dr Abdo Maree, Assoc. Professor of Plant Taxonomy, Faculty of Science, Al-Azhar University. A voucher specimen has been deposited in the Pharmacognosy Department, Faculty of Pharmacy, Al-Azhar University, Cairo, Egypt.

**Extraction and isolation**

Air-dried powdered aerial parts of *Melanocenchris abyssinica* (2kg) were subjected to exhaustive extraction with 70% ethanol (8Lx3). The combined ethanolic extracts were concentrated under vacuum at 40°C to dryness. The concentrated ethanolic extract (99g) was suspended in distilled water (500 ml) and partitioned successively with *n*-hexane, ethyl acetate and *n*-butanol to give 10gm, 6g and 5g, respectively. The ethyl acetate extract was subjected to a silica gel column eluted with *n*-hexane:ethyl acetate [100:0 to 45:55] to obtain seven fractions of A (250mg), B (640mg), C (1.0g), D (800mg), E (600mg), F (1.2g) and G (450mg). Fractions B, C and D were separately chromatographed on Si gel CC eluted with *n*-hexane:ethyl acetate [100:0 to 60:40], followed by purification on a Sephadex LH-20 column eluted with MeOH to give compounds **1** (22mg), **2** (19mg) and **3** (20mg), respectively. The F fraction was subjected to Si gel CC eluted with *n*-hexane:ethyl acetate [70:30 to 50:50] to give four sub fractions of F-1 (340mg), F-2 (280mg), F-3 (120mg) and F-4 (60mg). Sub fractions F-1 and F-2 were separately rechromatographed on Si gel CC eluted with *n*-hexane:ethyl acetate [70:30 to 60:40] followed by purification on a Sephadex LH-20 column eluted with MeOH to afford compounds **4** (26mg) and **5** (20mg), respectively.

*p*-coumaric acid (**1**): Colorless needles, UV $\lambda_{max}$ (MeOH) nm: 312, IR $\upsilon_{max}$ (KBr) $cm^{-1}$: 3430 (OH), 3100-2500 (OH), 1673 (CO), 1620, 1605, 1510 (C=C); $^1$H NMR (DMSO-$d_6$, 400 MHz) δ 10.78 (brs, OH), 7.51 (2H, d, *J*= 8.4 Hz, H-2, H-6), 7.49 (1H, d, *J*= 16.0 Hz, H-$\beta$), 6.79 (2H, d, *J*= 8.4 Hz, H-3, H-5), 6.29 (1H, d, *J*= 15.2 Hz, H-$\alpha$); $^{13}$C NMR (DMSO-$d_6$, 100 MHz) δ 168.49 (CO), 160.06 (C-4), 144.51 (C-$\beta$), 130.53 (C-2, 6), 125.72 (C-1), 116.20 (C-3, 5), 115.30 (C-$\alpha$); EIMS *m\z* 164 $[M]^+$.

Tricin (**2**): Pale yellow needles; UV $\lambda_{max}$ (MeOH) nm: 247, 270, 300sh, 350; IR $\upsilon_{max}$ (KBr) $cm^{-1}$: 3345 (OH), 1652 (CO), 1620, 1510 (C=C aromatic); $^1$H NMR (DMSO-$d_6$, 400 MHz) δ 12.97 (brs, 5-OH), 7.33 (2H, s, H-2`, 6`), 6.99 (1H, s, H-3), 6.57 (1H, d, *J*=1.8 Hz, H-8), 6.21 (1H, d, *J*=1.8 Hz, H-6), 3.88 (6H, s, 3`, 5`-OMe); $^{13}$C NMR (DMSO-$d_6$, 100 MHz) δ 182.26 (C-4), 164.17 (C-2), 164.11 (C-7), 161.86 (C-5), 157.87 (C-9), 148.64 (C-3`, 5`), 140.29 (C-4`), 120.84 (C-1`), 104.80 (C-2`, 6`), 104.04 (C-3, 10), 98.56 (C-6), 94.68 (C-8), 56.82 (3`, 5`-OMe); EIMS *m\z* 330 $[M]^+$.

Acetyl salcolin A and B (**3**): Yellow amorphous powder, UV $\lambda_{max}$ (MeOH) nm: 272, 288sh, 303sh, 335; IR $\upsilon_{max}$ (KBr) $cm^{-1}$: 3400 (OH), 1735, 1655 (CO), 1614, 1585, 1518 (C=C aromatic); $^1$H NMR (*$CD_3OD$*, 400 MHz) see table 1; $^{13}$C NMR (*$CD_3OD$*, 100 MHz) see table 2; EIMS *m\z* 330 [M-acetyl guaiacylglycerol moiety]$^+$.

Aegicin A and B (**4**): Yellow amorphous powder, UV $\lambda_{max}$ (MeOH) nm: 272, 287sh, 305sh, 336; IR $\upsilon_{max}$ (KBr) $cm^{-1}$: 3340 (OH), 1655 (CO), 1614, 1505 (C=C aromatic); $^1$H NMR (*$CD_3OD$*, 400 MHz) see table 1; $^{13}$C NMR (*$CD_3OD$*, 100 MHz) see table 2; EIMS *m\z* 446 $[M\text{-}2OH]^+$, 330 [M-hydroxyphenylglycerol moiety]$^+$.

Salcolin A (**5**): Yellow amorphous powder, UV $\lambda_{max}$ (MeOH) nm: 270, 286, 305sh, 333; IR $\upsilon_{max}$ (KBr) $cm^{-1}$: 3428 (OH), 1654 (CO), 1600, 1510 (C=C aromatic); $^1$H NMR (DMSO-$d_6$ and a mixture of 3:1 *$CDCl_3/CD_3OD$*, 400 MHz) see table 1; $^{13}$C NMR (DMSO-$d_6$, 100 MHz) see table 2; EIMS *m\z* 330 [M-guaiacylglycerol moiety]$^+$.

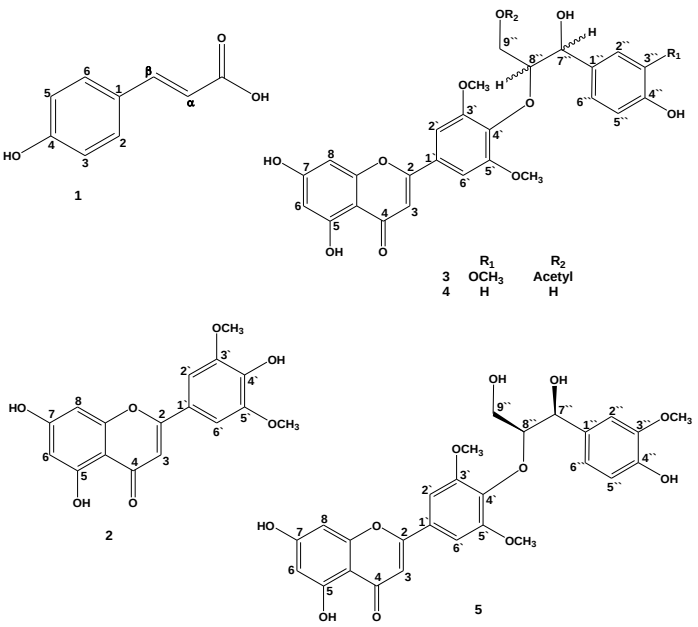


**Fig. 1: Compounds 1-5**

**Antimicrobial assays**

Antimicrobial activities of *n*-hexane, ethyl acetate and *n*-butanol fractions and compounds (**2**-**5**) of *Melanocenchris abyssinica* were investigated in *vitro* against different bacteria and fungi using the diffusion agar technique as described in literature[10]. The following bacterial strains were employed in the screening: Gram-positive bacteria; *Staphylococcus aureus* (RCMB 010028) and *Bacillis subtilis* (RCMB 010067), Gram-negative bacteria; *Escherichia coli* (RCMB 010052) and *Pseudomonas aeruginosa* (RCMB 010043). As fungal strains *Aspergillus fumigates* (RCMB 02568) and *Candida albicans* (RCMB 05031). Ampicillin, Gentamycin and Amphotericin B were used as reference drugs. The microbial species are environmental and clinically pathogenic microorganisms obtained from Regional Center for Mycology and Biotechnology (RCMB), Al-Azhar University.

**Antiviral assays**

The screening of antiviral activities of *n*-hexane, ethyl acetate and *n*-butanol fractions of *Melanocenchris abyssinica* herb using cytopathic effect inhibition assay which was reported in literature[11-13].

**Cytotoxicity assays**

The cytotoxicity of the *n*-hexane, ethyl acetate and *n*-butanol fractions were tested against three human tumor cell lines; Hepatocellular carcinoma cells (HepG-2), Colon carcinoma cells (HCT-116) and Breast carcinoma cells (MCF-7). The cells were obtained from the American Type Culture Collection (ATCC, Rockville, MD, USA). The cells were grown on Roswell Park Memorial Institute (RPMI) 1640 medium (Nissui Pharm. Co., Ltd., Tokyo, Japan) supplemented with 10% inactivated fetal calf serum and 50μg/mL gentamycin. The cells

were maintained at 37°C in a humidified atmosphere with 5% $CO_2$ and were sub cultured two to three times a week. The cytotoxic activity was determined by using cell viability assay method as described previously[14,15]. The experiments were performed in triplicates and the percentage of cell viability was calculated as the mean absorbance of control cells/mean absorbance of treated cells. Concentration-response curves were prepared and the $IC_{50}$ values were determined.

## RESULTS AND DISCUSSION

The aerial parts of *Melanocenchris abyssinica* were extracted with alcohol and the dried alcoholic extract was suspended in water and fractionated successively with *n*-hexane, ethyl acetate and *n*-butanol. The ethyl acetate soluble portion was subjected to repeated chromatographic columns using silica gel and sephadex LH-20 to afford five compounds (**1**-**5**) (Fig. 1) for the first time from the plant. The isolated compounds were identified by comparison of their spectroscopic data with the corresponding literature values as *p*-coumaric acid[16] (**1**), tricin[5] (**2**), a diastereoisomer of tricin 4`-*O*-[*threo*-β-guaiacyl-(9``-*O*-acetyl)-glyceryl] ether [9``-acetylsalcolin A] and tricin 4`-*O*-[*erythro*-β-guaiacyl-(9``-*O*-acetyl)-glyceryl]ether[9``-acetylsalcolinB][17] (**3**) , a diastereoisomer of tricin 4`-*O*-(*threo*-β-4-hydroxyphenylglyceryl) ether [Aegicin A] andtricin 4`-*O*-(*erythro*-β-4-hydroxyphenylglyceryl) ether [Aegicin B] [5,17-19] (**4**) and tricin 4`-*O*-(*erythro*-β-guaiacylglyceryl) ether [Salcolin A] [5,17,19] (**5**).

**Table 1:** $^1$H NMR data of 3, 4 and 5 (400 MHz)

| Position | 3 | 4 | 5 | |
|---|---|---|---|---|
| | ***CD$_3$OD*** | ***CD$_3$OD*** | **DMSO-*d$_6$*** | ***CDCl$_3$/CD$_3$OD*** |
| 3 | 6.68, s | 6.66, s | 6.97, s | 6.53, s |
| 6 | 6.21, brs | 6.19, brs | 6.21, brs | 6.22, brs |
| 8 | 6.46, brs | 6.45, brs | 6.56, brs | 6.40, brs |
| 2`, 6` | 7.19, s | 7.19, s | 7.31, s | 7.09, s |
| 3`, 5`-OMe | [a]3.91, s<br>[b]3.92, s | [a]3.91, s<br>[b]3.95, s | 3.86, s | 3.93, s |
| 2`` | [a]7.05, brs<br>[b]7.03, brs | [a]7.27, d, 8.3<br>[b]7.22, d, 8.3 | 7.03, brs | 6.90, d, 1.2 |
| 3`` | - | [a]6.77, d, 7.6<br>[b]6.74, d, 7.9 | - | - |
| 5`` | 6.77, d, 7.8 | [a]6.77, d, 7.6<br>[b]6.74, d, 7.9 | 6.70, d, 8.0 | 6.76, d, 8.0 |
| 6`` | [a]6.89, d, 8.0<br>[b]6.84, d, 8.2 | [a]7.27, d, 8.3<br>[b]7.22, d, 8.3 | 6.80,<br>dd, 8.2, 1.3 | 6.85,<br>dd, 8.2, 1.2 |
| 7`` | [a]4.96, d, 6.1<br>[b]4.94* | [a]5.03, d, 6.8<br>[b]4.93, d, 5.1 | 4.85, d, 4.8 | 4.98, d, 8.2 |
| 8`` | [a]4.56, m<br>[b]4.68, m | [a]4.28, m<br>[b]4.42,<br>dd, 8.5, 5.1 | 4.25, m | 4.20, m |
| 9``a | [a]3.96,<br>dd, 11.9, 5.1<br>[b]4.28,<br>dd, 11.7, 3.7 | [a]3.38,<br>dd, 12.4, 3.6<br>[b]3.67,<br>dd, 12.1, 3.2 | 3.25,<br>dd, 11.4, 4.6 | 3.31, m |
| 9``b | [a]4.30,<br>dd, 11.9, 3.4<br>[b]4.43,<br>dd, 11.8, 6.5 | [a]3.79, m,<br>[b]3.83, m, | 3.64,<br>dd, 11.6, 4.8 | 3.61,<br>dd, 13.0, 3.2 |
| 3``-OMe | [a]3.85, s<br>[b]3.86, s | - | 3.73, s | 3.80, s |
| 9``- CO$\underline{CH_3}$ | [a]1.91, s<br>[b]1.94, s | - | - | - |
| 5-OH | - | - | 12.87, brs | - |

[a] threo isomer, [b] erythro isomer.

***** masked by solvent peak.

**Table 2:** $^{13}C$ NMR data of 3, 4 and 5 (100 MHz)

| Position | 3 (*$CD_3OD$*) | 4 (*$CD_3OD$*) | 5 (DMSO-*$d_6$*) |
|---|---|---|---|
| 2 | [a]164.95, [b]164.86 | [a]164.99, [b]165.11 | 163.42 |
| 3 | 105.64 | [a]105.82, [b]105.76 | 105.26 |
| 4 | 183.85 | 183.73 | 182.26 |
| 5 | 162.99 | 163.18 | 161.83 |
| 6 | 100.04 | 100.29 | 99.70 |
| 7 | 165.94 | 166.26 | 167.44 |
| 8 | 94.98 | 95.21 | 94.87 |
| 9 | 159.16 | 159.35 | 157.91 |
| 10 | 105.25 | 105.43 | 103.15 |
| 1` | [a]127.69, [b]127.58 | [a]127.76, [b]127.88 | 125.82 |
| 2` | 104.68 | 104.94 | 104.67 |
| 3` | [a]154.54, [b]154.43 | [a]154.83, [b]154.65 | 153.43 |
| 4` | [a]140.33, [b]140.75 | [a]140.89, [b]140.43 | 140.33 |
| 5` | [a]154.54, [b]154.43 | [a]154.83, [b]154.65 | 153.43 |
| 6` | 104.68 | 104.94 | 104.67 |
| 3`, 5`-OMe | 56.65 | [a]56.90, [b]56.86 | 56.85 |
| 1`` | [a]133.17, [b]133.37 | [a]132.73, [b]133.11 | 133.47 |
| 2`` | [a]111.12, [b]111.49 | [a]129.37, [b]129.08 | 111.41 |
| 3`` | [a]147.18, [b]146.80 | [a]115.93, [b]115.72 | 147.36 |
| 4`` | [a]148.60, [b]148.50 | [a]158.19, [b]157.86 | 145.88 |
| 5`` | [a]115.67, [b]115.55 | [a]115.93, [b]115.72 | 115.13 |
| 6`` | [a]120.41, [b]120.70 | [a]129.37, [b]129.08 | 119.63 |
| 7`` | [a]74.83, [b]73.90 | [a]74.37, [b]74.06 | 72.06 |
| 8`` | [a]84.25, [b]85.32 | [a]87.54, [b]89.00 | 87.45 |
| 9`` | [a]65.07, [b]64.43 | [a]61.95, [b]61.79 | 60.87 |
| 3``-OMe | 56.19 | - | 56.00 |
| 9``- $CO\underline{C}H_3$ | [a]20.43, [b]20.50 | - | - |
| 9``-$\underline{CO}CH_3$ | [a]172.30, [b]172.56 | - | - |

[a] threo isomer, [b] erythro isomer

**Biological activity**

The antimicrobial, antiviral and cytotoxic activities of the *n*-hexane, ethyl acetate and *n*-butanol fractions of *Melanocenchris abyssinica* were evaluated. The antimicrobial activities of compounds (**2**-**5**) were also evaluated. The ethyl acetate extract showed weak antiviral effect against HAV-10, HSV-1 and HSV-2, while *n*-butanol extract showed weak antiviral effect against HAV-10 only. The *n*-hexane extract showed no antiviral activity against all viruses tested. All extracts and compounds (**2**-**5**) demonstrated variable antimicrobial activity against most of the specific organisms tested (Tables 3 and 4). The ethyl acetate extract was the most active against *C. albicans* and *E. coli* compared to that of *n*-hexane and *n*-butanol. Furthermore, compounds (**4** and **5**) showed higher antimicrobial activities against most of the tested organisms. Compounds (**4**) showed higher activity against both *B. subtilis* and *E. coli* more than that of the standards. On the other hand compound (**3**) showed a higher activity against *E. coli* only. The *n*-hexane fraction of *Melanocenchris abyssinica* exhibited the highest cytotoxic activity against the tested cell lines with values of $IC_{50}$ from 6.88 to 9.95µg/ml (Table 5).

**Table 3:** Antimicrobial activity of *Melanocenchris abyssinica*

| Organisms | Diameter of inhibition zone (mm) | | | |
|---|---|---|---|---|
| | ***n*-hexane** | **Ethyl acetate** | ***n*-butanol** | Standards |
| Fungi | | | | Amphotericin B |
| *A. fumigatus* | NA | 18.3±0.58 | NA | 22.9±0.44 |
| *C. albicans* | NA | 21.3±0.63 | NA | 21.4±0.25 |
| Gram +ve | | | | Ampicillin |
| *S. aureus* | NA | 20.6±0.58 | 16.6±0.58 | 28.9±0.14 |
| *B. subtilis* | NA | 22.4±0.58 | 18.2±0.58 | 28.3±0.37 |
| Gram –ve | | | | Gentamycin |
| *P. aeruginosa* | 12.3±0.58 | 16.8±0.44 | 13.4±0.44 | 20.3±0.37 |
| *E. coli* | 14.5±0.37 | 20.6±0.63 | 15.7±0.44 | 21.4±0.25 |

Well diameter: 6.0 mm …. …. (100µl was tested), Sample concentration (20mg/ml),
NA: No activity, data are expressed in the form of mean ± Standard deviation.

**Table 4:** Antimicrobial activity of isolated compounds (**2-5**)

| Organisms | Diameter of inhibition zone (mm) | | | | |
|---|---|---|---|---|---|
| | **2** | **3** | **4** | **5** | **Standards** |
| Fungi | | | | | Amphotericin B |
| *A. fumigatus* | 17.2±0.58 | 17.2±0.58 | 22.5±0.63 | 19.3±0.48 | 22.9±0.44 |
| *C. albicans* | 15.2±0.63 | 15.2±0.44 | 19.5±0.63 | 20.5±0.53 | 21.4±0.25 |
| Gram +ve | | | | | Ampicillin |
| *S. aureus* | 18.6±0.58 | 24.6±0.48 | 27.5±0.63 | 23.6±0.68 | 28.9±0.14 |
| *B. subtilis* | 21.2±0.38 | 25.4±0.68 | 29.5±0.53 | 27.4±0.58 | 28.3±0.37 |
| Gram –ve | | | | | Gentamycin |
| *P. aeruginosa* | 17.4±0.44 | 17.3±0.58 | 18.8±0.58 | 19.8±0.44 | 20.3±0.37 |
| *E. coli* | 19.7±0.58 | 21.5±0.37 | 22.6±0.63 | 21.6±0.63 | 21.4±0.25 |

Well diameter: 6.0 mm …. …. (100µl was tested), Sample concentration (20mg/ml),
NA: No activity, data are expressed in the form of mean ± Standard deviation.

**Table 5:** Cytotoxicity of *Melanocenchris abyssinica* against Hepatocellular carcinoma (HepG-2), Colon carcinoma (HCT-116) and Breast carcinoma (MCF-7) cells

| Sample conc. (µg) | Viability % | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | ***n*-hexane** | | | **Ethyl acetate** | | | ***n*-butanol** | | |
| | HepG | HCT | MCF | HepG | HCT | MCF | HepG | HCT | MCF |
| 100 | 8.61 | 9.04 | 6.38 | 19.78 | 31.29 | 43.82 | 24.86 | 38.91 | 43.39 |
| 50 | 15.29 | 17.48 | 13.92 | 38.86 | 46.72 | 67.93 | 34.54 | 49.13 | 51.24 |
| 25 | 24.84 | 31.29 | 17.98 | 56.91 | 65.23 | 81.46 | 47.23 | 72.87 | 66.89 |
| 12.5 | 32.84 | 43.61 | 32.57 | 83.98 | 80.94 | 87.14 | 68.98 | 81.56 | 78.13 |
| 6.25 | 51.93 | 59.25 | 67.21 | 92.46 | 89.37 | 93.81 | 88.74 | 94.35 | 89.72 |
| 3.125 | 85.46 | 83.36 | 86.43 | 96.37 | 94.12 | 96.52 | 98.41 | 97.08 | 96.34 |
| 1.56 | 91.32 | 90.47 | 90.89 | 99.04 | 98.34 | 99.04 | 100 | 100 | 98.78 |
| 0.78 | 97.45 | 93.28 | 95.18 | 100 | 100 | 100 | 100 | 100 | 100 |
| 0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| $IC_{50}$ (µg) | 6.88 | 9.95 | 9.36 | 34.6 | 45.6 | 87.2 | 23.4 | 49.1 | 57.9 |

## CONCLUSION

The present study has identified the isolation and identification of five phenolic constituents for the first time from the aerial parts of *Melanocenchris abyssinica*. This study provides also an evidence for the strong cytotoxic activity of the *n*-hexane extracts of *Melanocenchris abyssinica*. In addition to the highest antimicrobial activity of the ethyl acetate extract of the plant against *C. albicans* and *E. coli* that could be considered a valuable medicinal plant species. The higher activities of the ethyl acetate extract may due to the flavonolignan and flavonoid contents which were reported previously. Furthermore, this was confirmed by the higher antimicrobial activity of the isolated flavonolignans, compounds (**4** and **5**). Additional studies are needed to identify the constituents of *n*-hexane extract that are responsible for its higher activity.

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