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Phytochemical investigation of the aerial parts of *Fumaria parviflora* Lam.

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Abstract

Fumaria parviflora Lam. (Fumariaceae) is a small, branched, annual herb found in Europe, Asia, and Africa and in many parts of the world including Middle East and South Asia. Its aerial parts are used to treat gastrointestinal and respiratory tract disorders like diarrhoea, abdominal cramps, indigestion and asthma. Phytochemical investigation of its aerial parts led to the isolation of three new chemical compounds characterized as *n*-propyl-3,4-dioxymethylene benzene, 5β, 6, 7, 8, 9, 10β-hexahydrocoumarin and 2,6-dimethyl dodecan-10-oyl-12,15-olide along with *n*-tetradecanyl *n*-octadec-9-enoate, propanyl triol- 3, 2- *n*-di-octadecanoyl-1-*n*-octadeca-9',12'-dienoate, and *n*-tetradecanyl *n*-octadec-9,12-dienoate. The structures of these phytoconstituents have been established on the basis of spectral data analysis and chemical reactions.

Keywords: Fumaria parviflora Lam., Methanolic extract, Phytochemical, Analytical markers

Introduction

Fumaria parviflora Lam. (Fumariaceae) is a small, scandent, branched, annual herb, locally known as 'Shahtrah' in India [1] and 'Homaira' in Saudi Arabia. It grows in wheat fields [2] plains and low hills in Europe, Asia, Africa, and in many parts of the world including Middle East and South Asia. In the Unani traditional medicine, the plant is prescribed to treat gut and respiratory disorders, diarrhoea, abdominal cramps, indigestion and asthma [3, 4]. In folk medicine it is used in multiple plant formulations, including decoction and infusion [5]. The plant has been reported to possess anthelmintic, hepatoprotective, antidyspeptic, blood purifying, cholagogue, diaphoretic, diuretic, febrifuge and hypoglycemic properties [6, 7]. Phytochemical studies on *F. parviflora* revealed the presence of a several alkaloids including adlumidicein, copticine, fumariline, perfumine, protopine, fumaranine, fumaritine, paprafumicin and paprarine, flavonoids, glycosides, tannins, saponins, steroids and triterpenoids [8], protocatechuic acid and caffeic acid [9]. Because of their valuable metabolites, this medicinal plant is also used to promote spermatogenesis [10], antiinflammatory [11], nematicidal [12] and antimicrobial activity [13]. To maintain and upgrade traditional knowledge and subsequent scientific documentation, this medicinal plant appears to be a promising for new drug discovery programme [14]. The paper describes isolation of phytoconstituents from the aerial parts of *F. Parviflora* collected from Delhi region.

Materials and Methods

Materials

All chemicals were from Sigma-Aldrich unless otherwise stated. Melting points were determined on a thermoelectrically heated Perfit apparatus without correction. The IR spectra were measured in KBr pellet on a Bio-Red FT-IR spectrometer. UV spectra was obtained in methanol with a Lambda

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Bio 20 spectrometer. The ^{1}H (400 MHz) and ^{13}C (100 MHz) NMR spectra were recorded on Bruker spectrospin spectrometer with TMS as an internal standard. ESI-MS analysis was performed on a Synapt Mass spectrometer (Waters) equipped with direct inlet probe system. Column chromatography separations were carried out on silica gel (Merck, 60-120 mesh). Precoated silica gel plates (Merck, Silica gel 60 F_{254}) were used for analytical thin layer chromatography and the spots were visualized by exposure to iodine vapours and UV radiations.

Methods

Plant material

The *F. parviflora* whole plant was collected from the herbal garden of Jamia Hamdard, New Delhi and identified by Prof. Javed Ahmad, In-charge of the herbal garden. A specimen voucher of the drug was deposited in the herbarium of the Faculty of Pharmacy with a reference number PRL-JH/2011/05.

Preparation of extract and isolation

The dried *F. parviflora* whole plant (2.5 kg) was coarsely powdered and extracted with methanol for 72 h using a Soxhlet extractor. The methanolic extract was dried under reduced pressure to obtain a dark brown residue (380 g). The residue (100 g) was dissolved in minimum amount of methanol and adsorbed on silica gel column grade (60-120 mesh) to obtain slurry. The slurry was dried in air and chromatographed over silica gel column loaded in petroleum ether. The column was eluted with petroleum ether, petroleum ether-chloroform (3:1 and 1:3 *v/v*) and chloroform to isolate phyto compounds.

Results:

1. n- Tetradecanyl oleate (1)

Elution of the column with petroleum ether yielded colorless sticky mass of **1**, purified by preparative TLC, 475 mg (0.019 % yield), R_f 0.3 (chloroform), UV λmax (MeOH): 207 nm (log ε 5.8), IR λmax (KBr): 2911, 2843, 1736, 1645, 1459, 1414, 1312, 1089, 721 cm^{-1}. ^{1}H NMR ($CDCl_3$): δ 5.03 (1H, m, H-9), 5.01 (1H, m, H-10), 4.88 (2H, t, *J*= 6.0 Hz, H_2-1′), 2.30 (2H, t, *J*= 7.2 Hz, H_2-2), 2.07 (2H, m, H_2-8), 1.93 (2H, m, H_2-11), 1.64 (2H, m, CH_2), 1.52 (4H, m, 2x CH_2), 1.41 (4H, m, 2x CH_2), 1.28 (38H, brs, 19x CH_2), 0.89 (3H, t, *J*= 6.5 Hz, Me-18), 0.83 (3H, t, *J*= 6.3 Hz, Me-14′); ^{13}C NMR ($CDCl_3$): δ 173.74 (C-1), 139.27 (C-9), 114.07 (C-10), 74.09 (C-1′), 39.18 (CH_2), 37.30 (CH_2), 34.77 (CH_2), 34.17 (CH_2), 32.45 (CH_2), 31.95 (CH_2), 30.06 (CH_2), 29.72 (CH_2), 29.68 (7x CH_2), 29.61 (CH_2), 29.56 (CH_2), 29.39 (CH_2), 29.34 (CH_2), 29.22(CH_2), 29.18(CH_2), 28.97 (CH_2), 27.99 (CH_2), 25.34 (CH_2), 25.22 (CH_2), 22.71 (CH_2), 14.19 (C-18), 14.13 (C-14′). ESI MS *m/z* (rel. int.): 478 $[M]^+$ ($C_{32}H_{62}O_2$) (17.3), 281 (41.3), 265 (4.8), 213 (4.3).

Figure 1:

$$CH_3(CH_2)_7\overset{10}{C}H=\overset{9}{C}H(CH_2)_7\overset{1}{C}OO\overset{1'}{C}H_2\,(CH_2)_{12}\,\overset{14'}{C}H_3$$

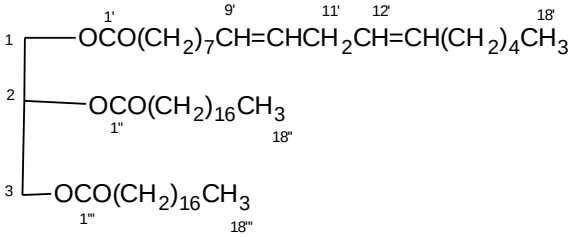
n-Tetradecanyl oleate (**1**)

2. Distearyl linoleiyl glyceride (2)

Elution of the column with petroleum ether-chloroform (3:1) gave pale yellow sticky mass of **2**, purified by preparative TLC (petroleum ether-chloroform, 3:1) 450 mg (0.068% yield), R_f 0.4, UV λmax (MeOH): 230 nm, (log ε 3.8). IR λmax (KBr): 2920, 2842, 1733, 1640, 1459, 1169, 910, 723 cm^{-1}. ^{1}H NMR ($CDCl_3$): δ 5.72 (1H, m, H-10′), 5.25 (1H,m, H-12′), 5.06 (1H, m, H-9′), 5.01 (1H, m, H-13′), 4.79 (1H, m, H-2), 4.51(2H, d, *J*=7.0 Hz, H_2-1), 4.01 (2H, d, *J*=7.0 Hz, H_2-3), 2.30 (2H, m, H_2-11′), 2.24(2H, t, *J*=7.5 Hz, H_2-2′), 2.22 (2H, t, *J*=7.0 Hz, H_2-2′′), 2.20 (2H, t, *J*=7.5 Hz, H_2-2′′′), 1.97 (2H, m, CH_2), 1.94 (2H,

m, CH_2), 1.55 (2H, m, CH_2), 1.52 (2H, m, CH_2), 1.47 (2H, m, CH_2), 1.44 (2H, m, CH_2), 1.42 (2H, m, CH_2), 1.29 (4H, m, 2x CH_2), 1.18 (62H, brs, 31x CH_2), 0.83 (3H, t, *J*= 7.0 Hz, Me-18′), 0.77 (3H, t, *J*=6.5 Hz, Me-18′′), 0.75 (3H, t, *J*=6.5 Hz, Me-18′′′). ^{13}C NMR ($CDCl_3$): δ 174.28 (C-1′), 173.98 (C-1′′), 173.63 (C-1′′′), 142.57 (C-10′), 139.01 (C-12′), 118.17 (C-9′), 114.07 (C-13′), 74.09 (C-2), 64.42 (C-1), 61.21 (C-3), 51.42 (C-11′), 39.85 (CH_2), 39.37 (CH_2), 37.43 (CH_2), 37.36 (CH_2), 36.63 (CH_2), 34.75 (CH_2), 34.40 (CH_2), 34.26 (CH_2), 34.16 (CH_2), 34.11 (CH_2), 33.93 (CH_2), 33.84 (CH_2), 32.80 (CH_2), 32.67 (CH_2), 31.94 (CH_2), 29.72 (CH_2), 29.68 (CH_2), 29.62 (CH_2), 29.56 (CH_2), 29.53 (CH_2), 29.49 (CH_2), 29.47 (CH_2), 29.38 (CH_2), 29.33 (CH_2), 29.28 (CH_2), 29.27 (CH_2), 29.21 (CH_2), 29.17 (CH_2), 29.10 (CH_2), 28.96 (CH_2), 28.66 (CH_2), 27.98 (CH_2), 25.13 (CH_2), 25.03 (CH_2), 24.96 (CH_2), 24.81 (CH_2), 24.73 (CH_2), 24.47 (CH_2), 22.70 (CH_2), 22.62 (CH_2), 22.56 (CH_2), 19.63 (C-18′), 16.35 (C-18′′), 14.12 (C-18′′′). ESI MS *m/z* (rel.int.): 886 $[M]^+$ ($C_{57}H_{106}O_6$) (2.2), 267 (3.6), 263 (5.1).

Figure 2:

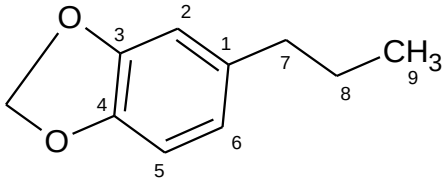


Distearyl linoleiyl glyceride (**2**)

3. *n*- Propyl -3, 4-dioxymethylene benzene (3)

Elution of the column with chloroform gave brown powder of **3**, recrystallised from acetone, 950 mg (0.04 % yield), R_f 0.65 (chloroform-methanol, 17:3), m.p. 235-236 °C, UV λmax (MeOH): 238, 295 nm (log ε 2.3, 3.1). IR λmax (KBr): 2920, 2840, 1652, 1527, 1489, 1382, 1271, 1033, 975, 927, 810 cm^{-1}. ^{1}H NMR ($CDCl_3$): δ 7.33 (1H, d, *J*= 2.7 Hz, H-2), 6.89 (1H, d, *J*= 8.5 Hz, H-5), 6.16 (1H, m, H-6), 3.36 (2H, brs, OCH_2O), 2.78 (2H, m, H_2-7), 2.51 (2H, m, CH_2), 1.39 (3H, t, *J*= 6.5 Hz, Me-9). ^{13}C NMR ($CDCl_3$): δ 144.04 (C-1), 125.19 (C-2), 148.57 (C-3), 146.11 (C-4), 123.29 (C-5), 108.94 (C-6), 55.05 (C-7), 53.74 (C-8), 23.83 (C-9), 102.27 (OCH_2O). ESI MS *m/z* (rel. int.): 164 $[M]^+$ ($C_{10}H_{12}O_2$) (5.2).

Figure 3:

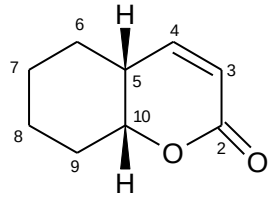


n- Propyl -3, 4-dioxymethylene benzene (**3**)

4. Hexahydrocoumarin (4)

Elution of the column with petroleum ether-chloroform (1:3) gave colorless amorphous powder of **4**, recrystallized from acetone, 5.7 g (0.228 % yield), R_f 0.39 (chloroform), m.p. 295-296 °C (decompose), UV λmax (MeOH): 240 nm (log ε 3.2). IR λmax (KBr): 2919, 2814, 1722, 1608, 1378, 978, 827 cm^{-1}. ^{1}H NMR ($CDCl_3$): δ 6.71 (1H, d, *J*= 7.5 Hz, H-3), 6.69 (1H, m, H-4), 4.47 (1H, m, $w_{1/2}$ = 5.5 Hz, H-10 β), 3.37 (1H, m, H- 9β), 2.89 (2H, m, H_2-5), 2.78 (2H, m, H_2-8), 2.26 (2H, m, H_2-6), 1.35 (2H, m, H_2-7). ^{13}C NMR ($CDCl_3$): δ 171.99 (C-2), 134.88 (C-3), 119.23 (C-4), 38.27 (C-5), 29.41(C-6), 29.23 (C-7), 34.11 (C-8), 39.06 (C-9), 68.24 (C-10). ESI Ms *m/z* (rel.int): 152 $[M]^+$ ($C_9H_{12}O_2$) (95.2).

Figure 4:

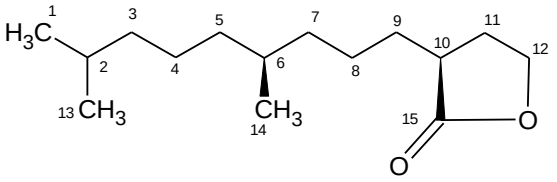


Hexahydrocoumarin (**4**)

5. 2, 6-dimethyl dodecan-10-oyl-12, 15-olide (5)

Elution of the column with chloroform afforded colorless mass of **5**, recrystallized from acetone, 950 mg (0.038% yield), R_f 0.4 (chloroform-methanol, 93:7), m.p. 240-241°C, UV λmax (MeOH): 240 nm (log ε 2.7), IR λmax (KBr): 2912, 2837, 1755, 1635, 1493, 1376, 1260, 1035, 840 cm^{-1}. ^{1}H NMR (DMSO-d_6): δ 3.63 (2H, m, H_2-12), 2.28 (2H, m, H_2-11), 2.01 (H, m, H-10), 1.72 (1H, m, H–6), 1.43 (1H, m, H-2), 1.25 (2H, m, CH_2), 1.04 (4H, m, 2x CH_2), 1.02 (4H, brs, 2x CH_2), 0.99 (2H, m, CH_2), 0.97 (3H, d, *J*= 5.5 Hz, Me-1), 0.95 (3H, d, *J*=7.5 Hz, Me-13), 0.91 (3H, d, *J*= 6.5 Hz, Me-14). ^{13}C NMR (DMSO-d_6), δ 15.57 (C-1), 36.05 (C-2), 29.31 (C-3), 29.25 (C-4), 24.79 (C-5), 39.97 (C-6), 24.44 (C-7), 22.47 (C-8), 18.45 (C-9), 53.78 (C-10), 21.38 (C-11), 60.69 (C-12), 17.16 (C-13), 11.60 (C-14), 174.47 (C-15). ESI MS *m/z* (rel. int.): 240 $[M]^+$ ($C_{15}H_{28}O_2$) (1.1), 197(8.3), 155(12.3).

Figure 5:

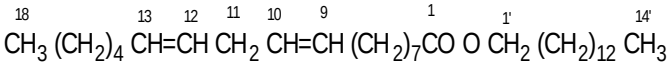


Fumariasesquiterpenolide (**5**)

6. n- Tetradecanyl linoleiate (FP-6)

Elution of column with chloroform furnished a pale yellow sticky mass of **6**, purified by preparative TLC (chloroform), 15.2 g, (0.61 % yield), R_f 0.3 (chloroform), UV λmax (MeOH): 239 nm, (log ε 3.1), IR λmax (KBr): 2923, 2852, 1721, 1641, 1457, 1376, 1217, 1124, 1072, 975, 721 cm^{-1}. ^{1}H NMR ($CDCl_3$): δ 5.73 (1H, m, H-10), 5.28 (1H, m, H-12), 5.19 (1H, m, H-9), 4.93 (1H, m, H-13), 4.02 (2H, d, *J*=6.8 Hz, H_2-1'), 2.70 (2H, m, H_2-11), 2.26 (2H, t, *J*=7.6 Hz, H_2-2), 2.17 (2H, m, CH_2), 1.99 (2H, m, CH_2), 1.77 (2H, m, CH_2), 1.56 (2H, m, CH_2), 1.53 (2H, m, CH_2), 1.33 (2H, m, CH_2), 1.29 (6H, brs, 3x CH_2), 1.22 (6H, brs, 3x CH_2), 1.18 (20H, brs, 10x CH_2), 0.91 (3H, t, *J*=7.0 Hz, Me-18), 0.82 (3H, t, *J*=6.7 Hz, Me-14'); ^{13}C NMR ($CDCl_3$): δ 167.74 (C-1), 139.27 (C-10), 130.96 (C-12), 128.85 (C-9), 114.09 (C-13), 71.79 (C-1'), 50.66 (C-11), 42.16 (CH_2), 33.97 (CH_2), 33.83 (CH_2), 29.70 (8x CH_2), 29.66 (CH_2), 29.61 (CH_2), 29.52 (CH_2), 29.46 (CH_2), 29.37 (CH_2), 29.27 (CH_2), 29.16 (CH_2), 29.11 (CH_2), 28.95 (CH_2), 27.71 (CH_2), 24.78 (CH_2), 22.70 (CH_2), 19.17 (C-18), 14.15 (C-14'). ESI MS *m/z* (rel.int.): 476 $[M]^+$ ($C_{32}H_{60}O_2$) (21.3).

Figure 6:



n -Tetradecanyl linoleiate (**6**)

3. Discussion

Compound **1** was obtained as a colorless sticky mass from petroleum ether eluent. It showed characteristic absorption bands in IR spectrum for ester group (1736 cm^{-1}), unsaturation (1645 cm^{-1}) and long chain aliphatic hydrocarbon (721 cm^{-1}). Its mass spectrum displayed a molecular ion peak at *m/z* 478 corresponding to a molecular formula of a saturated fatty ester ($C_{32}H_{62}O_2$). The ion peaks arising at *m/z* 265 $[CH_3(CH_2)_7CH=CH(CH_2)_7CO]^+$, 281 $[CH_3(CH_2)_7CH=CH(CH_2)_7\text{-}COO]^+$ and 213 $[M\text{-}265]^+$ indicated that oleic acid was esterified with a C_{14} aliphatic alcohol. The ^{1}H NMR spectrum of **1** displayed two one- proton multiplets at δ 5.03 and 5.01 assigned to vinylic H-9 and H-10 protons, respectively, a two- proton triplet at δ 4.88 (*J*=6.0 Hz) ascribed to oxygenated methylene H_2-1' proton, other methylene protons as a two-proton triplet at δ 2.30 (*J*=7.2 Hz) due to methylene H_2-2 adjacent ester group, as multiplets between δ 2.30-1.41 and

as a broad singlet at δ 1.28 (38H). Two three-proton triplets at δ 0.89 (*J*=6.5 Hz) and 0.83 (*J*=6.3 Hz) were accounted to terminal C-18 and C-14′ primary methyl protons, respectively. The ^{13}C NMR of **1** exhibited signals for ester carbon at δ 173.74 (C-1), vinylic carbons at δ 139.27 (C-9) and 114.07 (C-10), oxygenated methylene carbon at δ 74.09 (C-1′). Other methylene carbon signals resonating between δ 39.18 - 22.71 and methyl carbons at δ 14.19 (C-18) and 14.13 (C-14′). On the basis of these evidences the structure of **1** has been elucidated as *n*-tetradecanyl *n*-octadec-9-enoate.

Compound **2**, distearyl linoleiyl glyceride, was obtained as a yellow color sticky mass from petroleum ether-chloroform (1:3) eluants. It showed characteristic absorption bands in the IR spectrum for ester group (1733 cm^{-1}), unsaturation (1640 cm^{-1}) and long chain aliphatic hydrocarbon (723 cm^{-1}). Its mass spectrum exhibited a molecular ion peak at *m/z* 886 $[M]^+$ corresponding to the molecular formula of a glyceride ($C_{57}H_{106}O_6$). The ion peaks arising at *m/z* 263$[CH_3(CH_2)_7CH{=}CHCH_2(CH_2)_4CO]^+$ and 267 $[CH_3(CH_2)_{16}CO]^+$ suggested that linoleic and stearic acids were esterified with the glycerol. The ^{1}H NMR spectrum of **2** showed four one- proton multiplets at δ 5.72, 5.25, 5.06 and 5.01 assigned to vinylic H-10′, H-12′, H-9′ and H-13′ protons, respectively, a one-proton multiplet at δ 4.79 and two doublets at δ 4.51 (*J*=7.0 Hz) and 4.01(*J*=7.0 Hz) integrating for two- protons each were attributed oxygenated methane H-2 and methylene H_2-1 and H_2-3 protons of the glyceryl units, respectively. The other methylene protons resonated between δ 2.30- 1.18. Three triplets at δ 0.80 (*J*= 7.0 Hz), 0.77 (*J*=6.5 Hz) and 0.75 (*J*=6.5 Hz), all integrated for three protons each, were accounted to the terminal C-18′, C-18′′ and C-18′′′ primary methyl protons, respectively. The ^{13}C NMR spectrum of **2** exhibited signals for three ester carbons at δ 174.28 (C-1′), 173.98 (C-1′′) and 173.63 (C-1′′′), vinylic carbons from δ 142.57 to 114.07, oxygenated methine carbon signal at δ 74.09 (C-2) and oxygenated methylene carbons at δ 64.42 (C-1) 61.21 (C-3), other methylene carbons between δ 51.42- 22.56 and methyl carbons at δ 19.63 (C-18′), 16.35 (C-18′′) and 14.12 (C-18′′′). On the basis of above mentioned discussion the structure of **2** has been characterize as propanyl triol- 2, 3- *n*-di-octadecanoyl-1-*n*-octadeca- 9′,12′-dienoate.

Compound **3** was obtained as a brown color powder from chloroform eluant. Its IR spectrum showed characteristic absorption bands for aromatic ring (1652, 1527 cm^{-1}). On the basis of mass and ^{13}C NMR spectral data the molecular ion peak of **3** was determined at *m/z* 164 $[M]^+$ consistent with the molecular formula of a dioxymethylene aromatic hydrocarbon, $C_{10}H_{12}O_2$. The ^{1}H NMR spectrum of **3** showed two one-proton doublets at δ 7.33 (*J*= 2.7 Hz) and 6.89 (*J*= 8.5 Hz) assigned to aromatic meta-coupled H-2 and ortho-coupled H-5 and a one-proton multiplet δ 6.16 ascribed to H-6 protons, respectively. A two-proton broad singlet δ 3.36 was attributed to dioxygenated methylene protons. Other methylene protons resonated as two-proton multiplets at δ 2.78 and 2.51. A three-proton triplet at δ 1.39 (*J*= 6.5 Hz) was ascribed to C-9 primary methyl protons. The ^{13}C NMR spectrum of **3** showed signals for aromatic carbons between δ 148.57-108.94, dioxygenated methylene carbon at δ 102.27 and methylene carbons at δ 55.05 and 53.74 and methyl carbon at δ 23.83 (C-9). On the basis of these evidences the structure of **3** was characterized as *n*-propyl-3, 4-

dioxymethylene benzene. This is new aromatic compound.

Compound **4**, named hexahydrocoumarin, was obtained as a colorless amorphous powder from chloroform eluents. Its IR spectrum showed absorption bands for conjugated lactone (1722 cm^{-1}) and unsaturation (1608 cm^{-1}). On the basis of mass and ^{13}C NMR spectral data the molecular ion peak of **4** was determined at *m/z* 152 consistent with the molecular formula of hexahydrogenated coumarin, $C_9H_{12}O_2$. The ^1H NMR spectrum **4** exhibited a one-proton doublet δ 6.71 (*J*= 7.5 Hz) and a one-proton multiplet at δ 6.69 assigned to cis-oriented vinylic H-3 and H-4 protons, respectively. Two one-proton multiplets at δ 4.47 with half- width of 5.5 Hz and at 3.37 were attributed β- oriented oxygenated methine H-10 and methine H-9 near by the vinylic carbon, respectively. The methylene protons resonated as two-proton multiplets between δ 2.89-1.35. The ^{13}C NMR spectrum of **4** displayed signals for lactone carbon at δ 171.99 (C-2), vinylic carbons at δ 134.88 (C-3) and 119.23 (C-4), oxygenated methine carbon at δ 68.24 (C-10) and other methylene carbons between δ 39.06-29.23. On the basis of this discussion the structure of **4** has been characterized as 5β, 6, 7, 8, 9, 10β-hexahydrocoumarin. This is new compound.

Compound **5,** *Fumaria* sesquiterpenolide**,** was obtained as a colorless mass from chloroform eluents. Its IR absorption spectrum showed characteristic absorption band for lactone ring (1755 cm^{-1}). On the basis of mass and ^{13}C NMR spectral data the molecular ion peak of **5** was determined as *m/z* 240 which corresponded to the molecular formula of a sesquiterpenic lactone $C_{15}H_{28}O_2$. The ion fragments generating at *m/z* 155 $[M\text{-}C_4H_5O_2]^+$ due to expulsion of the γ-lactone ring and at *m/z* 197 $[M\text{-}C_3H_7]^+$ suggested the existence of the lactone ring at one terminal of an acyclic sesquiterpene. The ^1H NMR of **5** exhibited a two-proton multiplet at δ 3.63 assigned to oxygenated methylene H_2-12 protons. Three one-proton multiplets at δ 2.01, 1.72 and 1.43 were attributed to methine H-10, H-6 and H-2 protons, respectively. The remaining methylene protons resonated between δ 2.28-0.99. Three doublets at δ 0.97 (*J*=5.5 Hz), 0.95 (*J*=7.5 Hz) and 0.91 (*J*=6.5 Hz) integrating for three protons each were accounted to secondary C-1, C-13 and C-14 methyl protons, respectively, all attached to the saturated carbons. The ^{13}C NMR spectrum of **5** showed signals for lactone carbon at δ 174.47 (C-15), oxygenated methylene carbon at δ 60.69 (C-12) and methyl carbons at δ 15.57 (C-1), 17.16 (C-13) and 11.60 (C-14). The absence of any signal beyond δ 3.63 in the ^1H NMR spectrum and between δ 174.47 – 60.69 supported saturated nature of the molecule. On the basis of these evidences the structure of **5** has been formulated as 2, 6-dimethyl dodecan-10-oyl-12, 15-olide. This is new sesquiterpenic lactone.

Compound **6,** *n*-tetradecanyl linoleiate, was obtained as a pale yellow sticky mass from chloroform eluent. Its IR spectrum showed distinctive absorption for ester group (1721 cm^{-1}), unsaturation (1641 cm^{-1}), and long aliphatic chain (721 cm^{-1}). Its mass spectrum has molecular ion peak at *m/z* 476 $[M]^+$ corresponding to molecular formula of a fatty ester ($C_{32}H_{60}O_2$). The ^1H NMR spectrum of **6** displayed four one-proton multiplets at δ 5.73, 5.28, 5.19 and 4.93 assigned to vinylic H-10, H-12, H-9 and H-13 protons, respectively. A two-proton doublet at δ 4.02 (*J*= 6.8 Hz) was ascribed to oxygenated methylene H_2-1′ protons.

The other methylene protons appeared a two-proton triplet at δ 2.26, (*J*= 7.6 Hz) attributed to methylene H_2-2 protons nearby to the ester group, as two- proton multiplets between δ 2.70- 1.33 and broad singlets at δ 1.29 (6H) 1.22 (6H) and 1.18 (20H). Two three-proton triplets at 0.91 (*J*=7.0 Hz), 0.82 (*J*=6.7 Hz) were accounted to terminal C-18 and C-14′ primary methyl protons, respectively. The ^{13}C NMR spectrum of **6** displayed signals for ester carbon δ 167.74 (C-1), vinylic carbons from δ 139.19 to 114.09, oxygenated methylene carbon at δ 71.79 (C-1′), other methylene carbons between δ 50.66 – 22.70 and methyl carbons at δ 19.17 (C-18) and 14.15 (C-14′). Alkaline hydrolysis of **6** yielded linoleic acid. On the basis of foregoing discussion the structure of **6** has been established as *n*-tetradecanyl *n*-octadec-9, 12-dienoate.

Conclusion:

The present phytochemical investigation explored the isolation of three new compounds, which updates the previous research of *Fumaria parviflora* Lam. The isolated compounds may be used for the identity, purity and quality control purpose as well as analytical markers in future.

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