International Journal of Herbal Medicine
Available online at www.florajournal.com

E-ISSN: 2321-2187
P-ISSN: 2394-0514
IJHM 2016; 4(6): 179-183
Received: 27-09-2016
Accepted: 28-10-2016

Mohammed Ali
Phytochemistry Research Laboratory, Faculty of Pharmacy, Jamia Hamdard, Hamdard Nagar, New Delhi, India

Shahnaz Sultana
(a) Phytochemistry Research Laboratory, Faculty of Pharmacy, Jamia Hamdard, Hamdard Nagar, New Delhi, India
(b) Present address: College of Pharmacy, Jazan University, Jazan, Saudi Arabia

Mohammad Jameel
(a) Phytochemistry Research Laboratory, Faculty of Pharmacy, Jamia Hamdard, Hamdard Nagar, New Delhi, India
(b) Present address: Regional Research Institute of Unani Medicine, CCRUM, Ministry of AYUSH, Govt. of India, Aligarh, India

Correspondence
Mohammed Ali
Phytochemistry Research Laboratory, Faculty of Pharmacy, Jamia Hamdard, Hamdard Nagar, New Delhi, India

Phytochemical investigation of flowers of *Rosa damascena* Mill

Mohammed Ali, Shahnaz Sultana and Mohammed Jameel

Abstract
Rosa damascena Mill. (Rosaceae) has been appreciated for decorative, fragrance, cosmetics, food and folklore medicines to treat abdominal and chest pains, menstrual bleeding, digestive problems, constipation and to strengthen the heart. It is regarded as a symbol of affection, belief and magnificence. Phytochemical investigation of a methanolic extract of *R. damascena* flowers led to the isolation of four new compounds identified as *n*-cosan-5β-ol (1), (*cis*)- 6, 10, 14-trimethylpentadec-3-en-7β,11β-diol (damascene, 2), 7-hydroxy-4-(3'-methyl butanol)- coumarin- 3- en-one (rosacoumarin, 3) and cedr-6-en-12-ol-14-oic acid (rosacedrenoic acid, 4). The structures of these compounds have been established on the basis of spectral data analysis and chemical means.

Keywords: *Rosa damascene,* flowers, phytoconstituents, Isolation, characterization

1. Introduction
Rosa *damascena* Mill. (Rosaceae), commonly known as Gole Mohammadi, Gul-e-Surkh (in Persian), Ward-e-Ahmar (in Arabic), Damascus rose or Otto rose (in English) and Gulab (in Hindi) [1-2], is a well-known ornamental plant, referred as the king of flowers having more than 200 species throughout the world [3]. The name of *R. damascena* is derived from the city name Damascus, Syria, where it exists as a wild plant. It is distributed in China, India, Middle East, North America and Europe and cultivated in different countries around the world. The Bulgarian and Taif rose flowers are known for the production of high quality rose essential oils [4]. Rose is the symbol of love, purity, faith and beauty since ancient times [5]. Traditionally it is used to treat abdominal and chest pains, menstrual bleeding, digestive problems, depression, nervous stress, skin problems, headache and as an anti-inflammatory and cardiotonic [6]. Rose water is useful as an antiseptic agent for eye washing, mouth disinfecting and as antispasmodic to relieve the abdominal pains and bronchial and chest congestions [7-8]. A flower decoction is taken as a diuretic and to relieve fever, breast pain and menstrual problems. The rose petals are cooked with sugar or honey and ingested as a refrigerant [5]. Its rose petals are acrid, aromatic, aphrodisiac, appetizer, bitter, cardiotonic, expectorant, febrifuge, laxative, refrigerant and tonic; used to alleviate leprosy, eye infections and excessive perspiration [9]. It is added as a chief ingredient in various polyherbal Unani formulation used as an antiobesity, cardio-protective, hepatoprotective, blood diseases and skin disorders [2, 10].
Potential bioactive compounds *viz.*, roxyloside A, isoquercitrin, afzelin, cyanidin-3-O-β-glucoside, quercetin gentiobioside, damaurones, rugaurone, maritimein, tetrahydroxyaurone, tetrahydroxy-dimethoxyaurone, siamaurone, damaurone B and flavonol glycosides have been reported from the plants [11-13]. The rose essential oil was consisted mainly of phenyl ethyl alcohol, citronellol, nonadecane, geraniol, nerol, heneicosane, nonadecane, tricosane, citronellal, citral, carvone, citronellyl acetate, eugenol, ethanol, farnesol, nonanol, nonanal, phenyl acetaldehyde, phenylmenthyl acetate and phenyl geraniol [14-18]. In this communication isolation and characterization of new phytoconstituents have been targeted from flowers of *R. damascena* procured from Delhi.

2. Materials and Methods
2.1. Materials
All chemicals were procured 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 spectrophotometer. UV spectra were obtained in methanol with a Lambda Bio 20 spectrophotometer. The ^{1}H (300 MHz) and ^{13}C (75 MHz) NMR spectra were recorded on Bruker DRX 300 MHz instrument with TMS as an internal standard. Mass spectra were performed on a Jeol D-300 (EI/CI) system. Column chromatographic separations were carried out on silica gel (Merck, 60-120 mesh).

Pre-coated 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 vapors and UV radiations and spraying with ceric sulphate solution.

2.2 Methods

2.2.1 Plant Material

The flowers of *R. damascena* were procured from a local market, Khari Baoli, New Delhi and identified by Prof. M. P. Sharma, Department of Botany, Jamia Hamdard. A specimen voucher of the drug was deposited in the herbarium of the Phytochemistry Research Laboratory, Faculty of Pharmacy, Jamia Hamdard.

2.2.2 Preparation of Extract and Isolation

The pulverized flowers (1kg) were extracted exhausted with methanol using a Soxhlet extractor. The combined extracts were dried under reduced pressure to obtain a dark brown residue (190 g). The residue (100 g) was dissolved in minimum amount of methanol and adsorbed on silica gel column grade (60-120 mesh) to obtain a slurry. The slurry was dried in air and chromatographed over silica gel column loaded in chloroform. The column was eluted with chloroform and chloroform-methanol (99:1, 49:1, 93:7, 19:1, 3:1, 1:1, 1:3 *v/v*) in order of increasing polarity to isolate the following compounds 1-4.

2.3 *n*-Cosan-5β-ol (1)

Elution of the column with chloroform gave a colorless amorphous powder of 1, recrystallized from chloroform-methanol (1:1), 92 mg, m. p. 73-74 °C; IR ν_{max} (KBr): 3435, 2920, 2840, 1402, 1098, 794, 725 cm^{-1}. ^1H NMR ($CDCl_3$): δ 3.54 (1H, brm, $w_{1/2}$ = 16.3 H_z, H-5α), 1.55 (2H, m CH_2), 1.34 (2H, m CH_2), 1.29 (6H, brs, 3 x CH_2), 1.25 (24H, m, 12 x CH_2), 0.83 (3H, t *J* = 6.2 Hz, Me-1), 0.79 (3H, t, *J* = 6.8 Hz, Me-20); ^{13}C NMR ($CDCl_3$): δ 66.11 (C-5), 38.30 (CH_2), 34.1 (CH_2), 30.83 (CH_2), 29.62 (8 x CH_2), 29.55 (CH_2), 29.42 (CH_2), 29.33 (CH_2), 27.72 (CH_2), 25.26 (CH_2), 22.59 (CH_2), 14.70 (C-20), 14.67 (C-1). EIMS *m/z* (rel. int.): 298 $[M]^+$ ($C_{20}H_{42}O$) (6.9), 283 (7.5), 255 (10.3), 241 (15.3), 213 (7.8), 211 (16.6), 199 (6.7), 185 (11.2), 155 (12.6), 149 (19.6), 129 (16.7), 111 (15.8), 99 (16.1), 97 (27.2), 87 (13.6), 85 (73.2), 83 (27.1), 71 (74.3), 57 (100), 43 (93.8).

2.4 Damescanol (2)

Further elution of the column with chloroform afforded a colorless amorphous powder of 2, 181 mg, m. p. 69 - 71 °C; UV λ_{max} (MeOH): 215 nm (log ε 3.1); IR ν_{max} (KBr): 3430, 2952, 2853, 1635, 1462, 1378, 1253, 1168, 1097 cm^{-1}; ^1H NMR ($CDCl_3$): δ 5.31 (1H, m, $w_{1/2}$ = 8.9 Hz, H-3), 5.28 (1H, m, $w_{1/2}$ = 8.7 Hz, H-4), 3.73 (1H, brs, $w_{1/2}$ = 18.8 Hz, H-11), 3.47 (1H, brs, $w_{1/2}$ = 17.1 Hz, H-7α), 2.53 (2H, m, H_2-5), 2.06 (1H, m, H_2-2), 1.99 (1H, m, H-6), 1.49 (1H, m, H-14), 1.44 (1H, m, H-10), 1.23 (6H, brs, H_2-8, H_2-9, H_2-12), 1.08 (2H, m, H_2-13), 0.88 (3H, d, *J* = 6.4 Hz, Me-16), 0.86 (3H, d, *J* = 6.2 Hz, Me-15), 0.83 (3H, d, *J* = 6.5 Hz, Me-18), 0.74 (3H, d, *J* = 6.1 Hz, Me-17), 0.65 (3H, t, *J* = 6.1 Hz, Me-1); ^{13}C NMR ($CDCl_3$): δ 13.96 (C-1), 30.29 (C-2), 115.11 (C-3), 129.66 (C-4), 32.76 (C-5), 54.84 (C-6), 76.87 (C-7), 29.05 (C-8), 28.75 (C-9), 52.47 (C-10), 76.90 (C-11), 25.59 (C-12), 24.46 (C-13), 47.10 (C-14), 19.07 (C-15), 18.62 (C-16), 17.03 (C-17), 16.08 (C-18); EIMS *m/z* (rel. int.): 284 $[M]^+$ ($C_{18}H_{36}O_2$) (3.6), 255 (5.1), 227 (43.8), 213 (98), 199 (7.1), 185 (6.2), 157 (9.8), 151 (12.3), 143 (8.3), 137 (19.8), 129 (13.1), 127 (8.9), 125 (11.8), 121 (40.3), 111 (15.3), 109 (19.3), 101 (20.1), 97 (36.2), 95 (37.8), 83 (42.3), 81 (44.1), 71 (30.6), 69 (70.1), 57 (58.1), 55 (100), 43 (80.2).

2.5 Rosacoumarin (3)

Elution of the column with chloroform-methanol (49:1) yielded pale yellow crystals of 3, recrystallized from chloroform-methanol (1:1), 394 mg, m. p. 157-159 °C; UV λ_{max} (MeOH): 278, 320 nm (log ε 5.2, 2.1); IR ν_{max} (MeOH): 3434, 2924, 2854, 1710, 1615, 1530, 1451, 1377, 1231,1044 cm^{-1}; ^1H NMR (DMSO-d_6): δ 6.95 (1H, d, *J* = 7.6 Hz, H-5), 6.89 (1H, dd, *J* = 7.6, 3.0 Hz, H-6), 6.83 (1H, d, *J* = 3.0 Hz, H-8), 6.80 (1H, s, H-3), 3.65 (1H, d, *J* = 9.3 Hz, H_2-1'a), 3.55 (1H, d, *J* = 9.3 Hz, H_2-1'b), 2.48 (1H, m, H-3'), 1.28 (2H, m, H_2-2'), 0.89 (3H, d, *J* = 6.5 Hz, Me-4'), 0.86 (3H, d, *J* = 6.3 Hz, Me-5'); ^{13}C NMR (DMSO-d_6): δ 167.60 (C-2), 128 (C-3), 165.45 (C-4), 115.47 (C-4a), 138.51 (C-5), 119.42 (C-6), 165.46 (C-7), 108.83 (C-8), 145.53 (C-8a), 62.74 (C-1'), 29.03 (C-2'), 47.04 (C-3'), 15.16 (C-4'), 14.03 (C-5'); EIMS *m/z* (rel. int.): 248 $[M]^+$ ($C_{14}H_{16}O_4$) (46.7), 206 (10.1), 203 (29.3), 184 (32.6), 177 (5.3), 153 (100), 126 (36.1), 107 (32.3), 87 (53.4), 71 (5.5), 55 (65.5), 43 (78.9).

2.6 Rosacedrenoic acid (4)

Elution of the column with chloroform-methanol (19:1) furnished colorless crystals of 4, recrystallized from acetone - methanol (1:1) 118 mg, m. p. 56-57 °C; UV λ_{max} (MeOH): 221 nm (log ε 4.2); IR ν_{max} (KBr): 3455, 3426, 2926, 2854, 1709, 1636, 1463, 1376, 1245, 1175, 1096, 1032 cm^{-1}; ^1H NMR (DMSO-d_6): δ 5.28 (1H, s, H-7), 3.55 (2H, d, *J* = 10.2 Hz, H_2-12), 2.48 (1H, brm, $w_{1/2}$ = 12.8 Hz, H-11α), 2.26 (1H, brm, $w_{1/2}$ = 11.9 Hz, H-4α), 1.98 (1H, brm, $w_{1/2}$ = 11.6 Hz, H-1α), 1.48 (2H, brm, H_2-9), 1.26 (6H, brs, CH_2-2, CH_2-3, CH_2-10), 1.21 (3H, s, Me-13), 0.87 (3H, d, *J* = 6.2 Hz, Me-15); ^{13}C NMR (DMSO-d_6): δ 29.01 (C-1), 28.67 (C-2), 22.07 (C-3), 33.26 (C-4), 33.49 (C-5), 131.71 (C-6), 129.57 (C-7), 51.10 (C-8), 27.21 (C-9), 26.56 (C-10), 31.28 (C-11), 60.07 (C-12), 24.41 (C-13), 176.38 (C-14), 13.88 (C-15); EIMS *m/z* (rel. int.): 250 $[M]^+$ ($C_{15}H_{22}O_3$) (3.5), 204 (7.6), 189 (7.7), 183 (5.9), 165 (7.2), 153 (13.3), 150 (29.6), 143 (9.6), 139 (10.1), 138 (14.3), 121 (23.6), 113 (10.5), 111 (19.3), 110 (20.6), 109 (15.9), 107 (17.2), 97 (36.5), 85 (20.2), 81 (38.1), 67 (33.2), 56 (100).

3. Results and Discussion

The compound 1 showed IR absorption bands for hydroxyl group (3435 cm^{-1}) and long aliphatic chain (794, 721 cm^{-1}). Its mass spectrum displayed a molecular ion peak at *m/z* 298 corresponding to a molecular formula of saturated aliphatic alcohol, $C_{20}H_{42}O$. Generation of prominent ion peaks at *m/z* 241, 57 $[C_4\text{-}C_5$ fission$]^+$ and 211, 87 $[C_5\text{-}C_6$ fission$]^+$ indicated the location of hydroxyl group at C-5. The ^1H NMR spectrum of 1 showed a one-proton broad multiplet at δ 3.54 with half width of 16.3 Hz ascribed to α-oriented carbinol H-5 proton. Two three-proton triplets at δ 0.83 (*J* = 6.2 Hz) and 0.79 (*J* = 6.8 Hz) were accounted to terminal C-1 and C-20 primary methyl protons, respectively. Two multiplets at δ 1.55 (2H), and 1.34 (2H), and two broad singlets at δ 1.29 (6H), and 1.25 (24H) were associated with the methylene protons.

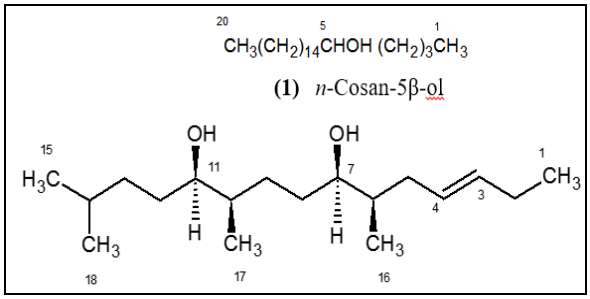
The ^{13}C NMR spectrum of 1 displayed signals for carbinol carbon at δ 66.11 (C-5), methylene carbons between δ 38.30 – 22.59 and methyl carbons at δ 14.70 (C-20) and 14.67 (C-1). The absence of any signal beyond δ 3.54 in ^1H NMR and 66.11 in ^{13}C NMR spectra supported the saturated nature of the molecule. On the basis of these evidences the structure of 1 was elucidated as *n*-cosan-5β-ol.

The compound 2, named Damescanol, had IR absorption

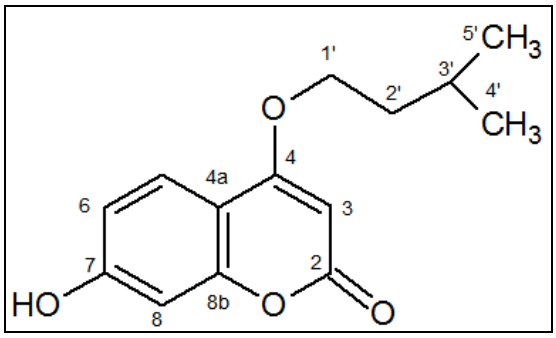
bands for hydroxyl groups (3430 cm^{-1}) and unsaturation (1635 cm^{-1}). Its mass spectrum showed a molecular ion peak at *m/z* 284 corresponding to a molecular formula to an acyclic norditerpenic diol, $C_{18}H_{36}O_2$. The generation of prominent ion peaks at *m/z* 255 [M - C_2H_5, C_2-C_3 fission] $^+$, 55 [C_4-C_5 fission, C_4H_7] $^+$ and 69 [C_5-C_6 fission, C_5H_9] $^+$ suggested the presence of the vinylic linkage at C-3. The ion peaks arising at *m/z* 97 [C_6-C_7 fission, C_7H_{13}]$^+$, 151 [M – 97 - $2H_2O$ fission]$^+$, 157, 127 [C_7-C_8 fission]$^+$, 109 [127-H_2O]$^+$, 143 [C_8-C_9 fission, $C_9H_{19}O$]$^+$, 125 [143-H_2O]$^+$, 129 [C_9-C_{10} fission, $C_8H_{17}O$]$^+$, 111 [129-H_2O]$^+$, and 137 [M – 129 - H_2O]$^+$ supported the location of hydroxyl group at C-7 [19]. The ion fragments formed at *m/z* 101 [C_{10}-C_{11} fission, $C_6H_{13}O$] $^+$, 43 [C_{13}-C_{14} fission, C_3H_7]$^+$, and 83 [101-H_2O]$^+$ indicated the existence of another hydroxyl group at C-11 and isopropyl group at terminal position of the carbon chain. The ^{1}H NMR spectrum of 2 showed two one-proton multiplet at δ 5.31 ($w_{1/2}$ = 8.9 Hz) and 5.28 ($w_{1/2}$ = 8.7 Hz) assigned to *cis*- oriented vinylic H-3 and H-4 protons, respectively. Two one-proton multiplets at δ 3.73 and 3.47 with half widths of 18.8 Hz and 17.1 Hz, respectively, were attributed correspondingly to α-oriented carbinol H-11α and H-7α protons. A two-proton broad singlet at δ 2.53 and two one-proton multiplets at δ 2.06 and 1.99 were ascribed to methylene H_2-5 and H_2-2 protons, adjacent to the vinylic linkage. Four three-proton doublets at δ 0.88 (*J* = 6.4 Hz, Me-16), 0.86 (*J* = 6.2 Hz, Me-15), 0.83 (*J* = 6.5 Hz, Me-18) and 0.74 (*J* = 6.1 Hz, Me-17) and a three-proton triplet at δ 0.65 (*J* = 6.1 Hz, Me-1) were associated with correspondingly secondary C-16, C-15, C-18 and C-17 and primary C-1 methyl protons, all located on saturated carbons. The remaining methylene and methine protons resonated between δ 2.04-1.08. The ^{13}C NMR spectrum of 2 displayed signals for vinylic carbons at δ 115.11 (C-3) and 129.66 (C-4), carbinol carbons at δ 76.87 (C-7) and 76.90 (C-11) and methyl carbons at δ 13.96 (C-1), 19.07 (C-15), 18.62 (C-16), 17.03 (C-17) and 16.08 (C-18). On the basis of these evidences the structure of 2 has been establishes as (*cis*)-6, 10, 14-trimethylpentadec-3-en-7β, 11β-diol, a new norditerpenic diol.

Compound 3, designated as rosacoumarin, exhibited UV absorption maxima for a coumarin at 232 and 335 nm ([20-21] and IR absorption bands for hydroxyl group (3434 cm^{-1}), carbonyl group (1710 cm^{-1}) and unsaturation (1615, 1530 cm^{-1}). Its molecular ion peak was established at *m/z* 248 on the basis of mass and ^{13}C NMR spectra consistent to a molecular formula of a coumarin derivative, $C_{14}H_{16}O_4$. The ion fragments arising at *m/z* 71 [$C_{1'}$ - O fission] $^+$ and 177 [M – 71]$^+$ indicated attachment of an isopentyl chain to the coumarin unit. The ^{1}H NMR spectrum of 3 showed a one-proton doublet at δ 6.95 (*J* = 7.6 Hz), assigned to *ortho*-coupled aromatic H-5 proton. A one-proton double doublet at δ 6.89 (*J* = 7.6, 3.0 Hz), a one-proton doublet at δ 6.83 (*J* = 3.0 Hz) and a one-proton singlet at δ 6.80 were ascribed to aromatic *ortho, meta*-coupled H-6, meta-coupled H-8 and H-3 protons, respectively. Two one-proton doublets at δ 3.65 (*J* = 9.3 Hz) and 3.55 (*J* = 9.3 Hz) were associated with H_2-1' oxy-methylene protons. Two three-proton doublets at δ 0.89 (*J* = 6.5 Hz) and 0.86 (*J* = 6.3 Hz) were accounted to secondary C-4' and C-5' methyl protons, respectively. A two-proton multiplet at δ 2.48 was attributed to methine H-3' proton. The ^{13}C NMR spectrum of 3 exhibited signals for carbonyl carbon at δ 167.60 (C-2), aromatic carbons in the range of δ 165.45 - 108.83, oxymethylene carbon at δ 62.74 (C-1′) and methyl carbons at δ 15.16 (C-4') and 14.03 (C-5'). The ^{1}H and ^{13}C NMR values of the coumarin were compared with the reported data of other coumarins [22-24]. On the basis of this discussion the structure of 3 has been establishes as 7-hydroxy-4-(3'-methyl butanol)-coumarin- 3- en-one, a new coumarin derivative.

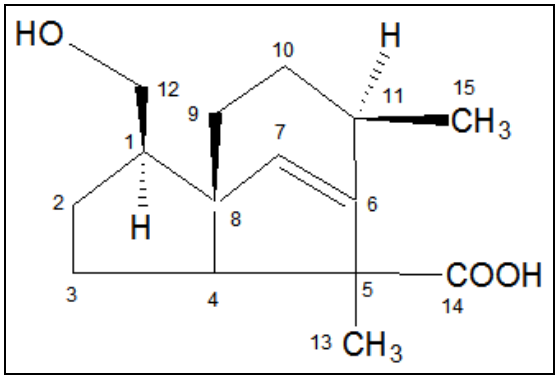
Compound 4, designated as rosacedrenoic acid, produced effervescence with sodium bicarbonate solution and decolorized bromine water indicating the presence of carboxylic acid group and unsaturation in the molecule. Its IR spectrum exhibited characteristic absorption bands for hydroxyl group (3455 cm^{-1}), carboxylic group (3426, 1709 cm^{-1}) and unsaturation (1636 cm^{-1}). Its molecular ion peak was determined on the basis of mass and ^{13}C NMR spectra at *m/z* 250 consistent to a molecular formula of the cedrene-type sesquiterpenes, $C_{15}H_{22}O_3$. The important ion fragments appearing at the *m/z* 72 [$C_{3,4}$-$C_{1,8}$ fission]$^+$, 165, 85 [$C_{4,5}$-$C_{1,8}$-$C_{4,8}$ fission]$^+$, 121 [165-CO_2]$^+$, 153, 97 [$C_{4,5}$-$C_{8,9}$ fission]$^+$, 67 [97-CH_2OH]$^+$, 109 [153-CO_2]$^+$, 138 [153-Me-C_8,C_7]$^+$, 111, 139 [$C_{4,5}$-$C_{10,11}$ fission]$^+$, 110 [125-Me]$^+$, 81 [125-CO_2]$^+$, and 143, 107 [$C_{4,5}$-$C_{6\text{-}11}$ fission]$^+$ supported the existence of the hydroxyl methylene group at the C-1 and methyl and carboxylic groups at C-5. The ion peaks generating at *m/z* 56 [$C_{8,9}$-$C_{6\text{-}11}$ fission]$^+$, 81, 169 [$C_{8,9}$-$C_{5,6}$-$C_{8,7}$ fission]$^+$, 67, 183 [$C_{9,10}$-$C_{7,8}$-$C_{5,6}$ fission]$^+$, 204 [M-HCOOH]$^+$, 189 [204-Me]$^+$, 150 [183-Me-H_2O]$^+$ suggested the location of the vinylic linkage at C-6 and another methyl group at C-11 [25]. The ^{1}H NMR spectrum of 4 showed a deshielded one-proton singlet at δ 5.28 assigned to vinylic H-7. A two-proton doublet at δ 3.55 (*J* = 10.2 Hz) was ascribed to hydroxymethylene H_2-12 protons. Three one-proton multiplets at δ 2.48 ($w_{1/2}$ = 12.8 Hz), 2.26 ($w_{1/2}$ = 11.9 Hz) and 1.98 ($w_{1/2}$ = 11.6 Hz) were accounted α-oriented methine H-11, H-4 and H-1 protons, respectively. A three-proton doublets at δ 0.87 (*J*= 6.2 Hz) was associated with C-15 secondary methyl protons. A six-proton broad singlet at δ 1.26 was ascribed to three methylene protons. A three-proton singlet at δ 1.21 was due to tertiary C-13 methyl protons. A two-proton multiplet δ 1.48 was due to methylene H_2-9 protons. The ^{13}C NMR spectrum of 4 exhibited important signals for vinylic carbons at δ 131.71 (C-6) and 129.59 (C-7), hydroxymethyl carbon at δ 60.07 (C-12), carboxylic carbons at δ 176.38 (C-14) and methyl carbons at δ 24.41 (C-13) and 13.88 (C-15). The ^{1}H and ^{13}C NMR spectra of the compound were compared with the reported values of cedrenes [26-28]. On the basis of this discussion the structure of 4 has been established as cedr-6-en-12-ol-14-oic acid, a new sesquiterpene.



(2) Damescanol



(3) Rosacoumarin



(4) Rosacedrenoic acid

4. Conclusion

The isolated secondary metabolites are valuable as they will provide necessary information for the further researchers as an effective analytical marker, identity, purity and quality control of this plant in future.

5. Acknowledgement

Authors are highly thankful to SAIF (CDRI Lucknow) and Central Instrumentation Facility, Jamia Hamdard, New Delhi for recording spectral data.

6. References

1. Loghmani KH, Sabzi-Fini O, Safari J. Essential oil composition of *Rosa damascena* Mill cultivated in central Iran. Scientia Iranica. 2007; 14:316-319.
2. Anonymous 1981. National Formulary of Unani Medicine; Government of India, Ministry of Health & Family Welfare (Department of AYUSH), New Delhi, Part I. 1981, 239
3. Gudin S. Rose: genetics and breeding. Plant Breeding Reviews. 2000; 17:159-89.
4. Shohayeb M, Abdel-Hameed ES, Bazaid SA, Maghrabi I. Antibacterial and Antifungal Activity of *Rosa damascena* Mill. Essential Oil, Different Extracts of Rose Petals. Global Journal of Pharmacology. 2014; 8(1):1-7.
5. Mahboubi M. *Rosa damascena* as holy ancient herb with novel applications. J Tradit Complement. Med. 2016; 6(1):10-16.
6. Ave-Sina. Law in Medicine. Interpreter; Sharafkhandy A, Teheran: Ministry of Guidance publication, 1990, 129-131.
7. Akhmadieva A, Zaichkina SI, Ruzieva RK, Ganassi EE. The protective action of a natural preparation of anthocyan (pelargonidin-3, 5-diglucoside). Radiobiologiia. 1992; 33:433-435.
8. Gochev V, Wlcek K, Buchbauer G. Comparative evaluation of antimicrobial activity and composition of rose oils from various geographic origins, in particular Bulgarian rose oil. Nat Prod Commun. 2008; 3:1063-1068.
9. Kirtikar KR, Basu BD. Indian Medicinal Plants. Bishen Singh Mahendra Pal Singh, Dehradun, India, International book distributor, 1975; 2(2):1366-1370.
10. Anonymous. Unani Pharmacopoeia of India, Government of India, Ministry of Health & Family Welfare (Department of AYUSH), New Delhi, 2007; 3:31.
11. Kwon EK, Lee DY, Lee H, Kim DO, Baek NI, Kim YE *et al*. Flavonoids from the Buds of *Rosa damascena* Inhibit the activity of 3-Hydroxy-3-methylglutaryl-coenzyme A Reductase and Angiotensin I-Converting Enzyme. J. Agric. Food Chem. 2010; 58:882-886.
12. Li YK, Sun JQ, Gao XM, Lei C. New Isoprenylated Aurones from the Flowers of *Rosa damascena*. Helvetica Chimica Acta. 2014; 97:414-419.
13. Nobeta K, Ara Y, Aoki Y, Miyaka M. Biosynthesis of Monoterpenes and Sesquiterpenes in *Larix leptolepis* Callus from Deuterated Mevalonates. Journal of Natural Product. 1990; 53:1241-1248.
14. Quizano L, Fronczek FR, Fisher NH. Sesquiterpene and diterpene lactones from *Melampodium leucanthum* and the molecular structure of 4(5)-dihydromelampodin B. Phytochemistry, 1985; 24:1747-1753.
15. Schieber A, Mihalev K, Berardini N, Mollov P, Carle R. Flavonol Glycosides from Distilled Petals of *Rosa damascena* Mill. Z. Naturforsch. 2005; 60c:379-384.
16. Gochev V, Jirovetz L, Wlcek K. Chemical composition and antimicrobial activity of historical rose oil from Bulgaria. J. Essent Oil Bearing Plants. 2009; 12:1-6.
17. Rusanov K, Kovacheva N, Rusanova M, Atanassov I. Low variability of flower volatiles of *Rosa damascena* Mill. Plants from rose plantations along the Rose Valley, Bulgaria. Indust Crops Prod. 2012; 37:6-10.
18. Ulusoy S, Boşgelmez-Tınaz G, Seçilmiş-Canbay H. Tocopherol, carotene, phenolic contents and antibacterial properties of rose essential oil, hydrosol and absolute. Curr Microbiol. 2009; 59:554-558.
19. Perumal K, Sambanda Moorthy TA, Savitha JS. Characterization of essential oil from offered temple flower *Rosa damascena* Mill. Asian J Exp Biol Sci. 2012; 3:330-334.
20. Moein M, Zarshenas MM, Delnavaz S. Chemical composition analysis of rose water samples from Iran. Pharm Biol. 2014; 52:1358-1361.
21. Umashankar T, Govindappa M, Yarappa Lakshmikantha R, Padmalatha Channabasava RS. Isolation and Characterization of Coumarin Isolated from Endophyte, Alternaria Species-1 of *Crotalaria pallida* and Its Apoptotic Action on HeLa Cancer Cell Line. Metabolomics. 2015; 5(4):1-8.
22. Dudek-Makuch M, Mat£awska I. Coumarins in horse chestnut flowers: isolation and quantification by UPLC method. Acta Poloniae Pharmaceutica. Drug Research. 2013; 70(3):517-522.
23. Luz RF, Vieira IJC, Braz-Filho R, Moreira VF. ^{13}C-NMR Data from Coumarins from Moraceae Family. Amer. J Anal. Chem. 2015; 6:851-866.
24. Intekhab J, Aslam M. Coumarins from The Roots of *Clausena pentaphylla*. FABAD J. Pharm. Sci. 2008; 33:67-70.
25. Cruz FG, Da-Silva-Neto JT, Guedes MLS. Xanthones and Coumarins from *Kielmeyera lathrophyton*. J. Braz. Chem. Soc. 2001; 12(1):117-122.
26. Joseph-Nathan P, Santillan RL, Gutierrez A. ^{13}C-NMR

Study of cedrol, 6-isocedrol and α-cedrene. J. Nat. Prod. 1984; 47(6):924-933.
27. Ali M. Techninques in triterpenoid identification. 1st ed., Birla publications: Delhi, 2001.
28. Perez-Hernandez N, Gordillo-Roman B, Arrieta-Baez D, Cerda-Garcia-Rojas CM, Joseph-Nathan P. Complete ^{1}H NMR assignment of cedranolides. Magn. Reson. Chem. 2015. DOI 10.1002/mrc.4246.