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CHEMICAL CONSTITUENTS FROM THE AERIAL PARTS OF *CAPPARIS DECIDUA* (FORSSK.) EDGEW.

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ABSTRACT

Capparis decidua (Forssk.) Edgew. (family Capparaceae) is a branching shrub or small tree found in the subtropical and tropical regions of southern Asia and Africa. The plant aerial parts are used to treat asthma, anorexia, boils, bruises, cardiac troubles, constipation, cough, diabetes, diarrhoea, dysentery, intermittent fever, jaundice, joint pain, liver infections, lumbago, parasitic worms, piles, pyorrhoea, renal disorders, rheumatism, skin diseases, swellings, toothache, indolent ulcers and wounds. Our study was planned to isolate chemical constituents from a methanolic extract of the aerial parts of *C. decidua* and to characterize their structures on the basis spectral data analysis. Phytochemical investigation of the aerial parts of *C. decidua* led to isolate five new chemical constituents as a saturated aliphatic keto alcohol identified *n*- docosan-1-ol-14-one (**1**), an aliphatic alcohol viz., *n*-tricosan-9β-ol (**2**), a sesquiterpenoid lactone formulated as germacr-3β-ol-12-ene-D-6,14-olide-15-oic acid (**3**), a polyamino- alkaloid characterized as 14, 15-didemthyl capparidisine (**4**) and a steroidal ester , viz. stigmast-5-en-3β-ol-3β-*n*-octacos-13′(Z)-enoate (β-sitosterol 3β-*n*-octacos-13′(Z)-enoate, **5**) along with a known disaccharide identified as β-D-fructofuranosyl-(1→2)- O-α-D-glucopyranoside (sucrose, **6**).

KEYWORDS: *Capparis decidua*, aerial parts, phytoconstituents, isolation, characterization.

INTRODUCTION

Capparis decidua (Forssk.) Edgew., syn. *C. aphylla* Roth (family Capparaceae or *Capparidaceae*), commonly known as karel, karer, karu and caper plant, is a densely branching shrub or small tree found in the subtropical and tropical regions of southern Asia including India and African countries. It is a slender plant, up to 6 m high, with many green leafless branches, small, light brown paired spines on the twigs at each node; leaves are very minute; flowers are pink in colour, red-veined, in small groups along the leafless shoots, in the axils of the spines; fruits are small many-seeded ovoid or sub-globulous, slightly mucronate pink berries of cherry size and shape, become blackish when dry.[1,2] The plant aerial parts are used as an abortifacient, acrid, analgesic, anthelmintic, antidiabetic, antidote, emetic, antifertility, anti-inflammatory, aphrodisiac, appetizer, astringent, carminative, counter irritant, diaphoretic, diuretic, emmenagogue, febrifuge, laxative, refrigerant, stimulant, stomachic, tonic and to treat anorexia, asthma, boils, bruises, cardiac troubles, constipation, cough, diabetes, diarrhoea, dysentery, intermittent fever, jaundice, joint pain, liver infections, lumbago, parasitic worms, piles, pyorrhoea, renal disorders, rheumatism, skin diseases, swellings, toothache, indolent ulcers and wounds.[1, 3,4] Young twigs are chewed to strengthen the gums and to ameliorate toothache. Young bud juice is dropped into the ear to cure earache. Young branches are used to treat ear infection and back pain. Wood ash is effective to relieve digestive tract infection and blood in stool.[3] Pickled fruits are taken to relieve constipation and other stomach ailments. The fruits are beneficial to comfort abdominal pain, biliousness, indigestion and rheumatism. The bark is useful as a diaphoretic, and to treat asthma, coughs, gum diseases, inflammation, acute pain, tooth decay and wounds.[1-4] The roots are considered as an antibacterial, aphrodisiac, anodyne, anthelmintic, carminative, digestive, expectorant, febrifuge, stimulant, sudorific, thermogenic, vermifuge and useful to relieve amenorrhoea, arthritis, constipation, dysmenorrhoea, dyspepsia, fever, jaundice, lumbago, odontalgia and rheumatism.[4] The root bark is used as an astringent, anthelmintic, anti-inflammatory, purgative and to cure dropsy, gout, rheumatism, cough, palsy, asthma, intestinal worms, intermittent fever and the powder is applied externally on malignant ulcer. Juice of the fresh plant is dropped into the ear to kill worms. The buds are utilized to subside boils.[1-5] The leaves are ingested as an appetizer and to overcome cardiac troubles. The shoots along with shoots of *Peganum harmala* are used as an antifertility drug. Ground stem and leaves effective

against alveolaris and pyorrhoea. Wood coal is beneficial in muscular injuries.[6]

The fruits contained fatty acid glycerides, *n*-tetracosanyl stearate, 3,4-dimethoxy-5- hydroxybenzaldehyde digalacturonosyl trilinoleate, 3,4- dimethoxy-5-hydroxybenzaldehyde digalacturonolinolenate, β-sitosterol-β-D-galacturonolinoleate, oleiyldigalacturonosyl triglucoside and galacturonotetra-arabinoside,[7] and 9-(11, 15, 15- trimethylcyclohex-11-ene-13-one-yl)-one-6- hydroxymethylene-7-one-yl, 4′-Me heptanoate.[8] The stem yielded p-hydroxybenzoic acid, protocatechuic acid, salicylic acid, syringic acid, vanillic acid, gentesic acid, 2-hydroxy-6-methoxybenzoic acid and sinapic acid,[9] β-sitosterol and β-sitosterol triacontenate.[10,11] The flowers possessed saturated aliphatic hydrocarbons, ketones (C28 and C32), *n*- nonacosanol, β-sitosterol-β-D-glucoside, β-sitosterol, pelargonidin-3-galactoside, glucocappasalin, glucocapparin, D-glucose and D-galactose.[8,12] The root bark afforded spermidine alkaloids isocodonocarpine, capparisinine and capparidisine,[13-15] other alkaloids, viz. 14-*N*-acetyl isocodonocarpine, 15-*N*-acetyl capparisine, cadabicine, stachydrine, capparisine and codonocarpine,[14, 16,17] oxygenated heterocyclic constituents capparisesterpenolide (3-carboxy-6, 17-dihydroxy-7, 11, 15, 19- tetramethyl eicos-13-ene-δ-lactone) and deciduaterpenolides (δ-lactone derivatives of 1, 3, 3-trimethyl- 1, 4-cyclohexadien- 6-one), sterols, diterpenic alcohol, butyl-3-oxoeicosanoate, 25-oxooctosan- 1, 20- diol and diterpenic ester identified as 9-(11, 15, 15-trimethylcyclohex-11- ene-13-one-yl)-one-6- hydroxymethylene-7-one-yl, 4-Me heptanoate.[18,19] The aerial parts furnished sesquiterpene lactones, germacr-3β-ol-7,9-dien-6,14-olide-15-oic acid and germacr-3β-ol-12-ene-6,14-olide-15-oic acid.[20] Herein we report the isolation and identification of chemical constituents from the aerial parts of *Capparis decidua*.

MATERIALS AND METHODS

The protocols of all methodologies (procedures, experimental designs and spectral data analysis) were adopted from the earlier published work.[7, 21,22]

Collection and authentication of plant materials

The aerial parts of *Capparis decidua* were collected from Delhi. The plant material was identified and authenticated by Prof. M. P. Sharma, Taxonomist, Department of Botany, Jamia Hamdard, New Delhi. A voucher specimen of the plant material was preserved in the herbarium of the Department of Pharmacognosy and Phytochemistry, Jamia Hamdard, New Delhi.

Extraction and isolation

The aerial parts of *C. decidua* (1 kg) were dried in air, coarsely powdered and extracted exhaustively with methanol in a Soxhlet apparatus. The extract was concentrated under reduced pressure to get a dark brown mass, 117.2 g. The dried residue (100 g each) was dissolved in minimum amount of methanol and adsorbed on silica gel column grade (60-120 mesh) to obtain a slurry. It was air-dried and chromatographed over a silica gel column loaded in petroleum ether (b. p. 60 – 80 °C). The column was eluted with petroleum ether, petroleum ether - chloroform (9:1, 3:1, 1:1, 1:3, *v/v*), chloroform and chloroform - methanol (99:1, 49:1, 19:1, 9:1, *v/v*) mixtures. Various fractions were collected separately and matched by TLC to check homogeneity. Similar fractions having the same R_f values were combined and crystallized with solvents. The isolated compounds were recrystallized to get pure compounds.

n- Docosan-1-ol-14-one (1)

Elution of the column with petroleum ether – chloroform (1:1) furnished a colourless amorphous mass of **1**, 219 mg, recrystallized with chloroform – methanol (1:1, v/v) mixture, m. p. 74 - 75 ^{o} C; UV λmax (MeOH): 210 nm (log ε 4.1); IR υ_{max} (KBr): 3463, 2923, 2848, 1708, 1463, 1411, 1376, 1295, 1227, 1049, 939, 720 cm^{-1}; ^{1}H NMR ($CDCl_3$): δ 3.46 (1H, t, J = 7.5 Hz, H_2-1), 2.55 (2H, m, H_2-13), 2.52 (2H, m, H_2-15), 1.54 (2H, m, H_2-12), 1.29 (32 H, brs, 16 × CH_2), 0.87 (3H, t, J = 7.2 Hz, Me-22); ^{13}C NMR ($CDCl_3$): δ 63.58 (C-1), 31.24 (C-2), 29.61 (C-3), 29.36 (C-4), 28.62 (C-5 to C-12), 55.19 (C-13), 203.16 (C-14), 53.23 (C-15), 28.62 (C-16 to C-18), 27.31 (C-19), 25.47 (C-20), 22.68 (C-21), 14.09 (C-22); EIMS *m/z* (rel. int.): 340 $[M]^{+}$ ($C_{22}H_{44}O_2$) (39.6), 311 (21.5), 267 (47.3), 227 (22.6), 199 (10.7), 183 (100), 141 (92.7), 123 (37.8), 113 (13.6).

n-Tricosan-9β-ol (2)

Further elution of the column with petroleum ether-chloroform (1:1) afforded colourless crystals of **2**, recrystallized from acetone-methanol (1:1), yield 189 mg, m. p. 68 - 69 °C; UV λ max (MeOH): 210 nm (log ε 3.6); IR υmax (KBr): 3430, 2936, 2867, 1464, 1379, 1059, 1022, 957, 727 cm^{-1}; ^{1}H NMR ($CDCl_3$): δ 3.35 (1H, m, $w_{1/2}$ = 18.6 Hz, H -9α), 1.71 (2H, m, H_2 -8), 1.68 (2H, m, H_2 -10), 1.54 (2 H, m, H_2 -7), 1.29 (24 H, brs, 12 x CH_2), 1.25 (10 H, brs, 5 x CH_2), 0.81 (3H, t, J = 6.1 Hz, Me-1), 0.78 (3H, t, J = 6.3 Hz, Me-23); ^{13}C NMR ($CDCl_3$): δ 14.23 (C-1), 22.69 (C-2), 25.34 (C-3), 29.32 (C-4 to C-8), 65.21 (C-9), 31.18 (C-10), 30.25 (C-11), 29.25 (C-12 to C-20), 24.96 (C-21), 22.69 (C-22), 14.15 (C-23); EIMS *m/z* (rel. int.): 340 $[M]^{+}$ ($C_{23}H_{48}O$) (10.8), 227 (6.1), 143 (32.1), 113 (100).

Germacr-3β-ol-12-ene-D-6,14-olide-15-oic acid (3)

Elution of the column with chloroform afforded colourless crystals of **3**, recrystallized from acetone-methanol (1:1), yield 121 mg, m. p. 91 - 93 °C; UV λ max (MeOH): 224 nm (log ε 3.4); IR υmax (KBr): 3427, 3241, 2938, 2853, 1725, 1693, 1642, 1469, 1364, 1051, 938 cm^{-1}; ^{1}H NMR ($CDCl_3$): δ 1.57 (1H, m, H_2-1α), 1.42 (1H, m, H_2-1β), 1.39 (1H, m, H_2-2α), 1.25 (1H, m, H_2-2 β), 3.48 (1H, brm, $w_{1/2}$ = 18.6 Hz, H-3 α), 1.46 (1H, m, H-4 α), 1.35 (1H, m, H_2-5α), 1.31 (1H, m, H_2-5 β), 4.28 (1H, m, $w_{1/2}$ = 15.3 Hz, H-6 α), 2.48 (1H, m, $w_{1/2}$ = 16.1 Hz, H-7 α), 1.29 (2H, m, H_2-8), 1.68 (2H, m, H_2-9), 2.26 (1H, m, $w_{1/2}$ = 14.9 Hz, H-10 α), 0.96 (1H, d, J = 7.2 Hz,

Me-11), 5.04 (1H, s, H_2-13a), 4.98 (1H, s, H_2-13b); EIMS *m/z* (rel. int.): 266 $[M]^+$ ($C_{15}H_{22}O_4$) (7.3).

14, 15-Didemthyl capparidisine (4)

Elution of the column with chloroform - methanol (3:1) fraction yielded yellow crystalline mass of **4**, recrystallized from acetone - methanol (1:1), yield 112 mg; m. p. 157 - 159 °C, UV λmax (MeOH): 217, 284 nm (log ε 5.1, 5.2); IR (KBr) γ_{max} : 3500, 3380, 3263, 2930, 2845, 1680, 1584, 1496, 1218, 1163, 1112, 1025, 973, 846 cm^{-1}; ^1H NMR (DMSO-d_6): δ 7.83 (1H, d, J = 9.1 Hz, H-11), 7.75 (1H, d, J = 9.3 Hz, H-6), 7.31 (1H, d, J = 9.1 Hz, H-12), 7.16 (1H, d, J = 2.9 Hz, H-9), 6.89 (1H, dd, J = 2.9, 9.3 Hz, H-5), 6.60 (1H, J = 11.3 Hz, H-2), 6.48 (1H, d, J = 12.5 Hz, H-16), 5.91 (1H, d, J = 11.3 Hz, H-3), 5.85 (1H, d, J = 12.5 Hz, H-17), 3.42 (8H, brs, H_2-19, H_2-22, H_2-23, H_2-25), 2.43 (6H, brs, H_2-20, H_2-21, H_2-24); EIMS *m/z* (rel. int.): 467 $[M]^+$ ($C_{25}H_{29}O_6N_3$) (58.3), 436 (53.1), 346 (7.5), 316 (9.8), 144 (100), 104 (4.8).

β-Sitosterol 3 β-*n*-octacos-13′(Z)-enoate (5)

Elution of the column with chloroform – methanol (19:1) produced a colourless amorphous mass of **5**, 219 mg, recrystallized with chloroform – methanol (1:1, v/v) mixture, m. p. 127 – 129 °C; UV λmax (MeOH): 217, 265 nm (log ε 1.8, 4.1); IR υ_{max} (KBr): 2925, 2852, 1736, 1645, 1464, 1377, 1245, 1159, 1011, 721 cm^{-1}; ^1H NMR ($CDCl_3$): δ 5.37 (1H, m, H-6), 4.11 (1H, brm, $w_{1/2}$ = 18.6 Hz, H-3α), 2.24 (2H, m, H_2-4), 2.09 (1H, m, H_2-7α), 2.06 (1H, m, H_2-7β), 1.85 (2H, m, H_2-2), 1.81 (2H, m, H_2-12), 1.68 (1H, m, H-9), 1.63 (2H, m, H_2-15), 1.61 (2H, m, H_2-16), 1.59 (1H, m, H-17), 1.56 (1H, m, H-20), 1.53 (1H, m, H-8), 1.48 (1H, m, H-24), 1.45 (1H, m, H-25), 1.36 (2H, m, H_2-1), 1.31 (2H, m, H_2-22), 1.28 (2H, m, H_2-23), 1.23 (2H, m, H_2-11), 1.06 (3H, brs, Me-19), 0.92 (3H, d, J = 6.1 Hz, Me-21), 0.88 (3H, d, J = 6.3 Hz, Me-26), 0.84 (3H, t, J = 6.5 Hz, Me-27), 0.81 (3H, t, J = 6.2 Hz, Me-29), 0.67 (3H, brs, Me-18), 5.33 (1H, m, $w_{1/2}$ = 9.7 Hz, H-14′), 5.31 (1H, m, $w_{1/2}$ = 10.9 Hz, H-13′), 2.35 (2H, t, J = 7.9 Hz, H_2-2′), 2.26 (2H, m, H_2-15′), 2.11 (2H, m, H_2-12′), 2.04 (2H, m, H_2-3′), 1.27 (44H, brs, 22 x CH_2), 0.78 (3H, d, J = 6.7 Hz, Me-28′); ^{13}C NMR ($CDCl_3$): δ 36.02 (C-1), 31.53 (C-2), 73.41 (C-3), 40.38 (C-4), 141.34 (C-5), 122.49 (C-6), 33.27 (C-7), 32.91 (C-8), 49.78 (C-9), 36.51 (C-10), 21.95 (C-11), 39.08 (C-12), 43.22 (C-13), 56.71 (C-14), 24.33 (C-15) , 28.43 (C-16), 55.87 (C-17), 11.91 (C-18), 19.73 (C-19), 36.38 (C-20), 18.75 (C-21), 34.59 (C-22), 26.15 (C-23), 45.87 (C-24), 29.18 (C-25), 20.34 (C-26), 19.86 (C-27), 24.95 (C-28), 11.87 (C-29), 173.62 (C-1′), 43.61 (C-2′), 38.91 (C-3′), 37.95 (C-4′), 29.65 (C-5′ to C-11′), 41.52 (C-12′), 130.12 (C-13′), 127.95 (C-14′), 29.68 (C-15 ′ to C-23′), 27.14 (C-24′), 26.05 (C-25′) , 25.58 (C-26′), 22.67 (C-27′), 14.12 (C-28′); EIMS *m/z* (rel. int.): 818 $[M]^+$ ($C_{57}H_{102}O_2$) (3.4), 421 (8.7), 413 (15.1), 405 (21.9), 397 (7.8), 223 (17.1), 197 (9.5).

β-D-Fructofuranosyl-(1→2)- O-α-D-glucopyranoside (6)

Elution of the column with chloroform – methanol (1:1) afforded a colourless powder of **6**, recrystallized from ethanol, yield 128 mg, m. p. 184 - 186 °C; IR υ_{max} (KBr): 3433, 3347, 3278, 2923, 2855, 1643, 1462, 1217, 1141, 1045, 771 cm^{-1}; ^1H NMR (DMSO-d_6): δ 4.98 (1H, d, J = 7.3 Hz, H-1), 4.90 (1H, m, H-2), 4.86 (1H, m, H-4), 4.13 (1H, m, H-3), 3.31 (1H, m, H-5), 3.14 (1H, d, J = 9.1 Hz, H_2-6), 4.95 (1H, d, J = 7.8 Hz, H-1′), 4.92 (1H, m, H-5′), 4.51 (1H, m, H-2′), 3.45 (1H, m, H-3′), 3.34 (1H, m, H-4′), 3.12 (1H, d, J = 8.9 Hz, H_2-6′); ^{13}C NMR ($CDCl_3$): δ 105.23 (C-1), 76.28 (C-2), 73.23 (C-3), 78.47 (C-4), 62.86 (C-5), 62.83 (C-6), 92.48 (C-1′), 74.11 (C-2′), 72.56 (C-3′), 66.69 (C-4′), 71.38 (C-5′), 61.53 (C-6′); EIMS *m/z* (rel. int.): 342 $[M]^+$ ($C_{12}H_{22}O_{11}$) (8.3), 179 (21.2), 163 (33.5).

RESULTS AND DISCUSSION

Compound **1** showed distinctive IR absorption bands for a hydroxyl group (3463 cm^{-1}), carbonyl group (1708 cm^{-1}) and long aliphatic chain (720 cm^{-1}). Its molecular weight was determined at *m/z* 340 on the basis of mass spectrum consistent with a molecular formula of a saturated aliphatic keto alcohol, $C_{22}H_{44}O_2$. The ion peaks arising at *m/z* 141 [C_{13} – C_{14} fission, CH_3-$(CH_2)_7$-CO, C_8H_{17}-CO]$^+$, 199 [M – 141, $(CH_2)_{12}$-$CH_2OH]^+$, 113 [C_{14} – C_{15} fission, CH_3-$(CH_2)_7$ -, $C_8H_{17}]^+$ and 227 [M – 113, CO-$(CH_2)_{12}$-$CH_2OH]^+$ indicated the existence of the carbonyl function at C-14 carbon atom. The ^1H NMR spectrum of **1** showed a two-proton triplet at δ 3.46 (J = 7.5 Hz) ascribed to hydroxymethylene H_2-1 protons. The methylene protons appeared as two-proton multiplets at δ 2.55, 2.52 and 1.54 and as a singlet at δ 1.29 (32H). A three-proton triplet at δ 0.87 (J = 7.2 Hz) was accounted to C-22 primary methyl protons. The ^{13}C NMR spectrum of **1** exhibited signals for the carbonyl carbon at δ 203.16 (C-14), hydroxymethylene carbon at δ 63.58 (C-1), other methylene carbons between δ 55.19 – 22.68 and methyl carbon at δ 14.09 (C-22). The absence of any signal beyond δ 3.46 in the ^1H NMR spectrum and carbon signals between δ 203.16 - 63.58 in the ^{13}C NMR spectrum ruled out the existence of any vinylic linkage in the molecule. On the basis of spectral data analysis, the structure of **1** has been elucidated *n*- docosan-1-ol-14-one, a new saturated aliphatic keto alcohol (Fig.1).

The IR spectrum of compound **2** showed absorption bands for a hydroxyl group (3430 cm^{-1}) and long aliphatic chain (727 cm^{-1}). Its mass spectrum displayed a molecular ion peak at *m/z* 340 corresponding to an aliphatic alcohol, $C_{23}H_{48}O$. The ion fragments arising at *m/z* 113 [C_8 – C_9 fission, $CH_3(CH_2)_7]^+$, 227 [M – 113, CH(OH)-$(CH_2)_{13}$-$CH_3]^+$ and 143 [C_9 – C_{10} fission, CH_3-$(CH_2)_7$-$CHOH]^+$ suggested the attachment of the hydroxyl group at C-9 carbon. The ^1H NMR spectrum of **2** exhibited a one-proton multiplet at δ 3.35 with half-width of 18.6 Hz was assigned to alpha-oriented H-9 carbinol proton. Three two-proton multiplets at δ 1.68, 1.54 and 1.29 and two broad singlets at δ 1.29 (24 H) and

1.25 (10 H) were attributed to the methylene protons. Two three-proton triplets at δ 0.81 (J = 6.1 Hz) and 0.78 (J = 6.3 Hz) were accounted to terminal C-1 and C-23 primary methyl protons. The ^{13}C NMR spectrum of **2** showed signals for the carbinol carbon at δ 65.21 (C-9), methylene carbons from δ 31.18 to 22.69 and methyl carbons at δ 14.23 (C-1) and 14.15 (C-23). The absence of any signal beyond δ 3.35 in the ^{1}H NMR spectrum and carbon signals after δ 65.21 in the ^{13}C NMR spectrum ruled out the existence of any vinylic linkage in the molecule. On the basis of these spectral data analysis, the structure of **2** has been established as *n*-tricosan-9β-ol, a new aliphatic alcohol (Fig. 1).

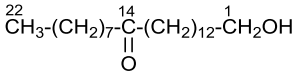
Compound **3** showed characteristic IR absorption bands for a hydroxyl group (3427 cm^{-1}), carboxylic function (3241, 1693 cm^{-1}), δ-lactone (1725 cm^{-1}) and unsaturation (1642 cm^{-1}). On the basis of mass and ^{13}C NMR spectra its molecular ion peak was established at *m/z* 266 consistent with a molecular formula of a monocyclic sesquiterpene lactone, $C_{15}H_{22}O_4$. The ^{1}H NMR spectrum of **3** displayed two one-proton singlets at δ 5.04 and 4.98 assigned to exocyclic vinylic methylene H_2-13 protons. A one-proton multiplet at δ 3.48 with half-width of 18.6 Hz was attributed to carbinol H-3α proton. A one-proton multiplet at δ 4.28 with half-width of 15.3 Hz was ascribed to oxymethine H-6α proton. A three-proton doublet at δ 0.96 (J = 7.2 Hz) was accounted to secondary C-11 methyl protons located on a saturated carbon. Two one-proton multiplets at δ 2.48 ($w_{1/2}$ = 16.1 Hz) and 2.26 ($w_{1/2}$ = 14.9 Hz) were due to alpha-oriented methine H-7 adjacent to the vinylic carbon and H-10 nearby to the carboxylic carbon, respectively. The remaining methine and methylene protons resonated in the range of δ 1.68 – 1.25. The ^{13}C NMR spectrum of **3** exhibited signals for lactone carbon at δ 169.35 (C-14), oxymethine carbon at δ 72.19 (C-6), carbinol carbon at δ 68.42 (C-3), carboxylic carbon at δ 180.38 (C-15), exocyclic methylene vinylic carbons at δ 150.27 (C-12) and 106.33 (C-13) and methyl carbon at δ 11.51 (C-11). On the basis of spectral data analysis the structure of **3** has been formulated as germacr-3β-ol-12-ene-D-6,14-olide-15-oic acid, a new sesquiterpenoid lactone (Fig. 1).

Compound **4** responded phenolic tests positively and its UV spectrum had absorption maximum at 284 nm for aromatic compounds. The IR spectrum of **4** disclosed the existence of distinctive absorption bands for the hydroxyl groups (3500, 3380 cm^{-1}), secondary amide (3263 cm^{-1}), carbonyl functions (1680 cm^{-1}) and aromatic ring (1584, 1025 cm^{-1}) in the molecule. On the basis of mass and ^{13}C NMR spectra, its molecular ion peak was determined at *m/z* 467 consistent with the molecular formula of a spermidine-type alkaloid capparidisine, $C_{25}H_{29}O_6N_3$. The ^{1}H NMR spectrum of **4** showed signals for aromatic protons as three one-proton doublets at δ 7.83 (J = 9.1 Hz), 7.75 (J = 9.3 Hz) and 7.31 (J = 9.1 Hz) assigned to ortho-coupled H-11, H-6, and H-12, respectively, as one-proton doublet at δ 7.16 (J = 2.9 Hz) due to meta-coupled H-9, and as a one-proton double doublet at δ 6.89 (J = 2.9, 9.3 Hz) ascribed to meta-, ortho-coupled H-5 proton. Four one – proton doublets at δ 6.60 (J = 11.3 Hz), 6.48 (J = 12.5 Hz), 5.91 (J = 11.3 Hz), 5.85 (J = 12.5 Hz) were attributed correspondingly to cis-oriented vinylic H-2, H-16, H-3 and H-17 protons. An eight proton broad singlet at δ 3.42 was accommodated to methylene H_2-19, H_2-22, H_2-23 and H_2-25 protons adjacent to the secondary amino groups. The other H_2-20, H_2-21 and H_2-24 methylene protons resonated as a six-proton singlet at δ 2.43. These evidences led to established the structure of **4** as 14, 15-didemthyl capparidisine, a new polyamino alkaloid (Fig. 1).

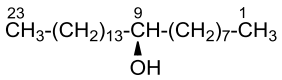
Compound **5** showed characteristics IR absorption bands for an ester function (1736 cm^{-1}), unsaturation (1645 cm^{-1}) and a long aliphatic chain (721 cm^{-1}). On the basis of mass and ^{13}C NMR spectra , the molecular ion peak of **5** was determined at *m/z* 818 corresponding to the molecular formula of a steroidal ester, $C_{57}H_{102}O_2$. The important ion fragments produced at *m/z* 413 [$C_{1'}$ - O fission, $C_{29}H_{49}O]^+$, 405 [M – 413, CH_3 -$(CH_2)_{13}$ - CH=CH-$(CH_2)_{11}$- CO]$^+$, 397 [C_3 – O fission, $C_{29}H_{49}]^+$ and 421 [M – 397, CH_3-$(CH_2)_{13}$ -CH=CH-$(CH_2)_{11}$-COO]$^+$ indicated that *n*-octacosenoic acid was esterified with β-sitosterol. The ion peaks generated at *m/z* 223 [$C_{12'}$ - $C_{13'}$ fission, CH=CH-$(CH_2)_{13}$-$CH_3]^+$ and 197 [$C_{14'}$ - $C_{15'}$ fission, CH=CH-$(CH_2)_{13}$-$CH_3]^+$ suggested the location of the vinylic linkage between $C_{13'}$ - $C_{14'}$ position. The ^{1}H NMR spectrum of **5** showed steroidal protons as a one-proton multiplet at δ 5.37 assigned to vinylic H-6 proton and a one-proton broad multiplet at δ 4.11 with half-with of 18.6 Hz attributed to oxygenated α-oriented H-3 proton. Two three-proton singlets at δ 1.06 and 0.67, three three-proton doublets at δ 0.92 (J = 6.1 Hz), 0.88 (J = 6.3 Hz) and 0.84 (J = 6.5 Hz) and one three-proton triplet at δ 0.81 (J = 6.2 Hz) were associated with the tertiary C-19 and C-18, secondary C-21, C-26 and C-27 and primary C-29 methyl protons, respectively. The other methine and methylene protons resonated between δ 2.24 – 1.23. The proton signals of the acyl chain appeared as two one-proton multiplets at δ 5.33 ($w_{1/2}$ = 9.7 Hz) and 5.31 ($w_{1/2}$ = 10.9 Hz) accounted to the cis-oriented vinyl H-14′ and H-13′ protons, respectively, a two-proton triplet at δ 2.35 (J = 7.9 Hz) was due to methylene H_2-2′ protons adjacent to the ester function, the other methylene protons appeared as two-proton multiplets at δ 2.26 (H_2-15′), 2.11 (H_2-12′) and 2.04 (H_2-3′) and as a broad singlet at δ 1.27 (44H) and a three-proton triplet δ 0.78 (J = 6.7 Hz) accounted to C-28′ primary methyl protons. The ^{13}C NMR spectrum of **5** showed important signals for steroidal vinylic carbons at δ 141.34 (C-5) and 122.49 (C-6), oxymethine carbon at δ 73.41 (C-3), methyl carbons at δ 11.91 (C-18), 19.73 (C-19), 18.75 (C-21), 20.34 (C-26), 19.86 (C-27) and 11.87 (C-29) and acyl signals for the ester carbon at δ 173.62 (C-1′), vinylic carbons at δ 130.12 (C-13′) and 130.34 (C-13′), methylene carbons from δ 43.61 to 22.67 and methyl carbon at δ 14.12 (C-28′). The ^{1}H NMR and ^{13}C NMR spectral data of the steroidal nucleus were

compared with other stigmastene-type molecules.[21,22] On the basis of spectral data analysis, the structure of **5** has been formulated as stigmast-5-en-3β-ol-3β-*n*-octacos-13′(Z)-enoate (β-sitosterol 3β-*n*-octacos-13′(Z)-enoate), a new steroidal ester. (Fig. 1).

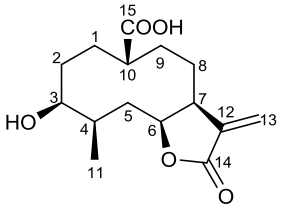
Compound **6** was a known disaccharide identified as β-D-fructofuranosyl-(1→2)-O-α-D-glucopyranoside (sucrose).[23,24]



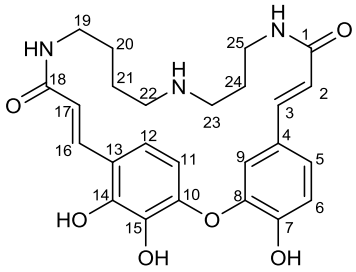
***n*-Docosan-1-ol-14-one (1)**



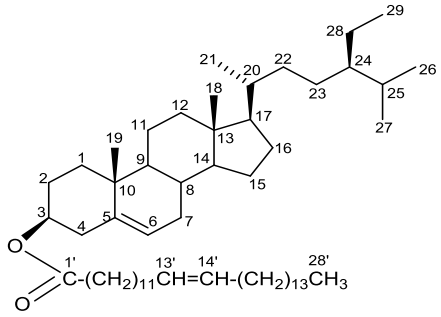
***n*-Tricosan-9β-ol (2)**



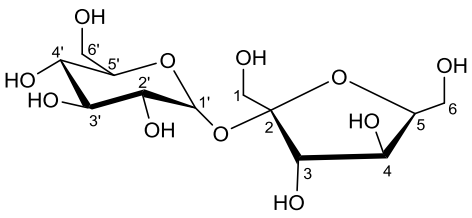
Germacr-3β-ol-12-ene D-6,14-olide-15-oic acid (3)



14,15-Dimethyl capparidisine (4)



β-Sitosterol-3β-octacos-13′(*Z*)-enoate (5)



Sucrose (6)

Fig. 1: Chemical constituents 1 to 6 isolated from the aerial parts of *Capparis decidua.*

CONCLUSION

Phytochemical investigation of the aerial parts of *Capparis decidua* led to isolate five new chemical constituents as a saturated aliphatic keto alcohol identified *n*- docosan-1-ol-14-one (**1**), an aliphatic alcohol viz., *n*-tricosan-9β-ol (**2**), a sesquiterpenoid lactone formulated as germacr-3β-ol-12-ene-D-6,14-olide-15-oic acid (**3**), a polyamino- alkaloid characterized as 14, 15-didemthyl capparidisine (**4**), and a steroidal ester , viz. stigmast-5-en-3β-ol-3β-*n*-octacos-13′(Z)-enoate (β-sitosterol 3β-*n*-octacos-13′(Z)-enoate, **5**) along with a known disaccharide identified as β-D-fructofuranosyl-(1→2)- O-α-D-glucopyranoside (sucrose, **6**).This work has enhanced understanding about the chemical constituents of the undertaken plant.

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