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CHEMICAL CONSTITUENTS FROM THE *CUSCUTA CHINENSIS* WHOLE PLANT AND *SALACIA OBLONGA* ROOTS

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ABSTRACT

Cuscuta chinensis Lam. (Convolvulaceae) is a slender yellow twining, holoparasitic plant used to treat chronic diarrhoea, decreased eyesight, impotence, leucorrhoea, lumbago, frequent micturition, nocturnal emissions, threatened abortion and vertigo. *Salacia oblonga* Wall. (family Celastraceae) is a climbing stout shrub with densely warty, lanceolate branchlets. Its aerial parts and roots are prescribed to cure asthma, diabetes, ear diseases, gonorrhoea, itching, leukaemia, inflammation and rheumatism. This research work was undertaken to characterize structures of chemical constituents isolated from these plants. Phytochemical investigation of the whole plant *C. chinensis* afforded known compounds identified as octadecanoic acid (stearic acid, **1**) and tetradecyl palmitate (myristyl palmitate, **2**), a new phenyl substituted ethyl glycol characterized as 1′-(3,4-dimethoxyphenyl) ethyl-1′β, 2′-diol (**3**), *n*-pentatriacontane (**4**) and a new unsaturated aliphatic alcohol formulated as (*Z*), (*Z*)-*n*-tetratriacont-21,27-dien-1-ol (**5**). The roots of *S. oblonga* afforded two new ponkoranol derivatives identified as 6′-dehydroxyneoponkoranol (**6**) and 5′-epi-6′-dehydroxyneoponkoranol (**7**) together with a known de-O-sulphonated ponkoranol (neoponkoranol, **8**). The structures of isolated phytoconstituents were established on the basis of analysis of spectral data and chemical means.

KEYWORDS: *Cuscuta chinensis* plant, *Salacia oblonga* roots, phytoconstituents, isolation, characterization.

INTRODUCTION

Cuscuta chinensis Lam. (Convolvulaceae), known as amar bel and common dodder, is distributed in Ethiopia, middle Asia, Mongolia, Russia, China, Iran, Iraq, Afghanistan, India, Sri Lanka, Indonesia, Korea, Japan, Taiwan, Thailand and Australia. It is a slender yellow twiner; stems thin, twining, filiform, glabrous; leaves absent, flowers sessile, hermaphrodite, in lateral fascicles, corolla pale yellow, widely funnel-form; capsule depressed-globose, irregularly dehiscent, enclosed by persistent corolla, pericarp thin, circumscissile; seeds 2-4, 1-2 mm long, ovulate, pale brown, rough. It is a holoparasitic plant which absorbs both water and nutrients from the host plants.[1,2] The twiner is used to treat chronic diarrhoea, decreased eyesight, impotence, leucorrhoea, lumbago, frequent micturition, nocturnal emissions, threatened abortion and vertigo. A stem lotion is utilized to relieve sore heads and inflamed eyes. The seed is aphrodisiac, demulcent, diaphoretic, hepatic and tonic.[3]

The stem contained beta-sitosterol, d-sesamin, 9(R)-hydroxy-d-sesamin, d-pinoresinol and daucosterol, 3',4'-dimethoxy-1-phenyl-1α, 2-ethanediol, tridecanyl palmitate, palmitic acid, *n*-pentatriacontane, *n*-triacont-21, 27-dien-1-ol, kaempferol, chlorogenic acid, 5,7-dimethoxyapigenin and quercetin.[4,5]The seeds furnished quercetin 3-O-beta-D-galactoside-7-O-beta-D-glucoside, quercetin 3-O -beta-D-apiofuranosyl-(1→2)-beta-D-galactoside, hyperoside isorhamnetin, kaempferol, quercetin, d-sesamin, 9(R)-hydroxy-d-sesamin and astragalin,[6-9] glycolipid lactone, cuscutic resinoside,[10] furofuran lignans neocuscutasides A, B and C,[11] 4-hydroxy-3, 5- dimethoxycinnamate, caffeic acid, quercetin, kaempferol and calycopteretin,[12] acidic polysaccharides,[13-15] a trisaccharide, glycosidic acids named cuscutic acids A-D, acetic acid, propionic acid, (2*S*)-2-methylbutyric acid, tiglic acid, (2*R*, 3*R*)-nilic acid, (11*S*) convolvulinolic acid and (11*S*)-jalapinolic acid,[16] lignan glycosides,[17] β-sitosterol, methyl 4-hydroxy-3,5-dimethoxycinnamate, β-sitosterol- 3- O- β- D-glucopyranoside, caffeic acid, quercetin, kaempferol and calycopteretin,[18] acylated trisaccharides cus-1 and cus-2 and a mixture of resin glycoside,[19] quercetin-3-O-β-D-apiofuranosyl-(1→2)-β-D-galactoside, hyperoside, kaempferol-3-O-β-D-glucoside, kaempferol, quercetin, and chlorogenic acid,[20] hyperoside, rutin, isorhamnetin and kaempferol.[21] The plant yielded flavonoids and

their glycosides, 4-caffeoyl-5-coumaroyl quinic acid, D-celery glycoside, dicaffeoylquinic acid, coumaroyl-dicaffeoylquinic acid, chlorogenic acid and stigmasterol, a tryptophan derivative alkaloid, cuscutamine and lignans named cuscutosides A and B.[22-24]

Salacia oblonga Wall. (family Celastraceae), known as ekanayaka, ponkorandi, ponkoranti and oblong leaf salacia, is a native to southern India, Sri Lanka, China, Vietnam, Malaysia, Indonesia and other Asian countries. It is a climbing stout shrub with densely warty, lanceolate branchlets; leaves are oblong, acute or obtuse at apex, acute at base, green, veined, and borne on stalks up to 1 cm long; peduncle short, stout, many-flowered; flowers many, green-yellow, bisexual, axillary; fruits orange-red, smooth berries; seeds 1-6, large, angular, embedded in a fleshy pulp.[25-27] The leaves are used to treat diabetes. The bark and root have been used to help control glucose and fat levels in the blood. Salacia is used as an acrid, bitter, thermogenic, urinary and liver tonic. The aerial parts and roots of Salacia are effective for treating asthma, diabetes, ear diseases, gonorrhoea, itching, leukaemia, inflammations and rheumatism.[28-31]

The *S. oblonga* roots yielded salacinol, kotalanol, kotalgenin-16-acetate , mangiferin, tannins, silicic acid diethyl bis (trimethylsilyl) ester, cyclotrisiloxane hexamethyl, *n*-hexadecanoic acid, γ-sitosterol, oleic acid, 2, 6, 10, 14, 18, 22- tetracosahexaene, 6, 10, 15, 19, 23 – hexamethyl -, (all *E*)-, 1,3,5-benzenetriol, N-methoxy-N-methyl acetamide, pentadecanoic acid, 14-methyl methyl ester and beta amyrin.[32-36] The aerial parts showed the presence of tetraethyl silicate, trichloroacetic acid, undec - 2 - enyl ester, phytol, benzeneethanol α - α - β - triphenyl and 2-p-nitrophenyl oxadiazol-1, 3, 4 one-5 , polyphenols, catechin, quercetin, synapic acid and syringic acid.[35,36] The stem possessed phenols, flavonoids and quinones.[37] The root bark furnished 25, 26-oxidofriedelane-1,3-dione.[38] The presence of herbal chemical constituents vary due to many factors such as soil, geographic regions, seasonal changes, plant species and application of fertilizers. Keeping in views the various therapeutic values, variation aspects of chemical constituents of the plants and development of ecofriendly, biodegradable and safer herbal preparations the whole plant of *Cuscuta chinensis* and roots of *Salacia oblonga* were screened for the isolation and characterization of their chemical constituents.

MATERIALS AND METHODS

General procedures

Melting points were determined on a Perfit melting point apparatus and are uncorrected. UV spectra were determined on Shimadzu-120 double beam spectrophotometer with methanol as a solvent. IR spectra were recorded in KBr pellet on a Shimadzu FTIR-8400 spectrophotometer. The ^{1}H and ^{13}C NMR spectra were scanned on a Bruker DRX (400 MHz) instrument using TMS as an internal standard and coupling constants (J values) are expressed in Hertz (Hz). Mass spectra were recorded by affecting electron impact ionization at 70 eV on a Jeol SX-102 mass spectrometer equipped with direct inlet prob system. The *m/*z values of the more intense peaks are mentioned and the figures in bracket attached to each *m/*z values indicated relative intensities with respect to the base peak. Column chromatography was performed on silica gel (60-120 mesh; Qualigen, Mumbai, India). Purity of the compounds was checked by TLC over silica gel G 60 F_{254} precoated TLC plates (Merck, Mumbai, India). Spots were visualised by exposing to iodine vapours and UV radiations (254 and 366 nm) and spraying with ceric sulphate solution.

Plant material

The whole plant of *Cuscuta chinensis* was collected from the cultivated plants grown in Lucknow. The roots of *Salacia oblonga* were procured from the local market of Khari Baoli, Delhi. These plant materials were identified by Prof. M. P. Sharma, Department of Botany, Faculty of Science, Jamia Hamdard. The voucher specimens of these drugs are preserved in the Department of Pharmacognosy and Phytochemistry, School of Pharmaceutical Education and Research, Jamia Hamdard, New Delhi.

Extraction and isolation

The pulverized materials (1.0 kg each) were extracted exhaustively in a Soxhlet apparatus with ethanol (95%). The combined extracts of each drug were dried under reduced pressure separately to secure a viscous dark brown residues (136 g and 121 g, respectively). A small portion of the each extract was analyzed chemically to determine the presence of different types of chemical constituents. The dried residues (100 g each) were dissolved in minimum amount of methanol and adsorbed on silica gel column grade (60-120 mesh) to obtain slurries. The slurries were air-dried and chromatographed individually over a silica gel column loaded in petroleum ether (b. p. 60 - 80°C). Each 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, 19:5, 9:1, 17:3, 4:1 7:3, 1:1, *v/v*). Various fractions were collected 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.

Isolation of a chemical constituent from *Cuscuta chinensis* whole plant

Stearic acid (1)

Elution of the column with petroleum ether afforded colourless crystals of **1**, recrystallized from acetone-methanol (1:1), 391 g, R_f 0.39 (*n*-hexane – ethyl acetate, 9:1), m. p. 63 - 64 ^{0}C; UV λmax 209 nm (log ε 3.9); IR υ_{max} (KBr): 3415, 2917, 2848, 1704, 1467, 1353, 1291, 1101, 941, 725 cm^{-1}; ^{1}H NMR ($CDCl_3$) : δ 2.35 (2H, t, J = 7.6 Hz, H_2-2), 1.57 (2H, m, H_2-3), 1.34 (2H, m, H_2-4), 1.29 (6H, brs, 3 x CH_2) 1.26 (20 H, brs, 10 × CH_2), 0.86 (3 H, t , J = 6.5 Hz, Me-16); ^{13}C NMR ($CDCl_3$): δ 189.39

(C-1), 33.87 (C-2), 31.92 (C-3), 29.68 (C-4), 29.63 (C-5), 29.60 (C-6), 29.53 (C-7), 29.50 (C-8), 29.48 (C-9), 29.43 (C-10), 29.37 (C-11), 29.32 (C-12), 29.26 (C-13), 29.16 (C-14), 28.72 (C-15), 24.56 (C-16), 22.68 (C-17), 14.12 (Me-18); +ve ESI MS *m/z* (rel. int.): 284 $[M]^+$ ($C_{18}H_{36}O_2$) (100).

Tetradecyl palmitate (2)

Elution of the column with petroleum ether – chloroform (1:1) furnished colourless mass of **2**, 342 mg, R_f 0.58 (*n*-hexane – ethyl acetate, 9:1), m. p. 65 - 66 °C; UV λ_{max} (MeOH) : 209 nm (log ε 3.6); IR υ_{max} (KBr): 2919, 2847, 1722, 1621, 1463, 1298, 1221, 1187, 943, 726 cm^{-1}; ^1H NMR ($CDCl_3$): δ 4.21 (2H, t, J = 7.2 Hz, H_2-1′), 2.36 (2H, t, J = 7.7 Hz, H_2-2), 2.05 (2H, m, H_2-3, H_2-4), 1.65 (2H, m, H_2-2′), 1.29 (4H, m, H_2-3′, H_2-4′), 1.27 (36H, brs, 18 x CH_2), 1.24 (4H, m, H_2-5, H_2-6′), 0.89 (3H, t, J = 6.9 Hz, Me-14′), 0.83 (3H, t, J = 6.9 Hz, Me-16); ^{13}C NMR ($CDCl_3$): δ 171.23 (C-1), 60.46 (C-1′), 33.81 (C-2), 31.96 (C-3), 29.68 (16 x CH_2), 29.61 (C-2′), 29.47 (C-3′), 29.38 (C-4), 29.28 (C-4′), 29.10 (C-5), 24.77 (C-14), 22.68 (C-15), 21.08 (C-13′), 14.23 (C-16), 14.13 (Me-14′); +ve ESI MS *m/z* (rel. int.): 452 $[M]^+$ ($C_{30}H_{60}O_2$) (6.3), 255 (92.8), 239 (5.7), 197 (4.7).

1′-(3,4-Dimethoxyphenyl) ethyl-1′β, 2′-diol (3)

Elution of the column with chloroform gave pale yellow crystals of **3**, recrystallized from chloroform-methanol (1:1), yield 198 mg; m. p. 129 - 130 °C, R_f : 0.82 (chloroform-methanol, 9:1); UV λmax (MeOH): 231, 281 nm; IR υmax (KBr) : 3411, 2927, 2849, 1619, 1521, 1466, 1382, 1269, 1237, 1215, 1153, 1029, 823 cm^{-1}; ^1H NMR ($CDCl_3$) : δ 6.91 (1H, d, J = 8.5 Hz, H-5), 6.86 (1H, d, J = 1.8 Hz, H-2), 6.79 (1H, dd, J = 1.8, 8.5 Hz, H-6), 4.70 (1H, dd, J = 4.8, 7.1 Hz, H-1′), 4.23 (2H, d, J = 7.1 Hz, H_2-2′), 3.94 (3H,brs, OMe), 3.19 (3H,brs, OMe); ^{13}C NMR ($CDCl_3$) : δ 132.97 (C-1), 119.02 (C-2), 146.74 (C-3), 145.31 (C-4), 114.29 (C-5), 108.65 (C-6), 85.92 (C-1′), 71.64 (C-2′), 55.92 (OMe), 54.21 (OMe); ESI MS *m/z* (rel. int.): 198 $[M]^+$ ($C_{10}H_{14}O_4$) (2.3).

***n*-Pentatriacontane (4)**

Elution of the column with chloroform produced colorless crystals of **4**, 117 mg yield, R_f : 0.73 (*n*-hexane – ethyl acetate, 7 : 3), m. p. 81 – 82 ºC; UV λmax (MeOH): 211 nm; IR υmax (KBr): 2926, 2843, 1461, 1374, 1129, 887, 723 cm^{-1}; ^1H NMR ($CDCl_3$): δ 1.56 (2H, m, CH_2), 1.34 (2H, m, CH_2), 1.31 (2H, m, CH_2), 1.28 (4H, m, 2 × CH_2), 1.25 (56H, brs, 28 × CH_2), 0.89 (3H, t, J = 6.8 Hz, Me-1), 0.85 (3H, t, J = 6.9 Hz, Me-35); ^{13}C NMR ($CDCl_3$): δ 37.13 (CH_2), 31.94 (CH_2), 30.05 (CH_2), 29.71 (25 × CH_2), 29.67 (CH_2), 29.36 (CH_2), 29.18 (CH_2), 27.12 (CH_2), 22.71 (CH_2), 14.15 (Me-1, Me-35); ESI MS *m/z* (rel. int.): 492 $[M]^+$($C_{35}H_{72}$) (88.2).

***n*- Tetratriacont-21,27-dien-1-ol (5)**

Elution of the column with chloroform yielded a pale yellow semisolid of **5**, 123 mg, R_f 0.64 (chloroform-methanol, 9:1) , m. p. 97 - 99 ºC; UV λmax 213 nm (log ε 3.7); IR υ_{max} (KBr): 3412, 2921, 2845, 1631, 1457, 1381, 1251, 1175, 879, 724 cm^{-1}; ^1H NMR ($CDCl_3$): δ 5.33 (1H, m, $w_{1/2}$ = 10.6 Hz, H-21), 5.30 (1H, m, $w_{1/2}$ = 9.8 Hz, H-22), 5.26 (1H, m, $w_{1/2}$ = 9.1 Hz, H-27), 5.23 (1H, m, $w_{1/2}$ = 10.4 Hz, H-28), 3.31 (2H, t, J = 6.6 Hz, H_2-1), 2.27 (2H, m, H_2-20), 2.23 (2H, m, H_2-23), 1.63 (2H, m, H_2-26), 1.59 (2H, m, H_2-29), 1.38 (10H, s, 5 x CH_2), 1.29 (38 H, brs, 19 × CH_2), 0.87 (3H, t, J = 6.8 Hz, Me-34); ^{13}C NMR ($CDCl_3$): δ 134.35 (C-21), 131.24 (C-22), 117.43 (C-27), 116.89 (C-28), 61.26 (C-1), 33.54 (C-20), 31.25 (C-23), 30.87 (23 x CH_2), 27.73 (C-4), 26.27 (C-3), 22.68 (C-2), 16.94 (C-1); +ve ESI MS *m/z* (rel. int.): 480 $[M]^+$ ($C_{34}H_{66}O$) (8.1), 475 (74.9), 405 (42.8), 379 (39.5), 323 (22.4), 297 (11.2), 97 (35.7).

Isolation of a chemical constituent from *Salacia oblonga* roots 6′-Dehydroxyneoponkoranol (6)

Elution of the column with chloroform-methanol (9:1) furnished colourless amorphous powder of **6**, recrystallized from chloroform – methanol (1:1), yield 112 mg; IR υ_{max} (KBr): 3510, 3456, 3385, 2956, 2837, 1651, 1456, 1404, 1020 cm^{-1}; ^1H NMR (DMSO-d_6): δ 4.62 (1H, m, $w_{1/2}$ = 14.1 Hz, H-2α), 4.53 (1H, m, $w_{1/2}$ = 8.4 Hz, H-3β), 4.25 (1H, m, $w_{1/2}$ = 14.6 Hz, H-4 α), 3.62 (2H, m, H_2-1), 3.59 (1H, d, J = 6.3 Hz, H_2-5a), 3.55 (1H, d, J = 6.5 Hz, H_2-5b), 4.28 (1H, m, $w_{1/2}$ = 16.3 Hz, H-2′ α), 3.65 (1H, m, $w_{1/2}$ = 8.1 Hz, H-3′ β), 3.66 (1H, m, $w_{1/2}$ = 8.7 Hz, H-4′ β), 3.52 (1H, m, $w_{1/2}$ = 8.9 Hz, H-5′β), 3.48 (2H, m, H_2-1′), 1.03 (3H, d, J = 6.5 Hz, Me-6′); ESI MS *m/z* (rel. int.): 299 $[M]^+$ ($C_{11}H_{23}O_7S^+$) (12.9).

5′-Epi-6′-Dehydroxyneoponkoranol (7)

Further elution of the column with chloroform-methanol (9:1) afforded colourless amorphous powder of **7**, recrystallized from chloroform – methanol (1:1), yield 97 mg; IR υ_{max} (KBr): 3501, 3449, 3378, 2943, 2834, 1648, 1452, 1411, 1026 cm^{-1}; ^1H NMR (DMSO-d_6): δ 4.49 (1H, m, $w_{1/2}$ = 14.6 Hz, H-2α), 4.46 (1H, m, $w_{1/2}$ = 8.6 Hz, H-3β), 4.21 (1H, m, $w_{1/2}$ = 14.2 Hz, H-4 α), 3.60 (2H, m, H_2-1), 3.59 (2H, d, J = 7.2 Hz, H_2-5), 4.22 (1H, m, $w_{1/2}$ = 16.9 Hz, H-2′ α), 3.62 (1H, m, $w_{1/2}$ = 8.3 Hz, H-3′ β), 3.55 (1H, m, $w_{1/2}$ = 8.2 Hz, H-4′ β), 3.50 (1H, m, $w_{1/2}$ = 16.4 Hz, H-5′ α), 3.48 (2H, m, H_2-1′), 1.05 (3H, d, J = 6.6 Hz, Me-6′); ESI MS *m/z* (rel. int.): 299 $[M]^+$ ($C_{11}H_{23}O_7S^+$) (4.3).

Neoponkoranol (8)

Elution of the column with chloroform-methanol (17:3) yielded colourless amorphous powder of **8**, recrystallized from chloroform – methanol (1:1), yield 109 mg; IR υ_{max} (KBr): 3515, 3443, 3373, 2931, 2846, 1649, 1451, 1413, 1032 cm^{-1}; ^1H NMR (DMSO-d_6): δ 4.58 (1H, m, $w_{1/2}$ = 15.4 Hz, H-2α), 4.47 (1H, m, $w_{1/2}$ = 8.2 Hz, H-3β), 4.02 (1H, m, $w_{1/2}$ = 14.6 Hz, H-4 α), 3.64 (2H, m, H_2-1), 3.59 (2H, d, J = 7.3 Hz, H_2-5), 3.90 (1H, m, $w_{1/2}$ = 16.7 Hz, H-2′ α), 3.63 (1H, m, $w_{1/2}$ = 8.5 Hz, H-3′ β), 3.56 (1H, m, $w_{1/2}$ = 8.9 Hz, H-4′ β), 3.51 (1H, m, $w_{1/2}$ = 8.9 Hz, H-5′β), 3.46 (2H, m, H_2-1′), 3.41 (2H, d, J = 8.1 Hz, H_2-6′); ESI MS *m/z* (rel. int.): 315 $[M]^+$ ($C_{11}H_{23}O_8S^+$) (12.9).

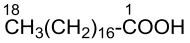
RESULTS AND DISCUSSION

Compound **1** was a known saturated fatty acid identified as octadecanoic acid (stearic acid).[39] Compound **2** was a known fatty acid ester identified as tetradecyl palmitate (myristyl palmitate) (Fig. 1).

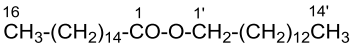
Compound **3** exhibited UV absorption maximum at 281 nm for an aromatic compound and IR absorption bands for a hydroxyl group (3411 cm^{-1}) and aromatic ring (1619, 1521, 1029 cm^{-1}). Its mass spectrum displayed a molecular ion peak at *m/*z 198 consistent with a molecular formula of a glycolated dimethoxy benzene, $C_{10}H_{14}O_4$. The ^{1}H NMR spectrum of **3** showed two doublets at δ 6.91 (J = 8.5 Hz) and 6.86 (J = 1.8 Hz H-2) and a double doublet at δ 6.79 (J = 1.8, 8.5 Hz) integrating for one proton each assigned to aromatic H-5, H-2 and H-6 protons, respectively, a one-proton double doublet at δ 4.70 (J = 4.8, 7.1 Hz) and a two-proton doublet at δ 4.23 (J = 7.1 Hz) were ascribed correspondingly to alpha oriented carbinol proton H-1′ linked to the aromatic ring and hydroxymethylene H_2-2′ protons. Two three-proton singlets at δ 0.96 and 0.87 were associated with the methoxy protons. The ^{13}C NMR spectrum of **3** displayed signals for aromatic carbons between δ 146.74 – 108.65, carbinol carbon at δ 85.92 (C-1′), hydroxymethylene carbon at δ 71.64 (C-1′) and methoxy carbons δ 55.92 and 54.21. On the basis of these evidences, the structure of **3** has been formulated as 1′-(3,4-dimethoxyphenyl) ethyl-1′β, 2′-diol (3) , a new phenyl substituted ethyl glycol (Fig. 1).

Compound **4** was a long chain aliphatic alcohol characterized as *n*-pentatriacontane.[40]

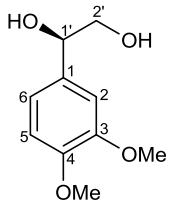
Compound **5** decolourized bromine water suggesting unsaturated nature of the molecule. Its IR spectrum showed characteristic absorption bands for a hydroxyl group (3412 cm^{-1}), unsaturation (1631 cm^{-1}) and long aliphatic chain (724 cm^{-1}). Its molecular weight was established at *m/z* 480 on the basis of mass spectrum consistent with a molecular formula of an unsaturated aliphatic alcohol with two vinylic linkages, $C_{34}H_{66}O$. The ion peaks arising at *m/z* 297 [C_{20} – C_{21} fission, $(CH_2)_{19}$-CH_2OH, $C_{20}H_{41}O]^+$, 323 [C_{22} – C_{23} fission, CH=CH-$(CH_2)_{19}$-CH_2OH, $C_{22}H_{43}O]^+$, 379 [C_{26} – C_{27} fission, $(CH_2)_4$-CH=CH-$(CH_2)_{19}$-CH_2OH, $C_{26}H_{51}O]^+$, and 405 [CH=CH-$(CH_2)_4$-CH=CH-$(CH_2)_{19}$-CH_2OH, $C_{28}H_{53}O]^+$, suggested the presence of the vinylic linkages at C-21 and C-27 carbon positions. The ^{1}H NMR spectrum of **5** showed four one-proton multiplets at δ 5.33, 5.30, 5.26 and 5.23 with half-width between 6.6 – 10.6 Hz assigned to cis-oriented vinylic H-21, H-22, H-27 and H-28 protons, respectively. A two-proton triplet at δ 3.31 (J = 6.6 Hz) was ascribed to the terminal hydroxymethylene H_2-1 protons. The other methylene protons appeared as multiplets from δ 2.27 to 1.59 and as singlets at δ 1.38 (10H) and 1.29 (38 H). A three-proton triplet at δ 0.87 (J = 6.8 Hz) was accounted to C-34 primary methyl protons. The ^{13}C NMR spectrum of **5** exhibited signals for the vinylic carbons in the range of δ 134.35 - 116.89, hydroxymethylene carbon at δ 61.26 (C-1), other methylene carbons between δ 33.54 – 22.69 and methyl carbon at δ 16.94 (C-34). On the basis of spectral data analysis, the structure of **5** has been elucidated as (Z), (Z)-*n*-tetratriacont-21,27-dien-1-ol, a new unsaturated aliphatic alcohol (Fig.1).



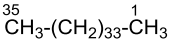
Stearic acid **(1)**



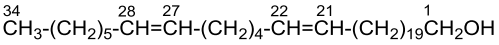
Tetradecyl palmitate **(2)**



1′-(3,4-Dimethoxyphenyl) ethyl 1′β, 2-diol **(3)**



n-Pentatriacontane **(4)**



n-Tetratriacont-21, 27-dien-1-ol **(5)**

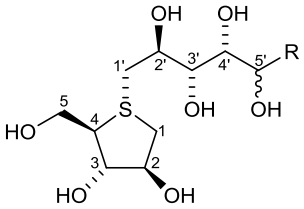
Fig. 1: Chemical constituents of 1 - 5 isolated from the whole plant of *Cuscuta chinensis*.

Compound **6** showed IR absorption bands for hydroxyl groups (3510, 3456, 3385 cm^{-1}). Its molecular ion peak was established at *m/z* 299 on the basis of mass spectrum consistent to a molecular formula of a ponkoranol-type sulfonium-ion glucosidase inhibitors. The ¹H NMR spectra of **6** exhibited three one-proton multiplets δ 4.62 ($w_{1/2}$ = 14.1 Hz), 4.53 ($w_{1/2}$ = 8.4 Hz) and 4.25 ($w_{1/2}$ = 14.6 Hz) assigned respectively to α-oxymethine H-2 and β-oxymethine H-3 and the α-methine proton nearby sulphur atom. Two two-proton multiplets at δ 3.82 and 3.82 were ascribed correspondingly to methylene H_2-1 and H_2-1′ protons adjacent to the sulphur atom. Two one-proton doublets at δ 3.59 (J = 6.3 Hz, H_2-5a), 3.55 (J = 6.5 Hz, H_2-5b) were accounted to the hydroxymethylene H_2-5. Four one-proton multiplets at δ 4.28 (1H, m, $w_{1/2}$ = 16.3 Hz), 3.65 (1H, m, $w_{1/2}$ = 8.1 Hz), 3.66 (1H, m, $w_{1/2}$ = 8.7 Hz), 3.52 (1H, m, $w_{1/2}$ = 8.9 Hz) were attributed to carbinol H-2′α, H-3′β, H-4′β and H-5′β protons, respectively. A three-proton doublet at δ 1.03 (J = 6.5 Hz) was associated with the secondary C-6′ methyl protons. On the basis of these evidences, the structure of **6** has been characterized as 6′-dehydroxyneoponkoranol, a new ponkoranol derivative (Fig. 2).

Compound **7**, $[M]^+$ at *m/z* 299 ($C_{11}H_{23}O_7S^+$), was a H-5′ α epimer of **6** established on the ^{1}H NMR spectral signal resonating as a one-proton multiplet at δ 3.50 having

half-width of 14.6 Hz. On the basis of spectral data analysis, the structure of **7** has been establishes as characterized as 5′-epi-6′-dehydroxyneoponkoranol, a new ponkoranol derivative (Fig. 2).

Compound **8** was a known de-O-sulphonated ponkoranol (neoponkoranol) (Fig. 2).[41-43]



5′α-OH, R = CH_3 6′-Dehydroxyneoponkoranol **(6)**
5′β-OH, R = CH_3 5′-Epi-6-dehydroxyneoponkoranol **(7)**
5′α-OH, R = CH_2OH Neoponkoranol **(8)**

Fig. 2: Chemical constituents of 6 - 8 isolated from the roots of *Salacia oblonga*.

CONCLUSION

Phytochemical investigation of the whole plant *Cuscuta chinensis* afforded octadecanoic acid (stearic acid, **1**), tetradecyl palmitate (myristyl palmitate, **2**), 1′-(3,4-dimethoxyphenyl) ethyl-1′β, 2′-diol (**3**), *n*-pentatriacontane (**4**) and (*Z*), (*Z*)-*n*-tetratriacont-21,27-dien-1-ol (**5**). The roots of *Salacia oblonga* yielded two new ponkoranol derivatives identified as 6′-dehydroxyneoponkoranol (**6**) and 5′-epi-6′-dehydroxyneoponkoranol (**7**) together with a known de-O-sulphonated ponkoranol (neoponkoranol, **8**). This work has enhanced understanding about the chemical constituents of the plant. Further research is recommended to screen bioactivities of the isolated phytoconstituents with a view for supplementing conventional drug development especially in developing countries.

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