Arab Gulf J.Scient. Res., **12** (1), pp.119 - 131(1994)

Alkaloids with Antimicrobial Activity From the Root of *Rhyzya stricta* Decn. Growing in United Arab Emirates

A.K. Bashir, A.A. Abdalla E.S. Hassan, I.A. Wasfi, M.A. Amiri and T.A. Crabb[1]

Desert and Marine Environment Research Centre, United Arab Emirates University, Al Ain, P.O. Box 17777, U. A. E.
[1]Department of Chemistry, Faculty of Science, University of Portsmouth, Portsmouth, U. K.

ABSTRACT. The extracts of the root of *R. stricta* growing wild in U.A.E. showed an antimicrobial activity. Using chromatographic techniques strictanol, tetrahydrosecamine, akuammidine and rhazimanine were isolated. Their structure were elucidated using spectroscopic analysis techniques (including MS, ^{1}H-NMR and ^{13}C-NMR). The antimicrobial activity of the isolated alkaloids and their MIC were determined.

Rhazya stricta Decaisene (Apocynaceae) is a shrub with a smooth central stem and dense semi-erect branches to 1 m but generally shorter, 50-70 cm. The plant is also widely distributed in Western Asia and abundantly found in Pakistan.

The presence of alkaloids in *Rhazya* was established in 1945 (Cordell *et al.* 1978). Recently, the total number of alkaloids isolated from *Rhazya* spp. has increased rapidly (Evans *et al.* 1968, Banerji *et al.* 1970 and Mukhopadhyay *et al.* 1981). Extensive work was carried out by Rahman *et al.* (1982, 1984, 1985, 1986, 1987, 1988 and 1989). Rhaizine and betaine alkaloids were identified in *R. stricta* growing in Saudi Arabia (Hassan *et al.* 1977). Certain alkaloids of *R. stricta* showed anti-cancer activity (Mukhopadhyay *et al.* 1981).

R. stricta is well reputed in the folk-medicine of U.A.E. for the treatment of diabetes mellitus, skin infection and stomach troubles. Although the antimicrobial activity of the crude extracts was reported (Elwam and Diab 1970) but little work was

carried out to isolate the active compounds. The only antimicrobial alkaloid isolated and characterised was stemmadenine (Mariee *et al.* 1988).

We were intrigued by the high broad spectrum activity of the crude extracts and the fractions of *R. stricta* which indicated the presence of a number of antimicrobial compounds. In addition, this investigation is a continuation of on-going systematic study of medicinal plants of U.A.E. In the present paper we report the antimicrobial activity of the crude extracts and of the active compounds and their MIC. The structures of the active compounds were elucidated using spectroscopic techniques (including MS, ^{1}H-NMR and ^{13}C-NMR). Compounds identified are: tetrahydrosecamine, strictanol, akuammidine and rhazimanine. This is the first report of strictanol, rhazimanine and akuammidine from the root of *Rhazya* spp. Tetrahydrosecamine was reported from the root and leaves of *R. stricta* and *R. orientalis* of Indian origin (Mukhopadhyay *et al.* 1981) but not of Pakistani origin.

Materials and Methods

Plant material: *R. stricta* root used in this study was collected from Al-Ain area (Jebel Hafeet) in March 1990. The plant was botanically authenticated and Herbarium specimens were deposited at the National Herbarium, Desert and Marine Environment Research Centre, United Arab Emirates University.

Preliminary extraction of R. stricta for antimicrobial studies

a. 10 g of coarsely powdered root was successively extracted with chloroform and methanol using a soxhlet apparatus. Final concentration was adjusted to 0.1 g/ml. The extracts were tested for their antimicrobial activity.

b. 100 g of the root was successively extracted with petroleum ether and ethanol. The ethanol extract was evaporated, almost, to dryness; suspended in water, acidified with 10% glacial acetic acid and extracted with chloroform to give a chloroform extract (Fraction 1). The aqueous acidic fraction was made alkaline using dilute NaOH solution and extracted with chloroform to give fraction 2. The remaining aqueous alkaline phase was extracted with n-butanol to give fraction 3. Final concentration of each extract was adjusted to 20 mg/ml. The different fractions were tested for their antimicrobial activity.

Antimicrobial activity:

Strains of *Staphylococcus aureus* (CCM 2107), *Bacillus subtilis* (DSM 347), *Escherichia coli* (NCTC 9001), *Pseudomonas aeruginosa* (NCTC 10332), *Candida*

albicans (Laboratory isolate), Aspergillus *terreus* (Laboratory isolate) and *A. flavus* (Laboratory isolate) were used in this study. The bacteria and fungi were prepared and diluted to contain 10^5 cells per ml for bacteria and 10^5 spores per ml for fungi.

Antimicrobial activity was determined by Reeves' modified method (1989). The cup was gently filled with 0.2 ml of the plant extract. Triplicates for each extract were carried out and the mean diameter of the inhibition zones was calculated. Solvents used to dissolve or to suspend extracts were used as control. For pure compounds 5 mg/ml concentration was used as stock solution.

Determination of minimum inhibitory concentration (MIC):

MIC was determined using the method described by Mariee *et al.* (1988). Different concentrations of the compounds were prepared from the stock solution by serial dilution and were used for MIC determination. 0.1 ml of the solution was used for the test.

Large scale extraction of R. stricta root:

Powdered root (3 kg) was successively extracted with petroleum ether, chloroform and ethanol using a soxhlet extraction apparatus to give a petroleum ether extract (9.20 g), a chloroform extract (166.50 g) and an alcohol extract 127.90 g).

The chloroform was evaporated almost to dryness in vacuo and the residue was suspended in 10% glacial acetic acid (250 ml) and extracted with chloroform to yield weakly basic alkaloids and neutral compounds (Fraction A). The remaining aqueous layer was basified using dilute NaOH and pH was adjusted to 9-11. The alkaline aqueous layer was extracted with chloroform to give the chloroform extract (Fraction B, 14.20 g).

Column chromatography of fraction A

Fraction A (30.0 g) was chromatographed using a silica gel column (350 g silica gel, particle size 0.2-0.5 mm and column dimensions were 5 cm (ID) × 160 cm). Elution being carried out with hexane and hexane-chloroform mixtures of increasing polarity.

Fractions 51-72 eluted with 30% chloroform in hexane gave a major non-absorbing UV compound (1.02 g). It gave a pink colour with sulphuric acid spray reagent. The compound was purified using a neutral alumina column (35 g). The purified compound (73 mg) was identified as sitosterol on the basis of cochromatography on TLC, IR and MS.

Elution of the column with 7.5% methanol in chloroform gave a mixture of two major compounds (0.60 g). The mixture was purified on a small neutral alumnia column (30 g. neutral alumina, Aldrich, mesh 150; column dimensions 2×32 cm).

IR ($HCCL_3$) ν max: 3460, 3170, 2980-2840, 1675, 1620, 1360, 760, and 720 cm^{-1}. UV (MeOH) λ_{max} :225, 280 sh and 290 nm.

MS (EI) m/z (rel.int) : 298(33), 282(24), 281(100), 269(6), 255(4), 241(4), 172(5), 159(4), 158(3), 156(4), 146(6), 144(6), 143(3), 138(5), 130(5), 126(5), 124(8), 110(5), 108(3), 96(4) and 77(3).

^{1}H-NMR ($CDCl_3$ + CD_3OD) δ : 0.94 (t, 3 H, $J_{18,19}$ = 7.5 Hz, H-18), 1.38 (q, 2 H, $J_{19,18}$ = 7.3 Hz, H-19), 1.62 (m, 1 H, H-17 α), 1.78 (m, 2 H, H-16), 1.85 (m, 1 H, H-17 β), 1.92 (m, 1 H, H-14 β), 2.28 (m, 1 H, H-15 α), 2.45 (m, 1 H,H-6 α), 2.50 (m, 1 H, H-14 α), 2.78 (m, 1 H, H-6 β), 3.06(d, 1 H, $J_{21\alpha,21\beta}$ = 12.3 Hz, H-21 α), 3.30(m, 2 H, H-5), 3.38 (d, 1 H, $J_{3,14}$ = 7.7 Hz, H-3 α), 3.63 (d, 1 H, $J_{21\beta,19\ \alpha}$ = 12.2 Hz, H-21 β), 3.76 (d, 1 H, $J_{3,14}$ = 8.6 Hz, H-3 β), 6.78 (d, 1 H, $J_{12,11}$ = 7.9, H-12), 6.90 (split dd, 1 H, $J_{10,9}$ = 7.3, $J_{10,11}$ = 7.3, $J_{10,12}$ < 1 Hz, H-10), 7.2 (split dd, 1 H, $J_{11,10}$ = 7.5, $J_{11,12}$ = 7.7, $J_{11,9}$ < 1 Hz, H-11), 7.30 (d, 1 H, $J_{9,10}$ = 7.3 Hz, H-9).

^{13}C-NMR (see Table 3).

Compound 3 eluted on using 20% methanol in ethyl acetate (33 mg) gave a pink colour with ceric sulphate R_f = 0.66 on using silica plates and butanol: acetic acid: water (7:2:2) as a solvent system.

IR ν max (KBr) : 3420, 3220, 2960-2840, 1730, 1460, 1380, 1330, 1200, 1175 and 750 cm^{-1}.

UV λ_{max} (MeOH): 225, 270, 282 and 295 nm.

MS (EI) m / z (rel. int.): 681 (M+1)(36), 680(4), 256(4), 150(1), 149(25), 131(23), 127(11), 126(100), 75(13), 74(10), 61(33) and 56 (24).
^{1}HNMR ($CDCl_3$, 270 MHZ): δ 0.98-0.81 (m, 6 H, CH_3), 2.0-3.5 (m, 35 H, CH_2 and CH), 3.67 (s, 3 H, $COOCH_3$), 3.82 (s, 3 H,$COOCH_3$), 4.30 (br m, 1 H, H-16), 6.35-7.96 (m, 8 H, aromatic), 9.67 (br s, 1 H indole NH).

Column chromatography of fraction B

Fraction B (13.8 g) was chromatographed using a silica gel column (250 g, particle size 0.2-0.5; column dimensions were 0.5 × 150 cm). The column was first eluted with 2 litres of each of the following solvents: hexane, 20% dichloromethane in hexane, 40% dichloromethane in hexane, 60% dichloromethane in hexane and chloroform. The eluent was then progressively changed to increasing polar mixtures of chloroform and methanol.

Compound 4: Elution of the column with 2.5% methanol in chloroform (Fraction 58-67) gave a morphous powder which was crystallised from a mixture of chloroform and methanol (155 mg, mp 240-2). It gave a blue colour with ceric sulphate and a positive alkaloid reaction with Dragendorff's reagent R_f = 0.41 in 10% methanol in chloroform.

IR (nujol mull) v max: 3510, 3270, 1720, 1460, 1430, 1380, 1350. 1320, 1300, 1220, 1100, 1080, 1060, 1030, 1000, 850, 770 and 730 cm^{-1}.

UV (CH_3 OH) λ_{max} :228, 277 and 290 nm.

MS (EI) m/z (rel.int.): 353(M+1) (23), 352(100), 351(45), 337(18), 335(10), 322(12), 321(42), 293(17), 250(17), 249(58), 236(19), 235(10), 221(8), 183(6), 182(12), 170(9), 169(44), 168(31), 167(8), 156(10), 154(7), 130(5), 129(7) and 115(7).

^{1}HNMR ($CDC1_3$ 270 MHZ) δ: 1.66 (split 'd, 3 H, $J_{18,19}$ = 6.8, $J_{18,21\alpha} = J_{18,21\beta} \simeq 2$ Hz, 18-CH_3), 1.88 (m, 1≃H, $J_{14\alpha,3}$ = 9.50, $J_{14\alpha,15} \simeq$ 1Hz, H-14 α), 2.65 (m, 1 H, $J_{14}\beta,_{14\alpha}$ = 13.0, $J_{14\beta,3} \simeq$ 1.0, $J_{14\beta,15}$ = 2.34, H-14 β), 2.86 (m, 1 H, H-6 β), 2.95 (s,3 H,17-$COOCH_3$), 3.17 (m, 1H, $J_{15,14\alpha}$ = 2.75, $J_{15,14\beta} \simeq$ 1.0 Hz, H-15), 3.35 (m, 1 H, $J_{6\alpha,6\beta}$ = 16.6, $J_{6\alpha,5\beta}$ = 3.1 Hz,H-6α), 3.52 (m, 1 H, H-21 α), 3.56 (m, 1 H, H-21 β), 3.65 (d, 1 H, $J_{17\alpha,17\beta}$ = 10.1 Hz, H-17 α), 3.78 (d,1 H, $J_{17\beta,17\alpha}$ = 10.1 Hz, H-17β), 4.20 (dd, 1 H, $J_{3,14\alpha}$ = 9.5, $J_{3,14\beta} \simeq$ 1.0 Hz, H-3), 5.42(split quartet, 1 H, $J_{19,18}$ = 7.0, $J_{19,21\alpha} \simeq J_{19,21\beta} \simeq J_{19,15} \simeq$ 1.0 Hz, H-19), 7.03 (ddd, 1 H, $J_{10,9}$ = 7.75, $J_{10,11}$ = 7.2, $J_{10,12}$ = 1.1 Hz, H-10), 7.1 (ddd, 1 H, $J_{11,12}$ = 8.1 $J_{11,10}$ = 7.1, $J_{11,9}$ = 1.3 Hz, H-11), 7.28 (dd, 1 H, $J_{12,11}$ = 7.3, $J_{12,10} \simeq$ 1.0 Hz, H-12), 7.4 (dd, 1 H, $J_{9,10}$ = 7.2 $J_{9,11} \simeq$ 1.0 Hz, H-9), 9.4 (s, 1 H, NH).

Compound 5: TLC analysis of fraction (74-87) eluted with 2.5% and 5% methanol in chloroform showed the presence of a major alkaloidal compound. The fractions were combined and taken to dryness in vacuo (0.61 g). The major constituent was purified using a neutral alumina column (30 g). Elution was carried out using chloroform and 2.5% methanol in chloroform (1.5 L each). The isolated compound (25 mg) gave a brownish green colour with ceric sulphate spray reagent. R_f = 0.30 on using 10% methanol in chloroform and silica gel plates.

IR v max (KBr): 3450-3220, 3000-2860, 1730, 1600, 1160 and 750 cm^{-1}

UV λ_{max} (MeOH): 220, 270 sh, 275 sh, 285 and 290 nm.

MS(EI) m/z (rel.Int.) : 355(M+1) (33), 354(100), 353(70), 339(6), 337(5), 323(27),252(38), 251(92), 250(14), 249(28), 237(13), 223(14), 221(7), 184(8), 170(20), 169(31), 156(15), 144(10) and 143(7).

^{1}H–NMR ($CDCl_3$, 270 MHz) δ: 1.64 (m, 3 H, $J_{18,19}$ = 6.8, Hz, $J_{19,21\beta}$ = 1.2 Hz, $J_{18,21\alpha}$ = 1.2 Hz), 2.0 (br m, 1 H, H-14 α), 2.18 (m, 1 H, H-14 β), 2.50 (m, 1 H, H-16), 2.63 (ddd, 1 H, $J_{5\alpha,5\beta}$ = 15.4 Hz, $J_{5\alpha,6\alpha}$ = 4.6 Hz, $J_{5\alpha,6\beta} \simeq$ 2 Hz, H-5 α), 2.96 (m, 1 H, H-5 β), 3.02 (br d, 1 H, $J_{21\beta,21\alpha}$ =11.4 $J_{11\beta,18} \simeq$ 2 Hz, H-21 β), 3.11 (m, 1 H, H-15), 3.20 (m, 1 H, H-6 β), 3.35 (ddd, 1 H, $J_{6\alpha,6\beta}$ = 14.8 Hz, $J_{5\alpha,6\alpha}$ = 5.1, $J_{6\alpha,5\beta}$ = 1.5 Hz, H-6α), 3.48 (m, 1H, H-17), 3.52 (m, 1 H, H-21 α), 3.56 (m, 1 H, H-17), 3.81 (s, 3 H, $COOCH_3$), 4.24 (br s, 1 H, H-3), 5.6 (split quartet, 1 H, J19,18 = 6.8 Hz, $J_{19,21\alpha} \simeq J_{19,21\beta} \simeq J_{19,15<}$ 1 Hz, H-19), 7.12 (ddd, 1 H, $J_{10,9}$ = 7.6 Hz, $J_{10,11}$ = 7.3 Hz $J_{10,12} \simeq$ 1Hz, H-10), 7.16 (ddd,1 H, $J_{11,12}$ = 7.5, Hz, $J_{11,10}$ = 6.0 Hz $J_{11,9}$ = 1.5Hz,H-11), 7.39 (dd, 1 H, $J_{12,11}$ = 7.5,$J_{12,10} \simeq$ 1Hz, H-12), 7.45 (dd, 1 H, $J_{9,10}$ = 7.5 Hz, $J_{9,11}$ = 1.5 Hz, H-9), 8.70 (s,1 H, NH)

^{13}C-NMR : see Table 3.

Results and Discussion

In this study the root of *R. stricta* growing in United Arab Emirates was investigated for its chemical constituents and for antimicrobial activity. The root was successively extracted with chloroform and methanol and the extracts were tested for their antimicrobial activity (see Table 1). The chloroform and methanol extracts exhibited a high antimicrobial activity against some bacteria and fungi.

To study the nature of the active compound(s) the extract of *R. stricta* was fractionated into weakly basic and neutral compounds (Fraction 1), strongly basic alkaloids (Fraction 2) and polar compounds (Fraction 3) and the water soluble compounds. It is interesting to note that fraction 1,2 and 3 showed a strong broad spectrum activity against the tested microbes and a positive colour reaction for alkaloids with Dragendorff's reagent.

Table 1. Antimicrobial activity of the extracts and fractions of *Rhazya stricta* root

Type of extract	Mean diameter of inhibition zone in mm.						
	S. aureus	*B. subtilis*	*E. Coli*	*P. aeruginosa*	*A. terrus*	*A. flavus*	*C.albicans*
Chloroform	30	23	–	–	34	–	20
Methanol	25	32	–	–	36	–	16
Fraction 1	14	21	15	20	13	20	15
Fraction 2	15	23	12	20	13	21	16
Fraction 3	25	28	21	22	23	21	20

The extract of *R. stricta* root was chromatographed using a silica gel column and a number of compounds were isolated, purified and characterised. UV spectrum of compound 2 is of a hydroxyindolenine system showing λ_{max} at 225, 280 and 290 nm. IR spectrum indicated the presence of - OH and C = N stretching vibrations at 3170 and 1675 cm^{-1}, respectively. The mass spectrum afforded a $[M]^+$ at m/z 298 corresponding to C_{19} H_{26} N_2 O. The ^{1}H-NMR spectrum showed the methyl (C-18 H) as a triplet at δ 0.94. The adjacent methylene protons (C-19H) resonated as a quartet at δ 1.38. The C-21 protons resonated as an AB quartet at δ 3.06 and 3.63 with J_{gem} 12.2 Hz. The ^{13}C-NMR spectrum showed that the C-2 quaternary carbon resonated at δ 146.4. The downfield signal at δ 89.75 was assigned to C-7. The three downfield methylene carbons were assigned to C-3, C-5 and C-21. These data are in accord with those reported for strictanol (Evans *et al.* 1968).

The mass spectrum of compound 3 showed a molecular ion at M^+ 680 corresponding to C_{42} H_{54} N_4 O_4 The base peak of the spectrum is at m/z 126 (C_8 H_{16} N), characteristic of the tetrahydrosecamine system containing a saturated 3-ethylpiperidene ring (Rahman and Malik 1987). The ^{1}H-NMR spectrum showed the presence of two overlapping triplets in the region 0.83-0.93 (J = 7.3 Hz, 2X CH_2 - CH_3) which were assigned to the C_{18} and C_{18}' methyl protons. It also establishes the presence of two-$COOCH_3$ groups. ^{13}C-NMR spectrum was obtained but the multiple signals in the broad band spectrum for many of the carbon atoms, presumably on account of conformational mobility, prevented unambiguous assignments. A similar doubling of signals has been previously reported in such type of compounds (Rahman and Khurshid 1988). These data are in accord with those reported for tetrahydrosecamine as the "narrow" isomer, having the two carbomethoxy groups in cis positions to each other at C-16 and at C-16'. (Mukhopadhyay *et al.* 1981, Verpoorte *et al.* 1983). This is the first report of tetrahydrosecamine from the root of *R. stricta*. It was isolated before from the leaves of the plant and shown to have a cytotoxic activity against Eagle's KB carcinoma of the nasopharynx in cell culture (Mukhopadhyay *et al.* 1981).

The mass spectrum of compound 4 showed a molecular ion at M^+ 352 corresponding to C_{21} H_{24} N_2 O_3. It exhibits UV absorption characteristic of a 2,3-disubstituted indole chromophore. Its IR spectrum shows bands for NH, OH and unconjugated ester function. The ^{1}H-NMR spectrum of the alkaloid establishes the presence of a $COOCH_3$ group, a hydroxymethyl function attached to a quaternary carbon, an ethylidine methyl side chain, an NH and four aromatic protones associated with the indole chromophore. Based on these spectral data and on ^{13}C-NMR data the akuammidine structure was assigned to the alkaloid (Yousif *et al.* 1983).

IR spectrum of compound 5 indicated the presence of an ester carbon (1730 cm^{-1}), OH and NH groups (3450-3220 cm^{-1}). The absence of characteristic Wenkert-Bohlmann bands in the region of 2700-2800 cm^{-1} indicated the presence of a cis-quinolizidine system (Rahman *et al.* 1986) as did the downfield signal at δ 4.24 in

the ^{1}H- NMR spectrum assigned to H-3. Its mass spectrum indicated that the M^{+} at m/z 354 leading to the molecular formula C_{21} H_{26} N_2 O_3. ^{1}H-NMR showed the presence of a multiplet for the ethylidine methyl at δ 1.64 exhibiting a vicinal coupling with H-19 and homoallylic coupling with H-21 α and H-21 β. The methylene protons of the primary alcoholic group appeared as two multiplets at 3.48 and 3.56. ^{13}C-NMR showed upfield values for C-2, C-3, C-5, C-6 and C-7 (see Table 3). Based on the above data and on 2DNMR (COSY) and DEPT experiments the structure of compound 5 is elucidated to be rhazimanine.

The isolated alkaloids (3,4 and 5) were tested for their antimicrobial activity and their MIC was determined (Table 2). Tetrahydrosecamine exhibited a high broad spectrum activity (except for *E. coli*) and the lowest activity was observed for akuammidine. Strictanol showed the highest activity against *E. coli* and *P. aeruginosa*.

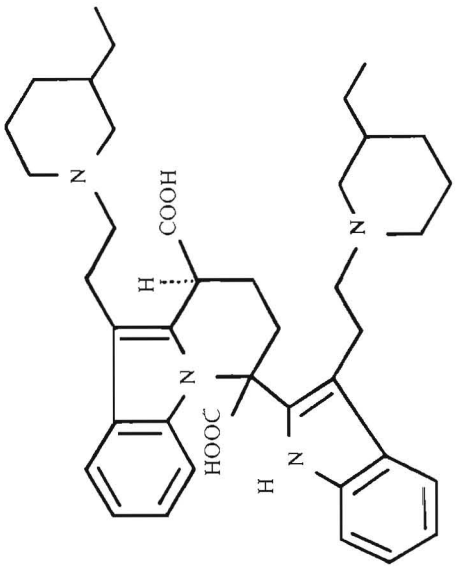
Table 2. Showing the inhibition zones and MIC of the alkaloids isolated from *Rhazya stricta* root

Test Organism	Mean diameter of Inhibition Zone (mm)				MIC (mg/ml)			
	2	3	4	5	2	3	4	5
Bacillus subtilis	9	22	0	0	1	0.2	–	–
Staphyllococcus aureus	10	16	0	8	1	0.5	–	2
Escherichia coli	15	0	0	10	0.5	–	–	2
Pseudomonas aerugimosa	14	12	9	12	0.5	5	2	1
Candida albicans	12	23	0	18	1	0.1	–	0.2
Aspergillus flavus	11	12	0	10	1	0.1	–	1
Apergillus terreus	9	8	0	0	1	0.1	–	–

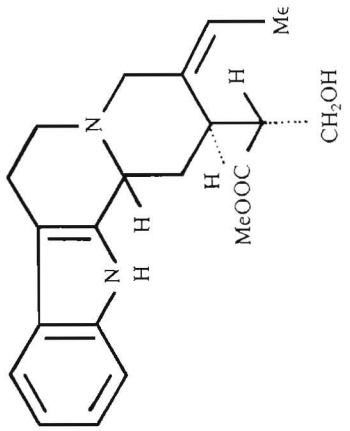
2 = Strictanol; 3 = Tetrahydrosecamine; 4 = Akuammidine; 5 = Rhazimanine.

Table 3. ^{13}C-NMR spectrum of compound 2,4,5

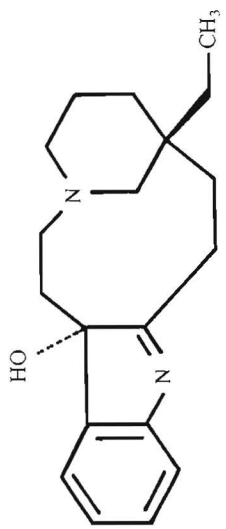
Carbon number	Chemical shifts in δ (ppm)		
	Strictanol (2)	**Akuammidine (4)**	**Rhazimanine (5)**
2	146.4	136.9	133.9
3	60.6	50.7	52.7
5	57.1	57.9	51.3
6	31.1	24.5	17.6
7	89.8	105.4	107.7
8	101.5	126.8	127.7
9	123.4	117.9	117.9
10	121.3	119.0	119.5
11	130.5	121.3	121.5
12	110.9	111.1	111.3
13	130.9	136.6	136.2
14	19.9	29.1	30.2
15	28.9	29.2	32.6
16	30.9	49.1	49.6
17	38.5	68.3	62.1
18	6.9	12.9	13.3
19	34.6	117.3	123.4
20	32.2	137.3	133.5
21	63.1	55.3	52.3
22	–	174.1	175.6
COOMe	–	50.7	52.1


COOH
H
N
HOOC
N
H
N
N

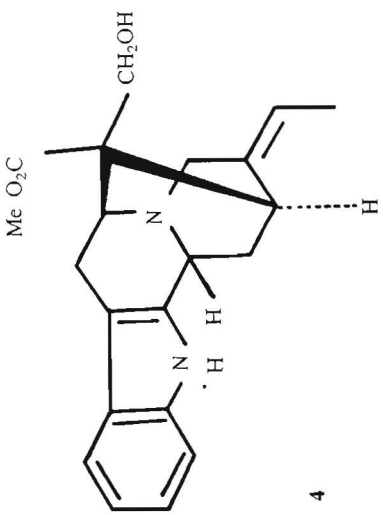
3


Me
H
CH2OH
H
MeOOC
N
H H
N H

5


CH3
N
HO
N

2


CH2OH
Me O2C
N
H
H
N
H

4

References

Banerji, A., Majumder, P.L. and **Chatterjee, A.** (1970) Occurence of geissoschizine and other minor biogenetically related alkaloids in *Rhazya stricta*. *Phytochem.*, **9:** 1491-1493.

Cordell, G.A., Smith, G.F. and **Smith, G.N.** (1978) The relative stereochemistry of the secamines. *J. Indian Chem. Soc.*, **55:** 1083-1091.

Evans, D.A., Smith, G.F., Smith, G.N. and **Stapleford, K.S.** (1968) *Rhazya* alkaloids: the secamine, a new group of indole alkaloids. *Chem. Commun.*, **15:** 859-861.

Elwam, S. and **Diab, A.** (1970) Bacterial inhibitors in *Artemisia monosperma* and *Rhazya stricta*. Egypt. *J. Bot.* **B:** 129.

Hassan, M.H., Muhtadi, F.J. and **Aziz, Omid A.** (1977) Phytochemical investigation of *Rhazya stricta* growing in Saudi Arabia. Part 1. Total alkaloid content and TLC screening. *Bull. Fac. Sci.* Riyadh Univ., Riyadh, Saudi Arabia. **8:** 331-339.

Mariee, K.N., Khalil, A.A. and **Nasser, A.A.** (1988) Isolation of the antimicrobial alkaloid stemmadenine from Iraqi *Rhazya stricta*. *J. of Natural Products*, **51**(1): 186-187.

Mukhopadhyay, S., Handy, G.A., Fuayama, S. and **Cordell, G.A.** (1981) Anticancer Indole Alkaloids of *Rhazya stricta*. *J. of Natural Products*, **44**(6): 696-700.

Rahman, Atta Ur and **Kaniz, F.** (1982) The alkaloids of *Rhazya stricta* and *R. orienlalis*. *J. Chem. Soc. Pak.*, **4**(2): 121-127.

Rahman, Atta Ur and **Malik, S.** (1984) Isolation of isovallesiachotamine from legumes of *Rhazya stricta*. *J. of Natural Products*, **47**(2): 388-389.

Rahman, Atta Ur and **Malik, S.** (1985) Vincadine from the legumes of *Rhazya stricta*. J. of Natural Products, **48**(1): 153-154.

Rahman, Atta Ur, Malik, S. and **Rahman, Habib Ur** (1986) Rhazimanine, an indole alkaloids from fruits of *Rhazya stricta*. *Phytochem.*, **25**(7): 173-174.

Rahman, Atta Ur and **Malik, S.** (1987) Strictanol and strictamine- Two new indole alkaloids from the fruits of *Rhazya stricta*. *Phytochem.*, **26**(2): 589-591.

Rahman, Atta Ur, Fatima, F. and **Khanum, S.** (1988) 15 β-hydroxyvincadiformine, an alkaloid from the leaves of *Rhazya stricta*. *Phytochem.*, **27**(11): 3721-3723.

Rahman, Atta Ur and **Khurshid, Z.** (1988) Studies on the alkaloids of *Rhazya stricta*. *Phytochem.*, **27**(6): 1926-1928.

Rahman, Atta Ur, Fatima, T. and **Khanum, S.** (1989) Rhazizine: A novel alkaloid from the leaves of *Rhazya stricta*. *Tetrahedron*, **45**(11): 3507-3512.

Reeves, D.S. (1989) *Antibiotics a ssay-In Medical Bacteriology, A Practical Approach*, edited by **Hawkey, P.M.** and **Lewis, D.H.** Oxford University Press, London.

Verpoorte, R., Kos-Kuyck, E.,Tsoi, A.T.A., Ruigrok, Jong, G. and **Svendsen, A.B.** (1983) Medicinal Plants of Surinam. *Planta Medica*, **48:** 283-289.

Yousif, A. Kaniz, F., Quesne, L. and **Rahman, Atta Ur** (1983) Further alkaloids Constituents of the leaves of *Rhazya stricta*. *Phytochem.* **22**(4): 1017-1019.

(Received 26/10/1992;
in revised form 05/05/1993)

أشباه قلويات فعالة ضد الميكروبات من جذور نبات الحرمل الذي ينمو بدولة الامارات العربية المتحدة

أحمد خضر بشير و عبدالله أحمد عبدالله و السيد سيد سليمان و إبراهيم عبدالرحمن وصفي و محمد هادي أميري و وتريفور كراب [1]

مركز بحوث الصحراء والبيئة البحرية - جامعة الامارات العربية المتحدة، العين ص.ب ١٧٧٧٧ دولة الامارات العربية المتحدة، [1] قسم الكيمياء - جامعة بورتسموث - بريطانيا

ينمو نبات الحرمل في المناطق الرملية الحصوية بالمنطقة الشرقية لامارة أبو ظبي (العين) بدولة الامارات العربية المتحدة، ويعتبر من النباتات الهامة في الطب الشعبي. ويستعمل لعلاج الالتهابات ومرض السكر واضطرابات المعدة.

أوضحت الدراسة ان خلاصة الكلوروفورم والميثانول لجذور نبات الحرمل لها فعالية عالية ضد معظم البكتيريا والفطريات تحت الدراسة. وباستعمال العمود الكروماتوغرافي تم فصل وتنقية أربع مركبات من مجموعة أشباه القلويات من جذور النبات.

كشفت دراسات الطنين النووي المغناطيسي، ومطياف الكتلة والدراسات الطيفية الأخرى عن أن هذه المركبات المفصولة هي: إستراليكانول وتتراهايدروسيكامين واكواميدين ورايزامنين. واتضح أن أشباه القلويات هي

المسؤولة عن فعالية نبات الحرمل ضد البكتيريا والفطريات، وقد تم تحديد التركيز الأدنى الذي يمنع نمو الميكروبات المذكورة أعلاه.

الجدير بالذكر أن هذه أول مرة يتم فيها فصل إسترايكانول وأكواميدين ورايزامينين من جذور نبات الحرمل ومعرفة التأثير المثبط لها على العديد من البكتيريا والفطريات.