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ARGENTINE, LUPININE, CYTISINE AND N-METHYLCYTISINE ALKALOIDS FROM SOPHORA SECUNDIFLORA CULTIVATED IN EGYPT.

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ABSTRACT

The Leaves of Sophora secundiflora cultivated in Egypt was found to contain the alkaloids : argentine, lupinine, cytisine and N-methylcytisine.

INTRODUCTION

The seeds of Sophora secundiflora (Orteg.) Lag. Leguminosae are known to produce hallucinogenic effect[1-3], which has been attributed to the presence of alkaloids[4-9]. The ingestion of the leaves of this plant was reported to lead to the production of poisonous milk[9]. Previous phytochemical investigation on lupin alkaloids revealed that the leaves harvested in Pakistan contained seven quinolizidine alkaloids : 11-oxocytisine, N-methylcytisine, N-formylcytisine, N-acetylcytisine, cytisine, anagyrine and baptifolime[10]. In a previous communication, the authors reported the isolation of sparteine and 13-hydroxysparteine and others from the plant[11,12].

As continuation of our screening for lupin alkalois in Leguminous plants we tried to seek more alkaloids in the leaves of S. secundiflora cultivated in Egypt.

EXPERIMENTAL

Material and Methods :

IR spectrum were determined in KBr discs using a Perkin-Elmer 267-grating spectrophotometer. ^{1}H-NMR spectra were recorded on a Varian Instrument EM-390 NMR spectrometer (90 MHz). The Mass spectrum were obtained on a Varian MAT,Model CH-5 spectrometer.

Plant Material :

The material wes collected in April 1984 from Aswan Botanic Island.

Extraction and Isolation of the Alkaloids :

The dried powdered leaves (1.2 kg) was extracted with ethanol to exhausion. The ethanolic extract was concentrated under reduced pressure, acidified with dil HCl and extracted with chloroform to remove the non-basic substances. The mother liquor was made basic with NH_4OH and extracted again with chloroform. The chloroform extract was dried with anhydrous Na_2SO_4 and evaporated under vacum to give crude alkaloidal mixture (10 g).

The crude alkaloidal mixture was chromatographed on a column of 500 g basic alumina, Prolabo. Elution was started with chloroform and chloroform-methanol mixtures of increasing polarities, the effluent collected in 200 fractions and monitored by TLC on silica gel G plates using chloroform-methanol (9:1) as solvent

Also preparative TLC was performed on silica ge GF_{254} (Merck) plates using cyclohexane-diethylamine (7:3) to obtain the alkaloids in pure state.

Four alkaloids were isolated:argentine,cytisine, lupinine and N-methylcytisine.

Argentine, Lupinine, Cytisine and N-Methylcytisine Alkaloids From Sophora Secundiflora Cultivated in Egypt.

Argentine :

Colourless needles mp. 260 C^{o} (MeOH), (600 mg), IR,cm^{-1}, revealed the following bands : 2600-2700,1640 and 1480 . The MS spectrum showed [M^{+}] m/z (rel.int.) 406 (18.7 %), 250(30), 217(32.7),203 (18.7) 191(79.2), 190(100), 160 (46.7), 147(54.2), 146(40) and 44 (181.3).

The ^{1}H-NMR (90 MHz,$CDCl_3$) revealed: 7.2 (dd,1H, J=9 and 7 Hz, C-4) 6.5(dd, 1H, J=9 and 1.5 Hz, C-3), 5.9(dd. 1H, J=7 and 1.5 Hz, C-5), 3.5-4.3 (m, 2H,C-7 and C-9) , 2.9 (m,4H, C-11 and C-12), 2.45 (b,m,2H, C-10) and 1.8 (b.,m., 2H, C-8).

Cytisine :

Colourless prisms (2g) mp. 155-57 C^{o}, (pet.ether), picrate mp. 279-280 C. IR:2810-2760, 1645 cm^{-1}. MS,[M^{+}), m/z (rel.int.) 190 (84 %), 160(27), 148 (48), 147(85), 146 (100) and 43 (90). The ^{1}H-NMR spectrum (90 MHz,$CDCl_3$) revealed the chemical shift values at 7.2 (dd., 1H, J=9 and 7 Hz, C-4), 6.5 (dd, 1H,J=9 and 1.5 Hz, C-3), 5.9 (dd, 1H, J=7 and 1.5 Hz, C-5), 3.5-4.3 (m., 2H,C-7 and C-9) and significant signals at 2.9 (m., 4H) for equatorial hydrogens at C-11 and C-12, while at 2.45 (b.,m., 2H,C-10), 1.8(b.,m., C-8). The ^{13}C-NMR was recorded and compared with that reported for cytisine[10]. The spectra was superimosed and showed signals at 163.6 (C=O), 152.1 (C-6), 138.7 (c-4) , 116.7 (C-3), 104.9 (C-5), 54.0(C-11*), 53.0 (C-13*) i.e. interchangable, 49.7 (C-10), 35.6 (C-7), 27.8(C-9) and 26.3 (C-8).

Lupinine :

Colourless prisms (1.2g), mp.78-80 C^{o} (pet. ether), picrate mp. 134-36 C^{o}. IR spectrum revealed the following bands 3180, 2880-2700, 1485 and 1400 cm^{-1}. MS spectrum

showed [M^+] at m/z value of 169 with predominant ions at 168(62 %), 152(100), 138(78), 110(51), 97(50) and 83(74). The ^{1}H-NMR (90 MHz $CDCl_3$), revealed signals at 2.91 2.72 (m., 2H,C-2 and C-10). The remainder of the absorption was represented by a broad peak centered near δ 1.5 ppm with a distinct shoulder at 2.o ppm corresponding to one proton (C-6).

^{13}C-NMR showed the signals at δ 64.4 (C-6), 64.37(CH_2OH) 56.9 (C-2), 56.7(C-10), 44.0(C-5), 29.8 (C-9), 25.6(C-8) and 24.6 (C-7).

Comparing these data with that of lupinine showed a good fit[13].

N-methylcytisine :

Colourless needles mp. 136-38 C^o (MeOH), (60 mg). Its picrate, methiodide and perchlorate were obtained melted at 230-32, 265-67 and 280-82 C^o respectively, co-chromatgraphy, mixed mp. and derivatives of the compound IV with an authentic sample of N-methylcytisine were found to be identical[14].

RESULTS AND DISCUSSION

Argentine alkaloid was isolated from the alkaloid mixture which was extracted from an ethanol extract of the leaves of S. secundiflora which gave colourless needles from methanol mp. 260 C^o. The molecular formula $C_{23}H_{26}O_3N_4$, was established by MS (M^+, m/z 406) with prominant fragments 191 (79.2 %), 190(100), 147 (54.2) and 146 (40) which are attributed to the AB ring system of cytisine-type[15,16].

The 190 base peak suggesting a two cytisine moieties this was confirmed by ^{1}H-NMR spectra which clearly indicated the presence of aromatic protons at 5.9, 6.5 and 7.2 ppm attributable to the protons at (C-5, C-3 and C-4) respectively of an ∝-pyridone ring system in cytisine-type alkaloid[14-16].

From the above results, its concluded that the compound of cytisine-type, it might be argentine, which was isolated from Ammodendron argentum[17]. This is the first report on the isolation of argentine alkaloid as major constituent of Sohpora species .

The molecular formula of compound II was found $C_{11}H_{14}O$, according to the MS spectrum which showed [M^{+}] ion at m/z value of 190 with predominant ions at m/z 160(26 %), 147 ((87) and 146 (100). Compound II is suspected to be of cytisine-type becausem upon spraying with 1 % w/v solution of ferric chloride in $CHCl_3$-acetone (3:1) it developed an orange red colour changing on subsequent spraying with a 3 % solution of H_2O_2 to light blue.

The ^{1}H-NMR was similar to those of compound I. ^{13}C-NMR spectrum of II, the nine signals attributable to the quinolizidine moiety beside two signals for two equqtorial interchangeable carbons were at δ 54.0 (C-11) and 53.0 (C-13) . Three signals were observed in the aromatic region at 138.7 116.7 and 104.9 ppm for (C-4, C-3 and C-5) of aromatic ring in cytisine.

The structure of compound II was suggested as cytisine.

The IR spectrum of compound III indicated the presence of strong Bohlmann bands 2880-2700, in addition, strong obsorption band at 3180 (free OH group). The molecular formula was $C_{10}H_{19}NO$ which confirmed by MS spectrum which showed a [M^+] at m/z 169 with predominant ions at m/z 152 (100), 138(80) and 110(51) which were similar to those of the spectra reported for lupinine[14,18,19].

The ^{1}H-NMR showed a multiplet at δ 2.91, 2.72 ppm, a broad multiplet centered at 1.5 ppm with a distinct shoulder at δ 2.0 ppm corresponding to 1H(C-6). ^{13}C-NMR showed nine signals corresponding to quinolizidine moiety inaddition to signal at 64.4 ppm for (CH_2OH). Five interchangeable signals at δ 28.3 (C-3), 25(C-4) 29.8 (C-9), 25.6(C-8) and 24.6 (C-7)

From the above results compound III was suggested as lupinine.

Compound IV was isolated in small quantities (60 mg). It was identified by preparation of its derivatives and co-chromatography with authentic samples of N-methylcytisine.

The presence of cytisine,in addition to its N-methyl derivatives and lupinine, justifies its hallucinogenic properties[7].

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قلوانيات أوراق السوفورا سكندفلورا المنزرع فى مصـــــر

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تم فصل أربعة قلوانيات من أوراق النبات باستخدام كروماتوجرافيا العمود وكروماتوجرافيا الدلبقة السميكة .

وقد أمكن التعرف على هذة القلوانيات بمساعدة الطرق الحديثه متمثلة فى مطياف الكتلة ، الرنين النووى المغناطيسى ، الاشعة دون الحمراء والرنين الكربونى المشع كما تم تحضير بعض أملاح هذة القلوانيات وهذة القلوانيات هى الارجنتين ، السيتزين ، ن - ميثيل ستيزين واليوبولين .

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