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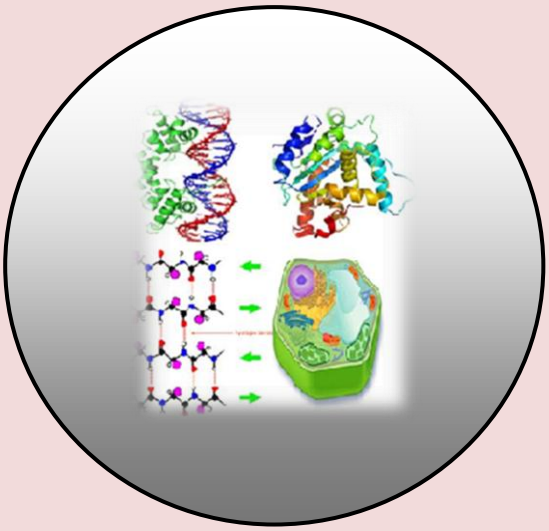

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RESEARCH PAPER
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An Alkaloid from *Alhagi pseudalhagi*

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ABSTRACT
Alhagi pseudalhagi known as Yavasaka in Ayurveda and Camelthorn in English is a small thorny shrub, normally used in folk medicine as a remedy for rheumatic pains and various types of gastrointestinal discomforts, urinary tract diseases and liver diseases. A number of chemical constituents e.g. alkaloids, flavonoids, steroids, glycerides, fatty acids have earlier been reported from this species. In view of the above facts, a detailed chemical investigation of Alhagi pseudalhagi was taken up by the present investigator to isolate and characterize further chemical constituents.
Keywords: Alhagi pseudalhagi, Leguminosae, Alkaloids, Antirheumatic and Apocavidine.

INTRODUCTION
Alhagi pseudalhagi belongs to family Fabaceae (Department of Ayush 1999) or Leguminosae (Atta and El-Sooud, 2004, Amani, 2006). It is alow erect shrub, widely distributed in the gangetic plans of India. It is an important ingredient of many Ayurvedic formulations. The plant is normally used in folk medicine as a remedy for rheumatic pains, bilharziasis and various types of gastrointestinal discomfort and in diseases of the urinary tract and liver (Bolus, 1983). The herb is bitter, autibilous in chest infections. The twig is bechic diaphoretic, diuretic and inopacities of cornea, leaf is antirheumatic and antibacterial. The plant is antiprotozoal, antiarrythmic, spasmolytic and anticancer (Viramani et al., 1992). Ethanol extracts of the leaves showed significant antibacterial activity against gram negative, gram positive bacteria, unicellular and filamentous fungi (Zain et al., 2012). Chemical studies on the stem and root indicated the presence of alkaloids: β-phenethylamine, N-methyl-β-phenethylamine, N-methyltyramine, hordenine, 3,4-dihydroxy-β-phenethyltrimethyl ammonium hydroxide, 3-methoxy-4-hydroxy-β-phenethyltrimethyl ammonium hydroxide, N-methylmescaline and salsolidine (Ghosal et al., 1973, Ghosal et al., 1974).

Three oleanane-type triterpene glycosides have been isolated from the roots and their structures have been assigned as 3β, 22β, 24-trihydroxy-olean-12-ene-15-oxo 3-O-α-L-rhamnopyranosyl (1→2)-β-D-galactopyranosyl-(1→2)-β-D-glucuronopyranosyl 22O-α-L-[rhamnopyranoside, 3β, 22β, 24-trihydroxy-olean-12-ene15-oxo 22-O-α-L-rhamnopyranoside and 3β, 22β, 24-trihydroxyolean-12-en 3-O-α-L-rhamnopyranosyl-(1→2)-β-Dgalactopyranosyl-(1→2)-β-D-glucuronopyranosyl-22-O-β Dglucopyranosyl-(1→2)-α-L-rhamnopyranoside (Hamed et al., 2012). Alhagitin (naringenin 5methyl ether 4′-glucoside), alhagidin (hesperitin 7-galactosyl (1→2) [rhamnosyl (1→6)] glucoside) (Singh et al., 1999), formonoetin, 3′,7 dihydroxyl-4′-methoxylisoflavone, 3′,7-dihydroxyl-4′,8 dimethoxylisoflavone, pratensein, tamarixetin, isoquercitrin, saliylic acid, vanillic acid, β-sitosterol and daucosterol (Zhang et al., 2009), isorhamnetin-3-O-[-α-l-rhamnopyranosyl-(1→3)]-β-Dglucopyranoside, 3'-O-methylorobol [2] and quercetin 3-O-β-dglucopyranoside (Ahmad et al., 2010) have also been isolated from the plant. We report here the isolation of apocavidine from the whole plant of *Alhagi pseudalhagi*. This is the first report of the occurrence of this alkaloid in *Alhagi pseudalhagi.*

MATERIAL AND METHODS

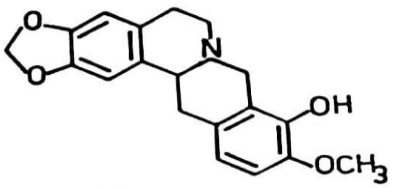
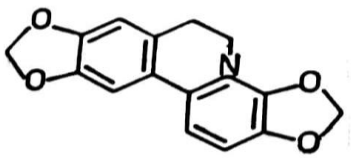
Whole plant of *Alhagi pseudalhagi* was collected from the Varanasi District, U.P., India and the identification verified by the Department of Botany, Banaras Hindu University, Varanasi. The principle of isolation and separation of alkaloids involved utilization of differential solubility in solvent of graded polarity in the presence and absence of fat, difference in basic strengths and phenolic and non-phenolic characters. Mps were uncorrected. CC was carried out on silica gel (BDH, 60-120 mesh), TLC on silica gel and PC on Whatman No 1 paper. Solvent used for TLC were C_6H_6-$CHCl_3$ (2:1, solvent A), C_6H_6-$CHCl_3$ (1:1, solvent B) and C_6H_6-$CHCl_3$ (1:2, solvent C) and for PC: n-BuOH-HOAcH_2O (4:1:5, solvent D). Dragendorff' was used for developing TLC plates. PCs were developed with acetonic $AgNO_3$-NaOH and washed with $Na_2S_2O_3$ solution. ^{1}HNMR spectrum was recorded on 300 MHz. Varian spectrometers. TMS was used as int. standard and chemical shift values were recorded in δppm. EIMS and FAB-MS were performed on a Kratos MS-50 instrument at 70 eV with evaporation of sample in the ion source.

The whole plant (3kg) was dried, powdered and repeatedly extracted with MeOH by could percolation at 25^0. The alkaloidal and non alkaloidal fractions were separated from the MeOH extract by usual procedure. This alkaloid was isolated from silica gel column chromatograpy of the chloroform soluble basic fraction of methanol extract. It crystallized from methanol as colourless granules, m.p. 168-170^{o}C, $C_{20}H_{21}NO_4$ (M+ 339.1478, HRMS); the UV spectrum (fig. 1) of the compound showed absorption maxima at 225 sh (log Ɛ 4.25) and 288nm (log Ɛ 3.25) and a minimum at 260 nm (log Ɛ 2.23). ^{1}HNMR : 0.88 (3H, d , J=6Hz, C-13CH_3.); 2.52(1H, m, C-6-H); 2.52(1H, m, C-5-H); 2.94(1H, m, C-5-H); 3.06 (1H, m, C-6-H); 3.22(1H, qd, J=6,2 Hz, C-13-H); 3.35(1H, d, J=15 Hz, C-8α-H); 3.55(1H, brs, J=2 Hz, C-14-H); 3.80(3H, S, C-3- OCH_3); 3.98(1H, d, J=15 Hz, C-8β-H); 5.88 (2H, t, J=3 Hz, -OCH_2O-);6.62(1H, S, C-4-H) ;6.65 (3H, S, C-1- H, C-11-H, C-12-H)(fig3). EIMS: m/z 339.1470(M^+, 100 %), 338.1397, 325.1274, 334.1238, 194, 177, 162, 149(fig4).

RESULT AND DISCUSSIONS

Chromatographic resolution of the methanolic extract of the whole plant of *Alhagi pseudalhagi* yielded an alkaloid apocavidine (Ap-2) C_{20} H_{21} NO_4. It showed a single spot with Dragendorff's reagent on each chromatoplates regardless of the solvent system used for developing. It resembles tetrahydroprotoberberine alkaloids in its ultraviolet absorption pattern as will be evident from the reported UV data of some common tetrahydroprotoberberine alkaloids (Shamma et al., 1972) shown in the table 1. The infrared spectrum of the compound (fig. 2) in KBr pellet showed characteristic absorption bands at 3400 cm^{-1} indicating the presence of hydroxyl group in the compound. The comparison of ^{1}HNMR data of the compound with (±) apocavidine clearly indicated that the chemical shifts of all the protons in the ^{1}HNMR of the compound were identical to the chemical shifts of the protons reported for (±) apocavidine (Rucker, 1994). The mass spectrum (fig. 4) showed a molecular ion peak at m/z 339.1470 and had characteristic ion peaks at m/z 177and 162 due to retro Diel's-Alder type fragmentation.

Table 1. UV spectral data of the compound and some tetrahydroprotoberberine alkaloids.

Name and Structure	UV λ_{max} nm (log ∈)
Ap-2	λ_{max}^{EtOh} 225 sh and 288 nm (4.25 and 3.25) λ_{min}^{EtOh} 260 nm (2.23)
 Nandinine	λ_{max}^{EtOh} 230sh and 286 nm (4.1 and 3.80) λ_{min}^{EtOh} 252 nm (2.3)
 Tetrahydrocoptisine (=stylopine)	λ_{max}^{EtOh} 237 and 289 nm (3.85 and 3.89) λ_{min}^{EtOh} 252 nm (2.70)

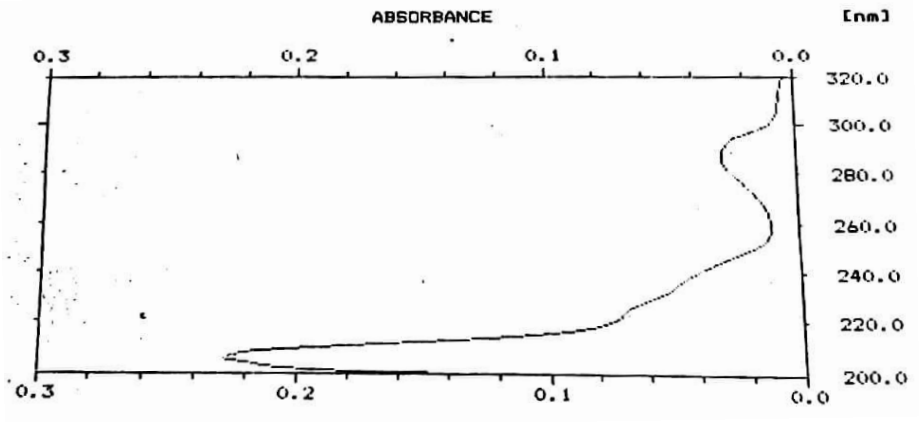


Figure 1. UV spectrum (in EtOH) of the compound.

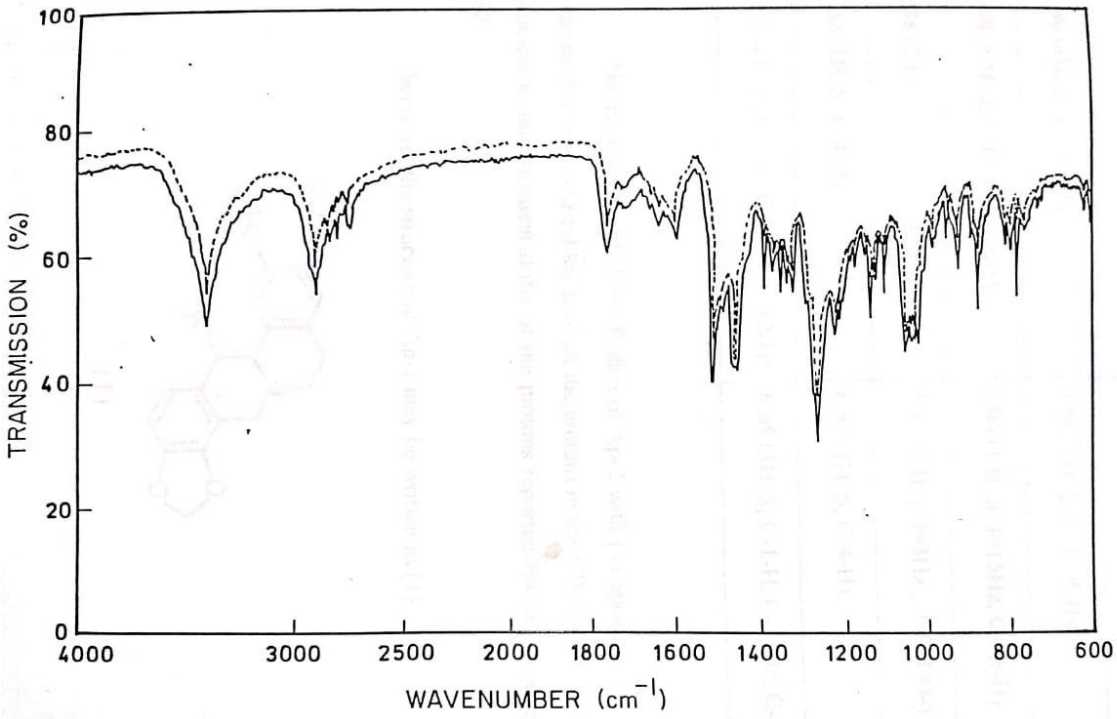


Figure 2. Superimposable IR spectrum (in KBr) of the compound.

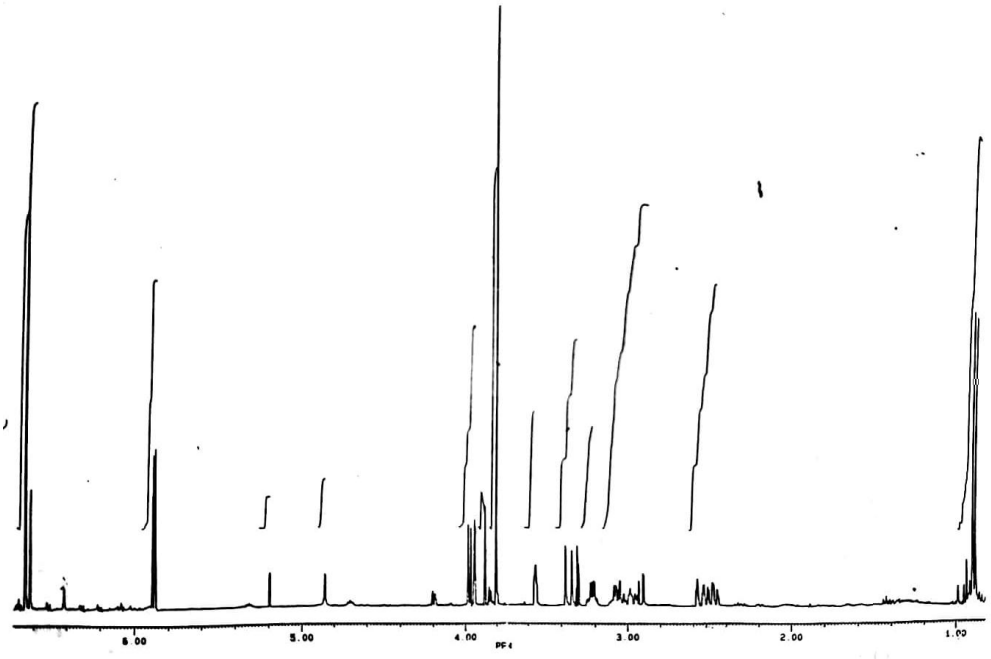
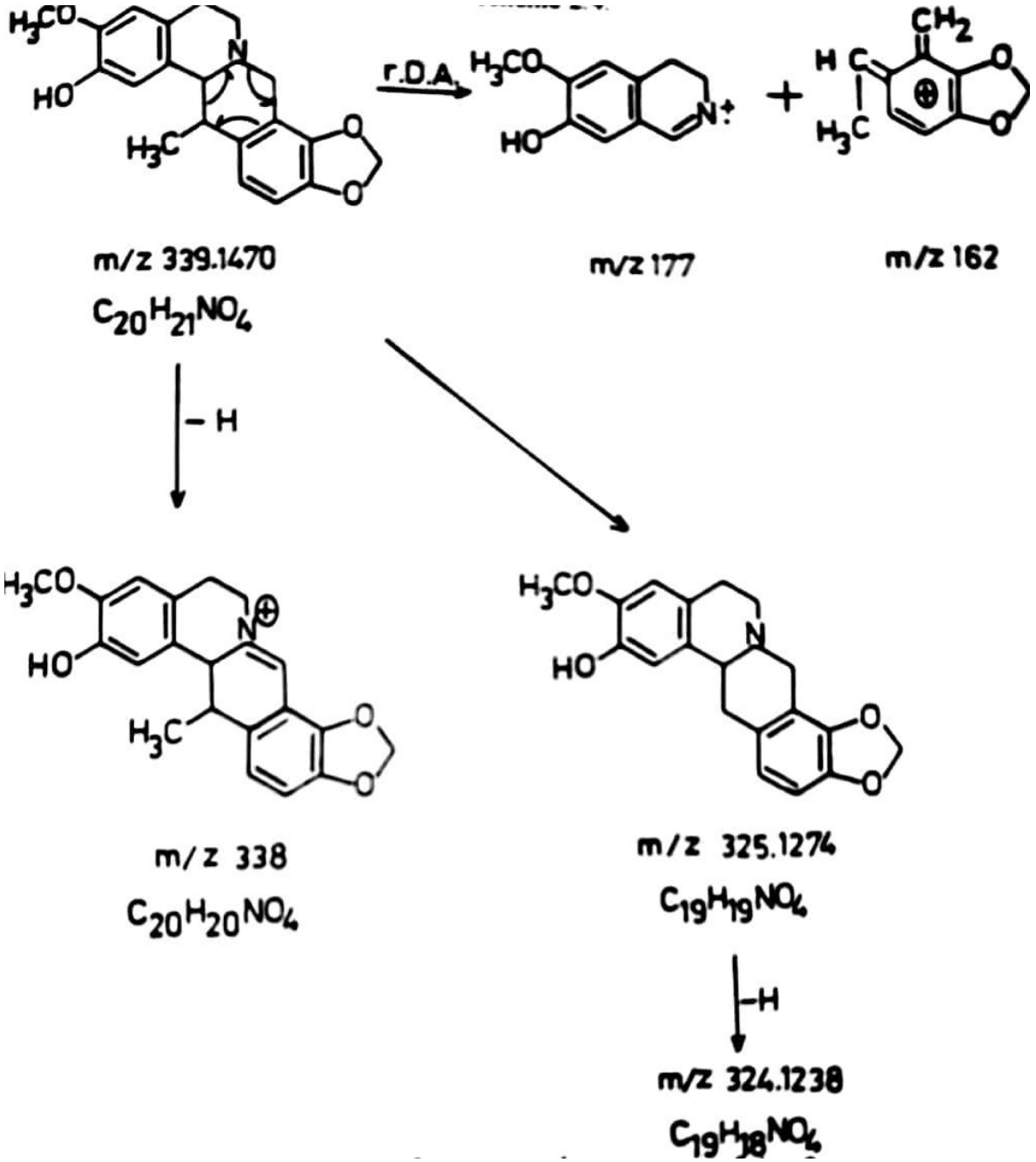


Figure 3. 400MHz ^{1}HNMR spectrum (in $CDCl_3$) of the compound.



Mass fragmentation pattern of the compound

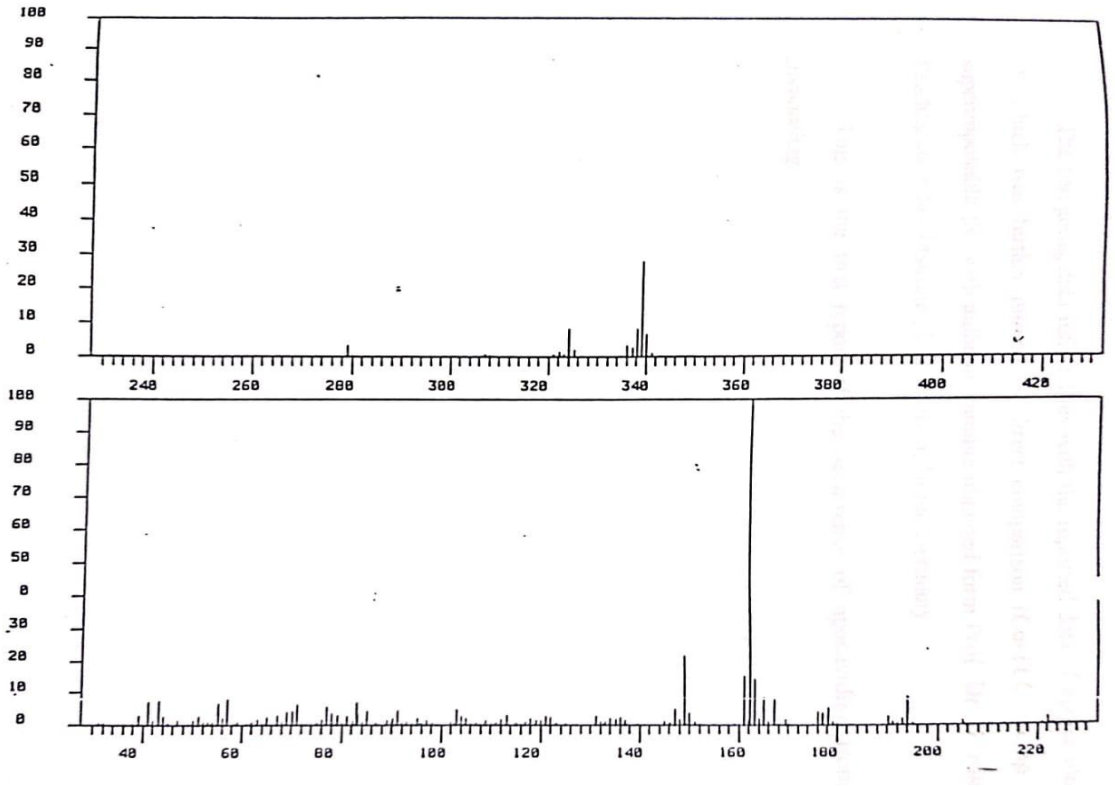
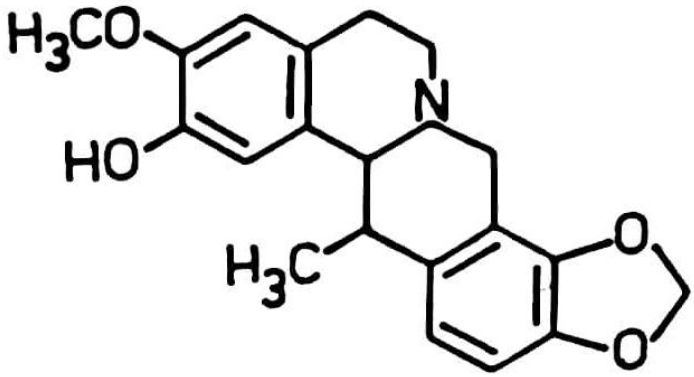


Figure 4. Mass spectrum of the compound.



Apocavidine

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