Alkaloid and Steroid from the Stem Bark of
*Jatropha curcas* (Euphorbiaceae)


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ABSTRACT: The plant *Jatropha curcas* grows well in different parts of Bangladesh and used in many medicinal purposes locally. The alkaloid atherospermidine and a steroid stigmasterol were isolated from the ethyl acetate extract of the stem bark of *J. curcas* by a combination of column and preparative thin-layer chromatography over silica gel. The structures of these compounds were determined by spectroscopic analysis (UV, IR, ¹H NMR and ¹³C NMR) and by comparison with published data. This is the first report of isolation of the alkaloid atherospermidine from this plant.

Keywords: *Jatropha curcas*, Alkaloid, Atherospermidine, Stigmasterol, Euphorbiaceae.

INTRODUCTION

*Jatropha curcas* (Family Euphorbiaceae) is a plant of Latin America which is now wide spread throughout arid and semi arid tropical regions of the world.¹⁻³ It is as bussy and fast growing plant which grows up to 3-4 m high. This plant is found in every part of the world except very cold areas. Previous phytochemical investigations on different species of *Jatropha* resulted in the isolation of essential oil, sugars.¹,⁴,⁵ Among other compounds alkaloids, flavonoids and steroids are most considerable components. In Bangladesh, *J. curcas* is widely distributed in the forest of northern districts. The latex of *Jatropha* contains an alkaloid known as “Jatrophine” which is believed to be anticarcinogenic.²,⁶ It is also used an external application for skin diseases and rheumatism and for sores on domestic livestock.²,⁷ The tender treatment of piles.²,⁸ The bark of *J. curcas* yields a dark-blue dye which is used in coloring cloth, fishing nets and line. *J. curcas* latex and twigs of the plant are used for cleaning teeth. The juice of the leaf possesses both procoagulant and anticoagulant activities.³ A number of compounds have been isolated from this plant such as tetradecyl-(E)-ferulate, 3-O-(Z)-coumaroyl oleanolic acid, heudelotinone, epi-isojatrogrossidione, 2-alpha-hydroxy-epi-isojatrogrossidione, and 2-methanthraquinone.⁹ Since this plant has good medicinal properties², the present work has been undertaken to isolate and identify biologically active secondary metabolites. In this paper the isolation and structural elucidation of two compounds, the alkaloid; atherospermidine (JC-1) and a steroid stigmasterol (JC-2) are being reported by using spectroscopic techniques like UV, IR, ¹H NMR and ¹³C NMR.

MATERIALS AND METHODS

General. Melting points were determined on a kolfer hot-stage apparatus and are uncorrected. UV spectrum was taken in MeOH solution using a Perkin-Elmer lambda 9UV/VIS/NIR Spectrometer. IR spectra were recorded in CHCl₃ solutions on either a Perkin-Elmer 580 or Philips 9800 FTIR spectrometer. ¹H NMR and ¹³C NMR spectra were...
obtained on Bruker WP 200 SY and AM 200 SY instruments (1H, 200 MHz; 13C, 50.32 MHz) using TMS as internal standard and CDCl3 as solvent. Electron impact mass spectra (EIMS) were recorded using a VG updated MS 12 Spectrometer and optical rotations were measured on an optical activity AA-100 Polarimeter in CHCl3 solution at 20ºC. Petroleum ether specifically refers to the bp 40-60º fractions.

Plant materials. The stem bark of J. curcas was collected from the district of Nilphamari, Bangladesh. The plant has been identified by Prof. Dr. Md. Abul Hasan, Department of Botany, University of Dhaka

Extraction and isolation. The sun-dried stem bark (950 g) of J. curcas was ground and then extracted with petroleum ether, ethyl acetate and methanol sequentially. The coed. ethyl acetate extract was then mixed with silica gel to prepare paste and the paste was then dried by using a Buchi rotavapor and subjected to flash column chromatography over silica gel (Merck Kieselgel 7-230 mesh). Elution of the column first with petroleum ether, increasing amounts of EtOAc in petroleum ether and finally with methanol yielded a number of fractions. The proportion of solvent systems used to obtain JC-1 (8 mg) and JC-2 (7 mg) were petroleum ether: EtOAc (80:20) (90:10) from fractions 14 and 5 respectively.

JC-1 (Atherospermidine) [I], yellowish needles (chloroform); m.p. 282-284°C; UV λmax: 247, 279, 310 nm; IR γmax: 1650 (conjugated ketone), 3025, 1602, 1579, and 1518 (aromatic) cm⁻¹. Its mass spectrum revealed a molecular ion peak at m/z 305 corresponding to C18 H11NO4, together with fragments at m/z 290 (M+-CH3), 277 (M+-CO), 275 (M'-CH3O), 274(M'-OCH3), 262 (M'-CH3-CO), 149 (C11H3N+), consistent with an oxoaporphine alkaloid. 10-11

The 1H NMR spectrum of JC-1 [I] revealed pyridine protons [δH 8.09, 8.78 (Abq, J=5.4 Hz, H-4, H-5)], characteristic ring D four spin system with H-8 and H-11 deshielded [δH 8.46, (1H, dd, J=8.0, 0.9 Hz, H-11)], 8.52 (1H, dd, J=8.0, 0.9 Hz, H-8), 7.65 (1H, dt, J=7.6, 1.5 Hz, H-9), 7.45 (1H, dt, J=7.6, 1.5 Hz, H-10)], a methylenedioxy group [δH 6.28 (s)] and a methoxyl group [δH 4.27(s)]. Comparison of 1H NMR

**RESULTS AND DISCUSSION**

Chromatography over silica gel of the ethyl acetate extract of the stem bark of J. curcas yielded two compound; an alkaloid, atherospermidine [JC-1 (I)] and stigmasterol [JC-2]. The structure of these compounds were elucidated by the spectroscopic analysis such as UV, IR, 1H NMR, 13C NMR and mass spectroscopy as well as by comparison of their spectral data with the published ones. 10-13

JC-1 (atherospermidine) [I] was obtained as yellowish needles from chloroform. It was UV active and showed absorption at λmax 247, 279, 310 nm. It showed a Dragendorff positive spot on TLC, indicating its alkaloidal nature. The IR spectrum exhibited bands at γmax 1650 (conjugated ketone), 3025, 1602, 1579, and 1518 (aromatic) cm⁻¹. Its mass spectrum revealed a molecular ion peak at m/z 305 corresponding to C18 H11NO4, together with fragments at m/z 290 (M'-CH3), 277 (M'-CO), 275 (M'-CH3O), 274(M'-OCH3), 262 (M'-CH3-CO), 149 (C11H3N+), consistent with an oxoaporphine alkaloid. 10-11

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data with the published values\textsuperscript{11,12} confirmed the structure of [1] as atherospermidine. It was clear from these data that JC-1 is closely related to liriodenine but has fully substituted ring A. The $^1$H NMR data (CDCl$_3$) were consistent with structure (1) which is sterospermidine but differ slightly from published values\textsuperscript{13} because of the deshielding effects of solvent (TFA). The $^{13}$C NMR spectrum is in accord with structure (1). It has quaternary for conjugated carbonyl [$\delta_C$182.4], six aromatic methines [$\delta_C$ 143.2, 134.0, 128.0, 127.3, 126.3, 119.6], a methylenedioxy group [$\delta_C$ 108.3], a methoxyl groups [$\delta_C$ 59.7] and nine aromatic quaternary [$\delta_C$ 150.0, 143.8, 136.5, 135.8, 132.9, 130.5, 129.6, 127.4, 122.3] carbons. Comparison with the published data\textsuperscript{13} further confirmed the structure of [1].

JC-2 (stigmasterol) was obtained as needle shaped crystals from methanol and has a melting point 160-164ºC. It showed a spot on the TLC plate after spraying with 25% H$_2$SO$_4$ and heating. The R$_f$ value of the compound was 0.33 in petroleum ether-ethyl acetate (90:10) on silica gel PF 254 plate. It was found to be soluble in petroleum ether, methanol, and chloroform. Co-TLC with an authentic sample confirmed the identity of this compound as stigmasterol.

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REFERENCES