

CONSTITUENTS OF *FERULA MARMARICA* L. RHIZOMES

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وجد أن المستخلص الكوماريني لريزومات نبات فرولامارمريكا (العائلة الخيمية) يحتوى على هيدروكربونات شمعية (ن ك ١٠ - ن ك ٢٥) ، حمض بيماريك ، المارمرسين والامبليرون بينما تم فصل مركبات ألفا-أميرين ، البيتا-سيتوستيرول وخليط من الهيدروكربونات (ن ك ١٠ - ن ك ٢٠) من الجزء الغير قابل للتصين.

*The coumarin fraction of the rhizomes of *Ferula marmarica* L. (Umbelliferae) was found to contain waxy hydrocarbons ($n-C_{10}$ to $n-C_{25}$), *d*-pimelic acid I, marmaricin II and umbelliferone III, whereas α -amyrin IV, β -sitosterol V and another mixture of hydrocarbons ($n-C_{11}$ to $n-C_{20}$) were isolated from the unsaponifiable fraction.*

INTRODUCTION

Some species of genus *Ferula* (Fam. Umbelliferae) have been used in folk medicine as diuretics, vermifuges and prescribed for articular pains, skin diseases, female sterility, and for rheumatism¹. A crystalline compound was isolated from the plant and given the name marmarin². The roots of *F. marmarica* were found to contain a sesquiterpene coumarin and was named marmaricin³. A phytochemical study of *Ferula marmarica* L. was undertaken to ascertain its toxic effect on farm animals.

EXPERIMENTAL

Plant material

The rhizomes of *Ferula marmarica* L. were obtained from the local market and identified by M. Gibali, Taxonomy Dept. NRC, Herbarium.

Apparatus

Melting points were uncorrected and determined on a Sturat melting point SMP1 apparatus.

Mass spectra were measured on a Micromass 7070 F Spectrometer. A Beckman IR 4220 Spectrophotometer was used.

Gas-Liquid Chromatography (GLC) of

Hydrocarbons: A Perkin Elmer GLC Model 910 provided with an FID was used, a column of stainless steel tubing of 1/8 inch and 12 feet length packed with 4% of OV-101 on chromosorb w/(A/w), 80-100 mesh. Carrier gas was N₂ at flow rate of 50 ml/min. The initial temperature was 100°C and final was 300°C, the rate of temperature increase was 2°C/min.

Extraction and isolation

The plant material was fractionated into coumarin and unsaponifiable fractions⁴. Thus, the rhizomes of *Ferula marmarica* L. (1 Kg) was exhaustively extracted with ethyl alcohol 95%. The alcoholic extract was concentrated under reduced pressure to afford a gummy syrup (200 g). This syrup was made up to a volume of one liter by the addition of further ethyl alcohol and the solution was then treated with an equal volume of 10% potassium hydroxide solution at room temperature and extracted with ether (5x1L). The combined ether extract was evaporated to dryness to afford the fatty matter (148 g). The alkaline aqueous solution was acidified with dilute hydrochloric acid and extracted with ether. The ether extract was washed with water, dried over anhydrous sodium sulphate and evaporated till dryness to give the coumarin fraction (20 g).

Seventy five grams from the fatty matter was refluxed with 5% alcoholic potassium hydroxide (1L) for 2 hrs. Extraction with ether afforded the unsaponifiable fraction (50 g).

A) Coumarin fraction

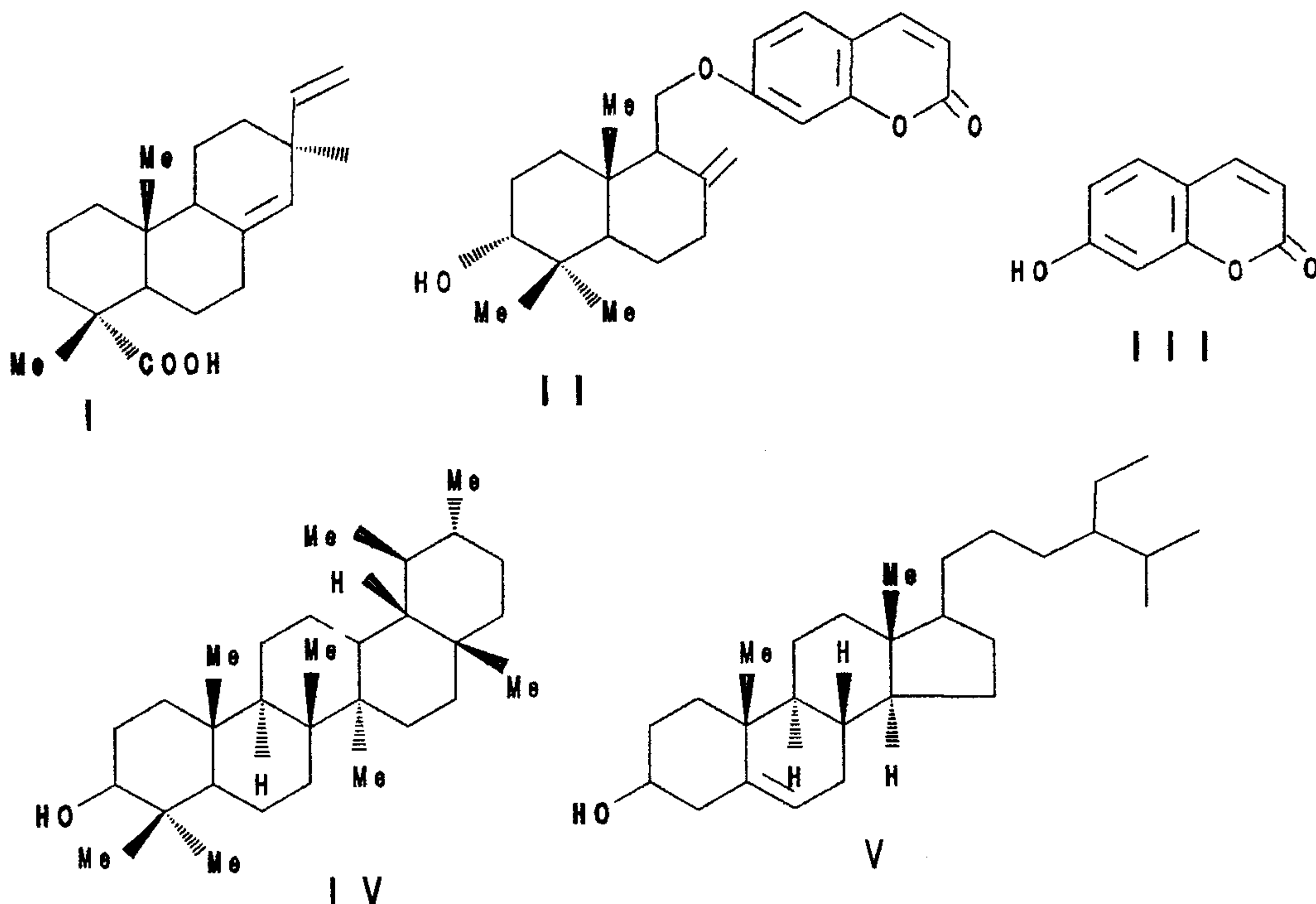
The coumarin fraction of *F. marmarica* (20 g) was passed through a silica gel column (700 g). Elution of the column with n-hexane (20 fractions, 250 ml each), afforded waxy hydrocarbons which were shown by GLC to be a mixture of n-alkane (n-C₁₀ to n-C₂₅), where n-C₁₄, n-C₁₆, n-C₁₈, n-C₂₀, and n-C₂₂ represent the major constituents (13.03, 21.44, 25.04, 11.49 and 10.46% respectively).

Further elution of the column with n-hexane/benzene (1:4) gave a single compound [R_f 0.66, using benzene/ethylacetate (8:2) as the developing system and silica gel G plate as adsorbent] non-coumarinic in nature, which showed positive Liebermann-Burchardt test for diterpenoids. This compound was crystallized from acetone to give (400 mg) colorless prisms, m.p. 217-219°C, and identified as d-pimaric acid **I**.

Mass spectrum of isolated compound **I** showed fragment ion m/e 302 (64%), 287 (84%), 241 (28%), 167 (32%), 133 (35%), 121 (100%).

¹³C-NMR spectrum of **I** has chemical shift values which are in close agreement with those published for d-pimaric acid⁵.

Elution of the column with benzene alone, then 1% methanol in benzene resulted in the isolation of a sesquiterpene coumarin (R_f 0.34), crystallized from ethanol to give colorless needles, m.p. 186-188°C and identified as marmaricin **II** using IR which showed bands at 845, 1120, 1615, 1720 and 3600 cm⁻¹, acid hydrolysis gave Umbelliferone **III** which was identified by direct comparison (CO-TLC, m.p. and m.m.p.) with an authentic sample of umbelliferone. Final elution of the column with 2% and 3% methanol in benzene afforded umbelliferone **III**, crystallized from aqueous methanol, m.p. 224-226°C (undepressed with an authentic sample).



B) Unsaponifiable fraction

10 g from the unsaponifiable fraction were chromatographed on a silica gel column (300 g). Elution of the column with n-hexane and n-hexane/benzene (1:1) afforded waxy hydrocarbons shown by GLC to be a mixture of n-alkane (n-C₁₁ to n-C₂₀), where n-C₁₁ (51.61%), n-C₁₅ (28.93%) and n-C₁₈ (18.04%) represent the major constituents.

Further elution of the column with benzene afforded colorless needles (R_f 0.65) m.p. 184-186°C, which were identified as α-amyrin IV by direct comparison with an authentic sample (CO-TLC, m.p. and m.m.p.) and by preparation of the acetyl derivative.

Finally elution of the column with methanol/benzene (1:99) afforded colorless plates, (R_f 0.6), which was identified as β-sitosterol V by direct comparison with an authentic sample (m.p. and m.m.p. 134-136°C) and by preparation of its acetyl derivative.

RESULTS AND DISCUSSION

In this study, column chromatography of the coumarin fraction led to the isolation of a waxy matter, GLC analysis of this wax revealed the presence of a mixture of n-alkanes (n-C₁₀ to n-C₂₅), where n-C₁₄, n-C₁₆, n-C₁₈, n-C₂₀ and

n-C₂₂ represent the major components. A diterpene identified as d-pimaric acid I, a sesquiterpene coumarin identified as marmaricin II and a coumarin identified as umbelliferone III were isolated.

Column chromatography of the unsaponifiable fraction led to the isolation of a mixture of waxy hydrocarbons, which was shown by GLC to consist of n-alkanes (n-C₁₁ to n-C₂₀) where n-C₁₁, n-C₁₅ and n-C₁₈ represent the major components. Also α-amyrin IV and β-sitosterol V were isolated.

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