Two Novel Acridone Alkaloids from *Atalantia ceylanica* (Rutaceae)

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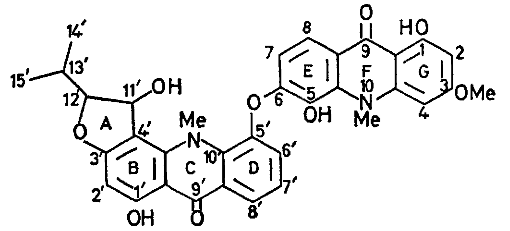
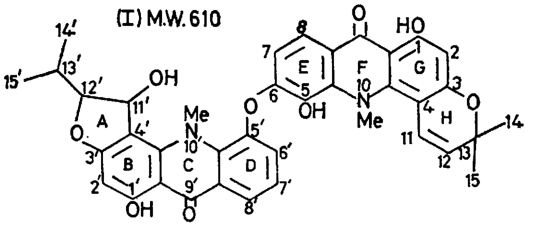
Summary The isolation of two alkaloids, atalanine (I) and ataline (II) from *Atalantia ceylanica* (Rutaceae) is reported and the assignment of a bi-acridone structure for these compounds is based on chemical results and spectroscopic data.

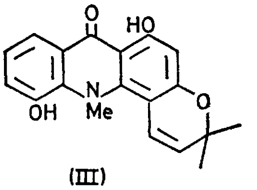
THE Rutaceae family of plants produces some thirteen basic alkaloid types[1] and the acridan-9-one (acridone) group of alkaloids represents a class specific to the Rutaceae. Recently the number of these alkaloids known has doubled[2] but in all cases so far reported the structures have been represented by modification on a single acridone ring system. From *Atalantia ceylanica* two alkaloids atalanine (I) $C_{34}H_{30}N_2O_9$, m.p. 216·5—217·5°, and ataline (II) $C_{38}H_{34}N_2O_9$, m.p. 209—210°, have been isolated. These represent a new type of alkaloid where two acridone rings are joined by an ether linkage.



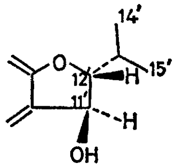
(I) M.W. 610



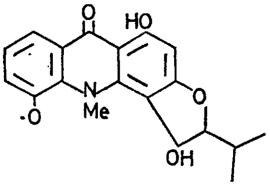
(II) M.W. 662



(III)



(IV)



(V)

A comparison of the u.v. chromophores of atalanine (I) and ataline (II) with that of acronycine[3] and with two 1,3,5-trihydroxyacridone-derived alkaloids also found in *A. ceylanica*[4] indicated the skeletal similarity of these compounds, while accurate mass measurement indicated a bi-acridone type structure for these compounds. The formation of a tetra-acetate [both (I) and (II)] coupled with an interpretation of their i.r. spectra indicated that four hydroxy-groups were originally present, two hydrogen bonded and phenolic, one non-hydrogen bonded and phenolic, and one benzylic, while the chemical shift values for the methyl groups in the tetra-acetates corroborated these structural assignments. A comparison of the δ values for the protons in atalanine and ataline with those for 5-hydroxynoracronycine (III)[4] enabled designations to be made as to the location of substituents.

Atalanine (I) contained one acridan-9-one nucleus substituted at positions 1,3,5, and 6 coupled to another acridone ring substituted at 1', 3', 4, and 5'. It also showed the presence of a methoxy-group together with the protons associated with an isopropyl group attached to a dihydrofuranol ring. Spin decoupling of these ring protons enabled a coupling constant of 7 Hz to be established for the protons at C-11' and C-12' thus indicating a *trans* stereochemical relationship between the hydroxy-group at C-11' and the isopropyl group at C-12' [see (IV)]. This assignment was based on the recent stereochemical results[5] associated with dihydrotaxol and related compounds, together with the data quoted by Zalkow and Ghosal for 2,3-dihydro-3-hydroxy-2-isopropylbenzofuran derivatives.[6]

Ataline (II) also showed the presence of a dihydrofuranol ring but the methoxy-group had been replaced by a dimethylchromene ring. The aromatic ^{1}H n.m.r. spectra indicated that an extra substituent occurred at C-4, corresponding to the point of attachment of the chromene rings.

Both the pyran and furan rings could conceivably arise through oxidative cyclisation of an isomeric Δ^2 or Δ^3 isopentenyl side chain, presumably *via* its epoxide, with direct formation of the furanol ring or followed by dehydration, to give the dimethylchromene ring. The dimethylchromene ring is well established in natural products but the dihydrofuranol ring is comparatively rare, though a dihydrofuran ring has been reported to be present in several acridone alkaloids.[7]

The location of the ether linkage in both alkaloids was tentatively assigned to C-5'–C-6 through biogenetic considerations since all the acridone alkaloids isolated with hydroxy-groups in ring A (corresponding to our rings D and E) have it located at the 5 position. In this position it would enable the radical intermediate (V) to couple with another acridan-9-one at the C-6 position, *i.e.*, *ortho* to its hydroxy-group, (the *para* position was excluded by consideration of its n.m.r.), and so produce atalanine or ataline. Mass spectral evidence also favoured these structures although alternative sites for the ether linkage cannot be excluded at present.

We thank the Carnegie Trust for the Universities of Scotland for a Studentship (A.W.F.).

(*Received*, 22*nd February* 1973; *Com.* 243.)

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[2] S. Johne and D. Groger, *Die Pharmazie*, 1972, **4**, 195.
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