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ANCISTROGUINEINES A AND B AS WELL AS ANCISTROTECTORINE-NAPHTHYLISOQUINOLINE ALKALOIDS FROM *ANCISTROCLADUS GUINEËNSIS**†

GERHARD BRINGMANN‡, CHRISTIAN GÜNTHER, STEFAN BUSEMANN, MANUELA SCHÄFFER, JAMES D. OLOWOKUDEJO§ and BABAJIDE I. ALO§

Institut für Organische Chemie der Universität, Am Hubland, D-97074 Würzburg, Germany; §Department of Chemistry, Faculty of Science, University of Lagos, Akoka, Lagos, Nigeria

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Key Word Index—*Ancistrocladus guineënsis*; Ancistrocladaceae; leaves; ancistroguineine A; ancistroguineine B; ancistrotectorine; naphthylisoquinoline alkaloids; biaryls, naturally occurring; quercetin; structural elucidation.

Abstract—The isolation of three naphthylisoquinoline alkaloids from the leaves of *Ancistrocladus guineënsis* is described. Their complete structures were established by spectroscopic, chiroptical and degradative methods. Thus, two hitherto unknown 5,8′-coupled naphthylisoquinolines, named ancistroguineines A and B, were isolated, constituting the first example of a pair of 3-epimeric naphthylisoquinoline alkaloids. Moreover, ancistrotectorine, a 7,3′-coupled alkaloid previously known only from the South-East Asian species *Ancistrocladus tectorius*, was isolated. Its absolute stereostructure was confirmed by oxidative degradation and by comparison of experimental and calculated CD spectra. © 1997 Elsevier Science Ltd

INTRODUCTION

Ancistrocladus guineënsis Oliv., a liana indigenous to Nigéria and Cameroon [2], belongs to the small monogeneric family of Ancistrocladaceae [3], which consists of *ca* 25 species. Like the closely related Dioncophyllaceae, the Ancistrocladaceae produce a unique class of natural products, the naphthylisoquinoline alkaloids [4]. These compounds are of high interest due to their unprecedented structures, promising biological activities and remarkable chemotaxonomical implications [4]. No phytochemical studies have so far been reported for *A. guineënsis*. The investigation of its secondary metabolites would, however, be of great interest for chemotaxonomic reasons and, in particular, because of the pronounced pharmacological properties of the closely related species, *A. korupensis* [5, 6]. This liana grows in the same region and has been found to be the, as yet, only source of anti-HIV dimeric naphthylisoquinolines, the michellamines [7], and their antimalarial monomeric 'halves', korupensamines A (**1a**) and B (**1b**) [8]. In the present paper, we report on the isolation and structural elucidation of two new naphthylisoquinoline alkaloids from *A. guineënsis*, ancistroguineines A (**2**) and B (**3**) (Fig. 1). The structure of the likewise isolated naphthylisoquinoline alkaloid ancistrotectorine (**4**), which is already known from the South East Asian species, *A. tectorius* [9], was confirmed with respect to its absolute configuration by degradative methods, as well as experimental and theoretical CD investigations. In addition, the widespread [10] flavone, quercetin, was identified.

RESULTS AND DISCUSSION

Because of the expected occurrence of naphthylisoquinoline alkaloids in *A. guineënsis*, an appropriate isolation method, as elaborated recently [1], was chosen, *viz.*, extraction of the dried and ground plant material with 1N sulphuric acid–methanol (5:1) and subsequent resolution of the extract using High Speed Countercurrent Chromatography (HSCCC) [11]. Further separation of the HSCCC fractions by column chromatography yielded three Dragendorff-positive compounds.

One of these substances, which co-occurred with the second, chromatographically very similar one in the third main HSCCC fraction, was shown to be a naphthylisoquinoline alkaloid by ^{1}H NMR and mass

* Part 95 in the series 'Acetogenic Isoquinoline Alkaloids'. For Part 94, see ref. [1].

† Dedicated to Prof. Peter Welzel, on the occasion of his 60th birthday.

‡ Author to whom correspondence should be addressed.

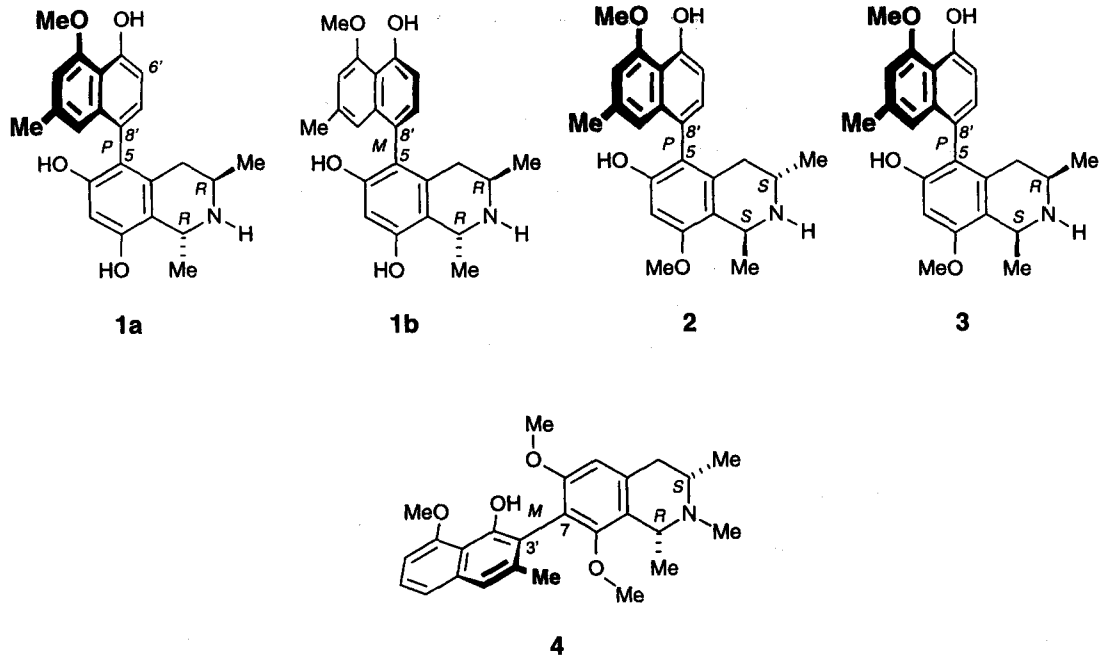
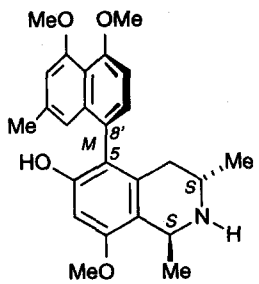


Fig. 1. Korupensamines A (**1a**) and B (**1b**) from *A. korupensis* and the alkaloids **2**–**4** from *A. guineënsis*.



spectroscopic analysis, HR mass spectrometry indicating a molecular formula $C_{24}H_{27}NO_4$. From the close analogy of the ^1H NMR data of the compound with those of the known [12] 5,8′-coupled alkaloid ancistrobrevine B (**5**) from *A. abbreviatus*, a similar molecular framework was to be expected.

Different from ancistrobrevine B (**5**), the molecule contains only two methoxy groups at C-4′ and C-8, as located by Rotating Frame Overhauser Enhancement Spectroscopy (ROESY) measurements [Fig. 2(a)]. The position of the coupling site at C-5 of the isoquinoline moiety was deduced from the high-field shift of the Me-3 protons (δ 0.97) and the protons at C-4 (δ 1.98), resulting from the anisotropic effect caused by the naphthyl substituent. In the naphthalene part, the biaryl axis cannot be positioned in the methyl-substituted isocycling ring, because of the normal, i.e. not high-field shifted position of Me-2′ (δ 2.36). The position of the axis at C-7′ can be excluded by the multiplicity of the signals of the two aromatic protons of that ring (two doublets). A ROESY interaction between H-4 and H-1′ indicates the proximity of these two molecular parts and establishes the biaryl axis to be located at C-8′, thus excluding a 6′-coupling site. The constitution of the alkaloid was further corroborated by a series of significant long-range H,C-Heteronuclear Multiple Bond Correlation (HMBC) interactions [Fig. 2(b)].

Since none of the known naphthylisoquinolines [4] has the same constitution as the isolated alkaloid, the compound must be new and has subsequently been named ancistroguineine A. Like the related alkaloids **1a**, **1b** and **5**, ancistroguineine A has a relative *trans*-configuration at C-1 *vs* C-3. This was deduced from the chemical shifts of H-1 (δ 4.34) and H-3 (δ 3.09), which lie in the typical range [4, 13] for *trans*-substituted 1,3-dimethyltetrahydroisoquinolines and, in particular, by a ROESY correlation of H-3 with the likewise pseudo-axial methyl group at C-1 [Fig. 2(c)].

For the elucidation of the absolute configuration at C-1 and C-3, our ruthenium-mediated oxidative degradation procedure [14], which has recently been further improved [15], was applied. From the *S*-configuration of the resulting Mosher-derivatives of both 3-aminobutyric acid (**6**) and alanine (**7**), the configurations at the two stereogenic centres of ancistroguineine A were established as *S*. This reveals a stereochemical relationship of the new alkaloid to ancistrobrevine B, which is likewise *S,S*-configured, rather than to korupensamines A (**1a**) and B (**1b**), which have the *R,R*-configuration.

The last stereochemical information required was the configuration at the biaryl axis, which, due to its restricted rotation, constitutes an additional stereogenic element. Regrettably, a determination of the relative configuration at the biaryl axis, by (sometimes long-range) NOE or ROESY interactions between particular protons in the naphthalene part, specifically

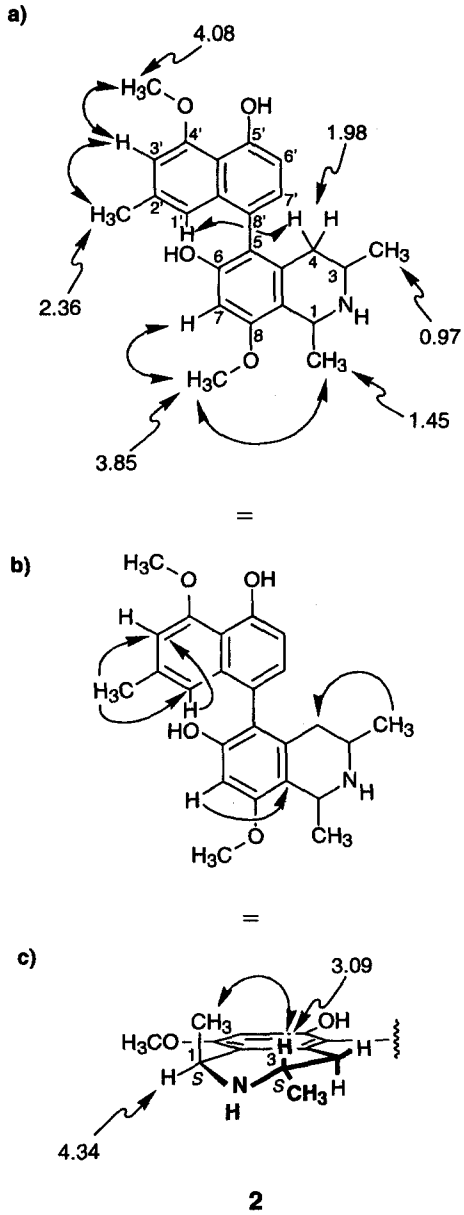
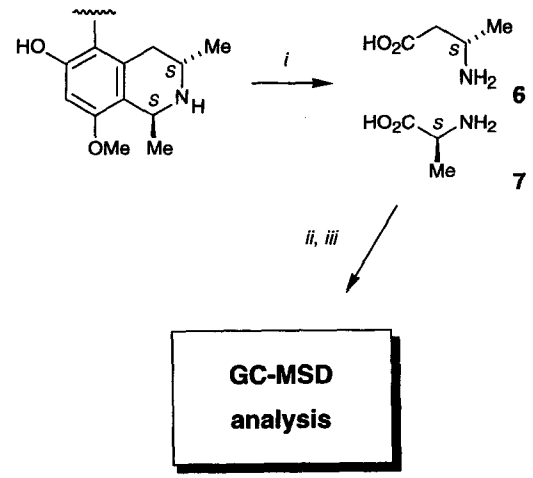


Fig. 2. Constitution **2** of ancistroguineine A as deduced from chemical shifts (δ values in ppm) and selected ROESY interactions (a) as well as HMBC correlations (b); its relative configuration at the stereocentres through chemical shifts and ROESY correlations (c).



Scheme 1. Absolute configuration at C-1 and C-3 of ancistroguineine A (**2**), by oxidative degradation and subsequent Gas Chromatography Mass Sensitive Detector (GC-MSD) analysis [14, 15]. (i) $RuCl_3$, $NaIO_4$; (ii) esterification with MeOH; (iii) '(*R*)-MTPA-Cl' ('Mosher's chloride').

with one of the diastereotopic protons at C-4 was not possible here. These two protons happen to be isochronic, so that the usually observable two signals overlap to give one doublet. By an investigation of the Circular Dichroism (CD), however, a clear attribution of the axial chirality of ancistroguineine A was possible. Thus, the virtually opposite CD spectra of the new compound and the *M*-configured alkaloid, ancistrobrevine B (**5**), indicate ancistroguineine A to have a *P*-configuration at the biaryl axis. This was further confirmed by the near-identity of the CD spectrum of **2** with that of **1a** (which is likewise *P*-configured), while the spectra of **2** and **1b** (*M*-configured) are again virtually opposite to each other. With its *P*-configuration at the axis and *S*-configuration at the two stereocentres, ancistroguineine A should be represented by the stereostructure **2**, as outlined in Fig. 1, indicating the new alkaloid to be likewise classified as a 5-*epi*-5′-*O*-demethylancistrobrevine B.

The second, slightly less polar alkaloid, which was isolated from the same HSCCC fraction, was found to be a stereoisomer of **2** and, thus, again a new compound, subsequently named ancistroguineine B. The position of the naphthyl substituent at C-5 of the isoquinoline moiety was indicated by the high-field shift of the Me-3 protons [δ 0.97, see Fig. 3(a)] and the protons at C-4 (δ 1.82 and 2.18). The coupling site in the naphthalene system was again found to be C-8′ from the 'normal' chemical shift of the Me-2′ protons (δ 2.35) combined with NOE and ROESY correlations between H_{eq}-4 and H-7′ as well as H_{ax}-4 and H-1′ (see also below). Again, like in **2**, the two methoxy groups are located at C-8 and C-4′, the remaining hydroxy groups being situated at C-6 and C-5′, as evident from NOE, ROESY and HMBC interactions [Figs. 3(a) and (b)].

Different from **2**, however, the relative configuration at C-1 *vs* C-3 must be *cis*, which can clearly be seen from NOE and ROESY interactions between H-1 and H-3, indicating that these nuclei must be on the same side of the tetrahydroisoquinoline system [Fig. 3(c)]. An additional hint at the relative *cis*-configuration at C-1 *vs* C-3 is the chemical shift of H-1 (δ 4.31) and, in particular, of H-3 (δ 2.75), as well as the chromatographic behavior as compared with that of **2** (more rapid elution for *cis*- than *trans*-isomers within the series [16].)

In contrast to the *trans*-configured alkaloid ancistroguineine A (**2**), its *cis*-diastereomer ancistroguineine B allowed the determination of the relative configuration at centres *vs* axis by NMR inves-

tigations, because, in this case, the two diastereotopic protons at C-4 are clearly differentiated. Hence, from distinct ROESY interactions between H_{ax}-4 and H-1′ (which are also indicative of the constitution, see above), these two protons must be on the same side of the molecule. This is confirmed by an additional clear ROESY interaction between H_{eq}-4 and H-7′, which thus must likewise be in close mutual proximity.

For the elucidation of the absolute configuration of **3**, again the improved oxidative degradation procedure was applied. The unequivocal identification of *R*-3-aminobutyric acid (**6**) (as its Mosher derivative) clearly establishes the absolute configuration at C-3 as *R*. Whereas, as for other *cis*-configured tetrahydroisoquinolines of this type [14, 15, 17], less reliable information can be deduced from the corresponding Mosher derivative of alanine (**7**), the absolute configuration at C-1 can unambiguously be seen from the relative *cis*-configuration established above, clearly indicating C-1 to be *S*-configured, as in **2**.

From the absolute stereoarray in the tetrahydroisoquinoline part and the known relative configuration at centres *vs* axis, the absolute configuration at the biaryl linkage can be deduced as *P* (as depicted in the stereodrawing in Fig. 3(c)), i.e. with the methyl-substituted naphthalene part above the isoquinoline plane. This is further confirmed by comparison of the CD spectra of ancistroguineines A (**2**) and B (**3**), which show a qualitatively very similar appearance. Thus, ancistroguineine B is represented by the stereostructure **3** and can therefore likewise be considered as a 3-*epi*-ancistroguineine A or a 1-*epi*-8-*O*-methylkorupensamine A.

From the first HSCCC fraction, a distinctly less polar naphthylisoquinoline alkaloid was isolated by column chromatography. The $[M]^+$ peak at *m/z* 421 in the mass spectrum and a high resolution measurement of the $[M–Me]^+$ peak allowed us to establish its molecular formula as $C_{26}H_{31}NO_4$. Again, by extensive ^1H NMR and ^{13}C NMR spectroscopy, the constitution of this non-polar alkaloid was established. Its 7,3′ coupling type was deduced in particular from the high-field shifted signals of Me-2′ (δ 2.17), OMe-6 (δ 3.69) and OMe-8 (δ 3.33), indicating that all of these three groups were adjacent to the biaryl axis [Fig. 4(a)], and HMBC interactions between H-1′ and C-8′, as well as between OH-4′ and C-3′ [Fig. 4(b)]. A compound of the constitution shown in Fig. 4(a) and (b), including the rare 7,3′-site of the biaryl axis, named ancistrotectorine (**4**), has previously been isolated from the South East Asian species *A. tectorius*. Still, given the slightly divergent physical and spectroscopic data and the fact that authentic material of ancistrotectorine from *A. tectorius* is presently not available (Cordell, G. A., personal communication), it proved to be necessary to complete the structural elucidation by establishing the relative and absolute configurations at all of the three elements of chirality. Again, as for **2** and **3**, the relative *cis*-configuration at C-1 *vs* C-3 was established through NOE interactions

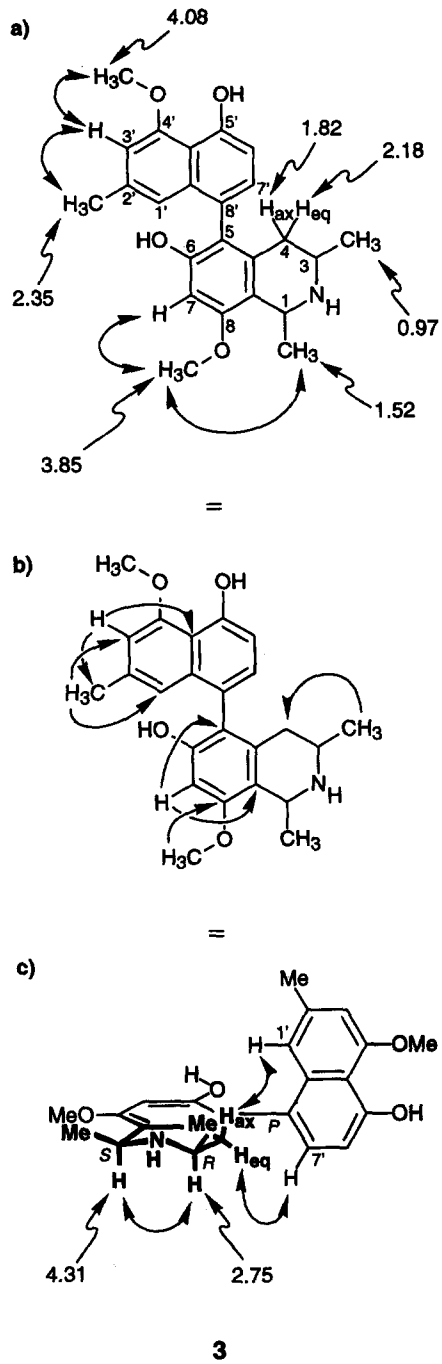


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Fig. 3. Selected ^1H NMR chemical shifts (δ values in ppm), as well as ROESY correlations (double arrows) (a) and HMBC interactions (b) relevant for the elucidation of the constitution; its relative configuration at the stereogenic centres and the biaryl axis (c) of ancistroguineine B (**3**) through chemical shifts and ROESY correlations.

between H-1 and H-3 [Fig. 4(c)], which was again consistent with the chemical shifts of H-1 (δ 3.75) and H-3 (δ 2.56). The absolute configuration was elucidated by the usual oxidative degradation procedure, to be 1*R*,3*S*. This is again in agreement with the structure published for ancistrotectorine [9].

While in the literature [9] the absolute configuration

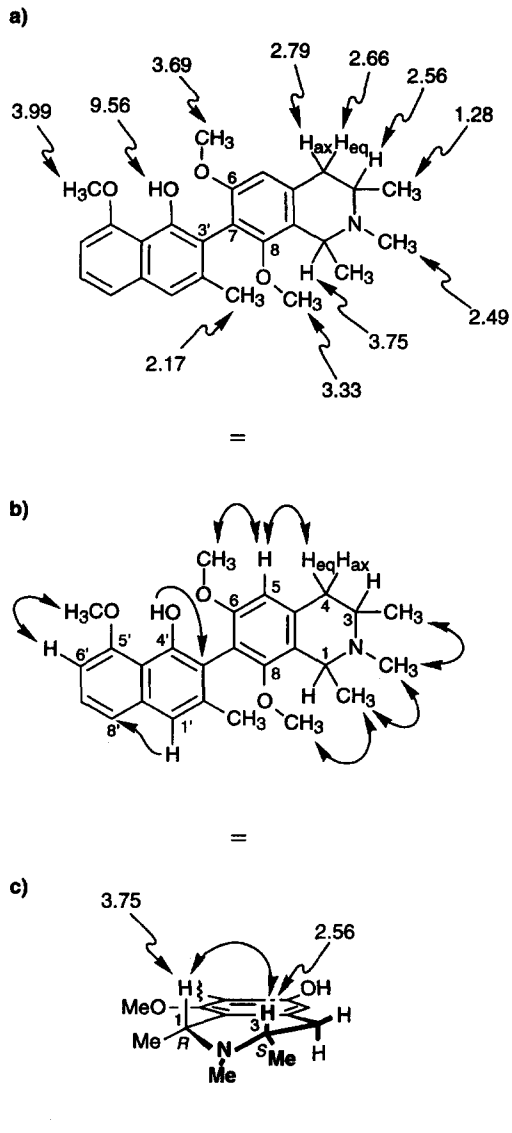

Fig. 4. Selected NMR data (δ values in ppm) as well as NOE, ROESY and HMBC interactions indicative of the constitution (a, b) and the relative configuration (c) of ancistrotectorine (**4**).

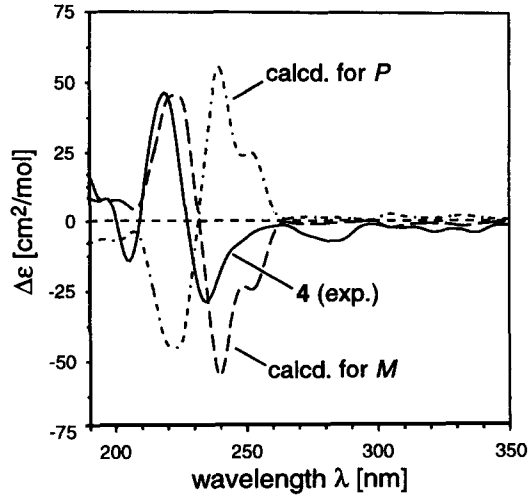

Fig. 5. Experimental CD spectrum of ancistrotectorine (**4**) from *A. guineënsis* (—) and the spectra calculated for the absolute *P*- (· · · ·) and *M*- (- - -) stereostructures.

at C-1 and C-3 for this alkaloid of *A. tectorius* had not been determined directly, the absolute axial configuration had been deduced by CD-comparison with a similar, likewise 7,3′-coupled alkaloid isolated previously [18, 19], named ancistrocladidine. From this, in combination with an X-ray structural analysis, the absolute configuration at the stereocentres had been concluded. Still, given the electronic difference between ancistrotectorine and ancistrocladidine—the latter being a dihydroisoquinoline—further evidence for the identity of ancistrotectorine from *A. tectorius* and the alkaloid described in this paper was highly desirable, as well as additional information on the stereostructure. Regrettably, in this case, no diagnostically useful long-range NOE interactions were observable, e.g. between Me-2′ and significant protons within the tetrahydroisoquinoline part, e.g. with H-1, for the elucidation of the relative configuration at axis and stereocentres. For this reason, we applied the efficient method [20, 21] of calculating the CD spectrum of ancistrotectorine, both for the *M*-configured structure **4** and for its *P*-diastereomer. The good agreement of the experimental CD spectrum of the isolated alkaloid (and thus of ancistrotectorine from Cordell) with that of **4**, which has *M*-configuration, and the near-opposite spectrum calculated for the *P*-atropodiastereomer of **4** show that the isolated compound indeed has the *M*-configuration at the biaryl axis and, therefore, the stereostructure **4**. This ultimately establishes that the alkaloid from *A. guineënsis* is identical to authentic ancistrotectorine from *A. tectorius*, even without the availability of comparison material, and again corroborates the structural proposal by Cordell *et al.*

The last HSCCC fraction contained quercetin, a widespread flavone [10], which had previously also been isolated i.e., from *A. heyneanus* [22].

The results of this first phytochemical investigation of the Central African *Ancistrocladus* species, *A. guineënsis*, give interesting insights into the chemo- and, thus, geo-taxonomic context of this most remarkable liana. Thus, although ancistrotectorine (**4**) is a known compound, its isolation from *A. guineënsis* is the first report on a 7,3′-coupled naphthylisoquinoline alkaloid from an African *Ancistrocladus* species. From its *S*-configuration at C-3 and its oxygen function at C-6, it belongs to the pure Ancistrocladaceae-type alkaloids, which are typical of Asian [4] and East African [1] species of this family, but are far less frequently found in West and Central African lianas. By contrast, the new alkaloids ancistroguineines A (**2**) and B (**3**) show a 5,8′-coupling type, which is relatively common to Central and West African *Ancistrocladus* species, in particular to *A. korupensis* (cf. structures **1a** and **1b**) and *A. abbreviatus* (cf. structure **5**), and even the

East African species, *A. robertsoniorum* [1], whereas no 5,8′-coupled naphthylisoquinolines have ever been isolated from Asian representatives of this interesting genus. Likewise, most remarkably, **3** is an *N*-unsubstituted naphthylisoquinoline alkaloid with a relative *cis*-configuration at C-1 *vs* C-3. This structural type has hitherto been found only in isoancistrocladine from the Indian species, *A. heyneanus*, yet with a 1*R*,3*S*-configuration; hence, **3** is the first 1*S*,3*R*-configured *N*-unsubstituted naphthylisoquinoline alkaloid. The rare occurrence of this '1,3-*cis*-NH array' possibly has to do with its instability compared with the corresponding *trans*-diastereomers [23, 24]. Furthermore, **2** and **3** are the very first example of a pair of 3-epimeric naphthylisoquinoline alkaloids, all other pairs of diastereomeric alkaloids from Ancistrocladaceae are either epimeric at the axis (**1a** and **1b**) or at C-1. This shows the broad synthetic variability and creativity of Ancistrocladaceae plants and demonstrates that it is rewarding to investigate the structures of further co-occurring alkaloids and, in particular, the biogenetic factors determining their stereochemical formation. This work is in progress.

EXPERIMENTAL

General. Mps uncorr. Optical rotations: 25°, 10 cm cell, $CHCl_3$. CD: 25°, EtOH. IR: KBr. ^1H NMR (200 MHz or 600 MHz) and ^{13}C NMR (150.9 MHz) were recorded in $CDCl_3$ with the solvent as int. standard ($CDCl_3$, δ 7.26 and δ 77.01, respectively). Proton detected, heteronuclear correlations were measured using HMQC (Heteronuclear Multiple Quantum Correlation, optimized for $^1J_{HC}$ = 150 Hz) and HMBC (optimized for $^nJ_{HC}$ = 7 Hz). EIMS: 70 eV. CC: silica gel (60–200 mesh, Merck) by addition of 5% aq. NH_3. TLC: precoated silica gel 60 F_{254} plates (Merck), deactivated with NH_3. Spots were visualized under UV light and by Dragendorff's reagent. HSCCC: $CHCl_3$–MeOH–0.1 M HCl (5:5:3), mobile phase: lower phase, (H) → T, Triple Coil No. 14, 1.7 mm × 950 mm (large coil), TLC detection (see above), flow 2 ml min^{-1}, 850 min^{-1} [1].

Plant material. Leaves of *A. guineënsis* Oliv. were collected in Akwa Ibom State of Nigeria in July 1994 and identified by the Forestry Research Institute Herbarium in Ibadan, Nigeria. A voucher specimen is deposited at Lagos University Herbarium (LUH), No. Olowo, Alo and Ariwaodo 195.

Extraction and isolation. Leaves (*ca* 330 g) were extracted with 1NH_2SO_4–MeOH (5:1) at room temp. After evapn of MeOH *in vacuo*, the soln was extracted with *n*-hexane and subsequently with $CHCl_3$. The solvent of the $CHCl_3$ soln was evapd and the residue was subjected to HSCCC. Portions of 4 ml were collected and combined to give 4 frs.

Isolation of ancistroguineine A (**2**). The third fr., which consisted of two alkaloids with similar chromatographic behaviour, was resolved by CC on silica gel eluting with $CHCl_3$–MeOH–conc. NH_3 95:5:0.1 to yield **2** as the more polar fr., which was obtained as needles (12.2 mg) from $CHCl_3$. Mp 202–204°. $[\alpha]_D^{25}$ +191.4° ($CHCl_3$; *c* 0.52). CD: $\Delta\varepsilon_{225}$ −23.7, $\Delta\varepsilon_{238}$ +15.8, $\Delta\varepsilon_{287}$ −2.3 (EtOH, *c* 0.06). IR ν_{max} cm^{-1}: 3390 (O—H), 1600 (C=C), 1575 (C=C), 1250 (C—O), 1108 (C—O). ^1H NMR (600 MHz, $CDCl_3$): δ 0.97 (3H, *d*, *J* = 6.2 Hz, Me-3), 1.45 (3H, *d*, *J* = 6.6 Hz, Me-1), 1.98 (2H, *d*, *J* = 7.5 Hz, H-4), 2.36 (3H, *s*, Me-2′), 3.09 (1H, m_c, H-3), 3.85 (3H, *s*, OMe-8), 4.08 (3H, *s*, OMe-4′), 4.34 (1H, *q*, *J* = 6.6 Hz, H-1), 6.46 (1H, *s*, H-7), 6.67 (1H, *s*, H-3′), 6.83 (1H, *s*, H-1′), 6.88 (1H, *d*, *J* = 7.9 Hz, H-6′), 7.16 (1H, *d*, *J* = 7.8 Hz, H-7′). ^{13}C NMR (150.9 MHz, $CDCl_3$): δ 21.5 (Me-1), 22.2 (Me-2′), 22.6 (Me-3), 36.0 (C-4), 42.0 (C-3), 47.2 (C-1), 55.2 (OMe-8), 56.2 (OMe-4′), 95.8 (C-7), 106.8 (C-3′), 110.0 (C-6′), 113.8 (C-10′), 117.3 (C-9), 117.9 (C-1′), 121.0, 121.5 (C-8′, C-5), 131.7 (C-7′), 135.4 (C-2′), 135.8, 136.8 (C-10, C-9′), 152.6, 155.0, 156.4, 156.6 (C-4′, C-5′, C-6, C-8). The ^{13}C attribution was achieved by HMQC and HMBC expts. EIMS: *m/z* (rel. int.): 393 $[M]^+$ (7), 379 $[M-Me+1]^+$ (27), 378 $[M-Me]^+$ (100). HRMS *m/z* 378.171 $[M-Me]^+$ ($C_{23}H_{24}NO_4$ requires: 378.171).

Isolation of ancistroguineine B (**3**). From the less polar CC fr. ancistroguineine B was isolated as an amorphous solid (9.4 mg). $[\alpha]_D^{25}$ −141.2° ($CHCl_3$; *c* 0.04). CD: $\Delta\varepsilon_{230}$ −57.0, $\Delta\varepsilon_{246}$ +9.9, $\Delta\varepsilon_{275}$ −2.4, $\Delta\varepsilon_{301}$ +1.4, $\Delta\varepsilon_{342}$ −1.6 (EtOH, *c* 0.09). IR ν_{max} cm^{-1}: 3390 (O—H), 1600, 1575 (C=C), 1250, 1105 (C—O). ^1H NMR (200 MHz, $CDCl_3$): δ 0.97 (3H, *d*, *J* = 6.3 Hz, Me-3), 1.52 (3H, *d*, *J* = 6.1 Hz, Me-1), 1.82 (1H, *dd*, J_{gem} = 16.1 Hz, J_{ax} = 10.6 Hz, H_{ax}-4), 2.18 (1H, *dd*, J_{gem} = 16.5 Hz, J_{eq} = 1.9 Hz, H_{eq}-4), 2.35 (3H, *s*, Me-2′), 2.75 (1H, m_c, H-3), 3.85 (3H, *s*, OMe-8), 4.08 (3H, *s*, OMe-4′), 4.31 (1H, *q*, *J* = 6.3 Hz, H-1), 6.51 (1H, *s*, H-7), 6.66 (1H, *d*, *J* = 1.2 Hz, H-3′), 6.85 (1H, *d*, *J* = 1.1 Hz, H-1′), 6.88 (1H, *d*, *J* = 7.8 Hz, H-6′), 7.18 (1H, *d*, *J* = 7.8 Hz, H-7′), 9.51 (1H, *s*, OH-5′). ^{13}C NMR (150.9 MHz, $CDCl_3$): δ 22.1 (Me-3), 22.3 (Me-2′), 23.2 (Me-1), 36.6 (C-4), 48.2 (C-3), 49.7 (C-1), 55.1 (OMe-8), 56.2 (OMe-4′), 96.3 (C-7), 106.9 (C-3′), 109.6 (C-6′), 114.0 (C-10′), 117.3 (C-5), 118.5 (C-1′), 121.6 (C-9), 130.9 (C-7′), 136.4 (C-2′), 136.7 (C-4′), 137.3 (C-9′), 152.4 (C-6), 155.1 (C-5′), 156.3 (C-8′), 157.6 (C-8). EIMS: *m/z* (rel. int.): 393 $[M]^+$ (11), 379 $[M-Me+1]^+$ (26), 378 $[M-Me]^+$ (100). HRMS *m/z* 378.171 $[M-Me]^+$ ($C_{23}H_{24}NO_4$ requires: 378.171).

Isolation of ancistrotectorine (**4**). From the first HSCCC fr. ancistrotectorine was isolated by CC on silica gel using $CHCl_3$–MeOH (19:1) as eluent. Recrystallization from EtOH gave colourless needles (7.2 mg) of **4**. Mp 150–151°; ref. [9] mp 134–140° (Me_2CO). $[\alpha]_D^{25}$ −3.6° (EtOH; *c* 0.20); ref. [9]: $[\alpha]_D^{25}$ 0° ($CHCl_3$). CD: $\Delta\varepsilon_{198}$ +8.0, $\Delta\varepsilon_{206}$ −14.3, $\Delta\varepsilon_{219}$ +46.4, $\Delta\varepsilon_{235}$ −28.9, $\Delta\varepsilon_{264}$ −1.5, $\Delta\varepsilon_{284}$ −7.4 (EtOH, *c* 0.11). IR, ^1H NMR, and EIMS similar to those reported for authentic **4** [9]. ^{13}C NMR (150.9 MHz, $CDCl_3$): δ 20.55 (Me-2′), 21.5 (Me-3), 23.6 (Me-1), 38.9 (C-4), 41.8 (*N*-Me), 55.4 (C-3), 55.9 (OMe-5′, OMe-6), 57.3 (C-1),

60.0 (OMe-8), 103.0 (C-6′), 106.0 (C-5), 113.5 (C-10′), 117.3 (C-7), 117.8 (C-3′), 118.6 (C-1′), 121.2 (C-8′), 125.5 (C-7′, C-9), 136.2 (C-9′), 136.9 (C-10), 138.3 (C-2′), 151.4 (C-4′), 156.0, 156.13, 156.3 (C-5′, C-6, C-8). HRMS: *m/z* 406.202 $[M-Me]^+$ ($C_{25}H_{28}NO_4$ requires: 406.202).

Oxidative degradation of alkaloids. The degradation, the derivatization of the corresponding amino acids and the subsequent GC-MSD analysis were carried out as described in ref. [15].

Isolation of quercetin. The last HSCCC fr. yielded an amorphous, yellow solid (43.0 mg), identical to an authentic sample of quercetin (Sigma) with respect to ^1H, ^{13}C, IR and MS data. Mp > 300° (decomp.); ref. [22] mp 310°.

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