The whole plants of *A. macrosperma* (collected from Suryamaninagar, Agartala in December, 1986) were air-dried and milled. The milled plant material (300 g) was extracted with petrol (b.p. 60–80°) and rectified spirit successively in a soxhlet for 48 h each. The alcoholic extract was concentrated to a gummy residue (20 1 g). Chromatography[3,4] of a part of the residue (1.3 g) through Amberlite IR 120 (H^+) and elution of the column for neutral and basic amino acids with water and aqueous 4 *N* HCl[5] led to the identification of lysine, arginine, hydroxyproline and valine by co-pc with authentic samples.

Another portion of the crude residue (1.6 g) was chromatographed through Amberlite IRA 400 (OH^-) and elution of the column with water and 2 *N* acetic acid for neutral and acidic amino acids, led to the identification of glycine, proline, methionine, phenylalanine, leucine, valine, tyrosine, aspartic acid and glutamic acid by co-pc with authentic samples. Valine was found also from the column of cation-exchange resin.

All these amino acids were isolated as their ninhydrin complexes by preparative pc[5,6] on Whatmann (3 mm) samples using solvent system n-BuOH–HOAc–H_2O (12 : 3 : 5) as developer. Their relative yields ($\mu g\ g^{-1}$) of the air-dried whole plant based on colorimetric estimation are as follows: proline, 67.9; hydroxyproline, 42 8; methionine, 23.8; tyrosine, 18 4; phenylalanine, 15.3; leucine, 14.2; arginine, 13.5; lysine, 9.2; valine, 9.2; glutamic acid, 2.3; aspartic acid, 1.3; and glycine, 1.3.

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References

1. D. B. Deb, "The Flora of Tripura State", Today & Tomorrow, New Delhi, 1983, Vol. 2, p. 328.
2. J. D. Hooker, "Flora of British India", Bishen Singh Mahendra Pal Singh, Dehra Dun, 1983, Vol. 4, p. 702.
3. E. Lederer and M. Lederer, 'Chromatography", Elsevier, New York, 1957, p. 127.
4. E. Stahl, "Thin Layer Chromatography", 2nd. ed., Toppan, Tokyo, 1969, p. 737.
5. B. Dinda and M. K. Saha, *J. Indian Chem. Soc.*, 1985, 62, 789.
6. D. Abbott and R. S. Andrews, "An Introduction to Chromatography", Houghton Mifflin, Boston, 1965, p. 18.

Chemical Constituents of the Bark and Leaves of *Pterospermum heyneanum* Wall.

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PTEROSPERMUM heyneanum Wall. (Syn. *P. xylocarpum*) is reputed for its medicinal use[1]. Isolation of kaempferol, its 3-*O*-galactoside, kaempferide-7-*O*-glucoside and β-sitosterol were earlier reported[2,3] from the stem cuttings of *P. heyneanum* Wall. In continuation of our work on the plants of Sterculiaceae family[4], we now report the chemical constituents of the bark and leaves of *P. heyneanum*.

The air-dried and powdered bark (1.5 kg) of *P. heyneanum* was extracted successively with n-hexane, chloroform and methanol. The plant waxes were removed from the hexane extract by repeated treatment with methanol and the wax-free residue (6 g) yielded n-triacontanol (100 mg), m p. 84–5°; taraxerone (120 mg), m.p. 240–42°; friedelin (150 mg), m.p. 258–59°; taraxerol (100 mg), m.p. 292–93°; and β-sitosterol (200 mg), m.p. 135–36° on column chromatography. The isolated compounds were identified by their physical and spectral (ir and ^1H nmr) characteristics and direct comparison with the authentic samples.

The residue (4 g) from the chloroform extract on chromatographic resolution over silica gel gave β-sitosterol-3-*O*-β-D-glucoside (250 mg), compound A (25 mg) and aurantiamide acetate[5–7] (60 mg). The residue from the methanol extract yielded only an additional quantity of β-sitosterol glycoside.

Compound A was obtained as a pale yellow oil but it showed homogeneity on tlc (Si-gel, R_f 0.76, C_6H_6–EtOAc, 9 : 1; fluorescent yellow spot when sprayed with methanolic sulphuric acid and heated to 80°). It responded to L–B test for steroids, developed yellow colour with TNM and showed positive Zimmermann colour reaction. Its ir ($CHCl_3$) spectra exhibited bands at 3 450 (OH), 1 720 and 1 680 cm^{-1} (C=O), and the uv spectra (MeOH) showed maxima at 242 (log ε, 4.2) and 273 nm (3.7). Its ^1H nmr spectra showed signals for 4 methyls at δ 0.71–0.98 and two hydrogens of a α,β-unsaturated carbonyl system at δ 5.95 and 6 55 (d, *J* 10 Hz each) in addition to a 1H multiplet at δ 5.22 and a 1H broad singlet at δ 5.68. From the foregoing observations, compound A is considered to be a α,β-unsaturated-ketosterol whose complete characterisation could not be carried out for want of material.

Aurantiamide acetate, $C_{27}H_{28}N_2O_4$ (M^+ 444) was obtained from C_6H_6–EtOAc (9 : 1) eluate and it crystallised from benzene as colourless feathery needles, m.p. 185–86°, $[\alpha]_D$ –26.5°; ν_{max} 3 300, 1 730, 1 660, 1 255, 745, 690 cm^{-1}. The compound was characterised from the results of hydrolysis (6 *N*

HCl) experiment, ^{1}H nmr and mass spectral analysis and by direct comparison with an authentic sample[8]. This is the first report of the isolation of aurantiamide acetate from a plant of Sterculiaceae family.

The air-dried and powdered leaves (1 kg) of *P. heyneanum* were successively extracted with n-hexane, chloroform and methanol. The defatted residue (5 g) from the n-hexane extract on column chromatography yielded lupeol acetate (100 mg), m.p. 211–12°; lupanone (80 mg), m.p. 204–05°; taraxerone (100 mg); friedelin (120 mg), taraxerol (200 mg) and β-sitosterol (400 mg). The residue (4 g) from the chloroform extract yielded kaempferol (100 mg), m p. 277–78°. Methanol extract yielded no crystalline compound.

The co-occurrence of different groups of triterpenes in this plant is of biogenetic significance.

Acknowledgement

The authors thank Professor C. B. S. Rao of this Department for an authentic sample of aurentiamide acetate One of the authors (S.N.R) is grateful to U. G. C., New Delhi, for the award of a Teacher Fellowship.

References

1. R. N. Chopra, S. L. Nayar and I. C. Chopra, "Glossary of Indian Medicinal Plants", C.S.I.R., New Delhi, 1956, p. 207.
2. K. P. Tiwari, R. N. Chaudhary and K. K. Singh, *J. Indian Chem. Soc.*, 1977, **54**, 916.
3. R. Gunasegaran and S. S. Subramanian, *Indian J. Pharm. Sci*, 1979, **41**, 72.
4. A. S. R. Anjaneyulu and S. Nooka Raju, *Indian J. Chem., Sect. B*, 1984, **23**, 1010.
5. A. Banerji and R. Das, *Indian J. Chem.*, 1975, **13**, 1234.
6. S. K. Talapatra, A. K. Mallik and B. Talapatra, *Phytochemistry*, 1980, **19**, 1199.
7. R. E. Cox, K. K. Chexal and J. S. E. Holker, *J. Chem. Soc. Perkin Trans.*, 1976, 578.
8. G. V. Subba Raju, Ph. D. Thesis, Andhra University, 1982.

Chemical Examination of *Tephrosia hamiltonii*

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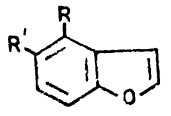
Department of Chemistry, Osmania University, Hyderabad-500 007

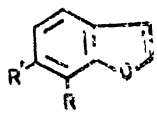
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THE genus Tephrosia elaborates several types of flavonoid compounds[1]. Chemical investigation of *Tephrosia hamiltonii* (Fam.: Leguminosae) does not seem to have been reported so far. We now report the result of chemical investigation on this plant.

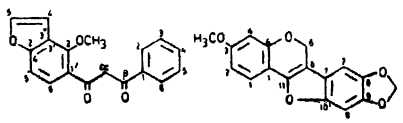
The air-dried pods of *T.hamiltonii* were extracted successively with petroleum ether, chloroform and methanol. The combined chloroform and methanol extracts, after the usual work up, followed by column chromatography led to the isolation of two colourless compounds, designated as compound-A and -B.

Compound-A (**1**; 0.0075%), m p. 150°, $C_{10}H_8O_4$, M^+ 192, did not give any colouration with alcoholic $FeCl_3$, but was soluble in aqueous $NaHCO_3$ and aqueous NaOH, indicating the presence of a carboxyl group; formed the liquid monomethyl ester (**2**), $C_{11}H_{10}O_4$, M^+ 206, with diazomethane, supporting the presence of one carboxyl group in **1**; ν_{max} 1 670br (carboxyl), 1 595, 1 540, 1 465 (aromatic ring), 1 065 (benzofuran) and 1 230 cm^{-1} (aromatic C–O stretch); λ_{max} (MeOH) (log ε) 222 (4.65), 245sh (4 08) and 280 nm (3.36), similar to those of disubstituted benzofurans[2]. The ^{1}H nmr spectra (90 MHz, $CDCl_3$) of compound-A, revealed the presence of one methoxyl group at δ 4 35 (3H, s) and two AB doublets, one at δ 7.75 (d, *J* 2.5 Hz) and 7.10 (d, *J* 2.5 Hz) assignable to H–2 and H–3 of benzofuran nucleus, respectively. Further, the nmr spectra also showed two *ortho*-coupled doublets at δ 7.46 (1H, *J* 9 Hz) and 8.2 (1H, *J* 9 Hz). The foregoing analytical and spectral data indicate that compound-A is a benzofuran derivative containing methoxyl and carboxyl groups on adjacent positions in the benzonoid ring and premitted four alternative isomeric structures (**1**, **3**, **4** and **5**). As ^{1}H nmr spectrum of **1** showed a





1, R=OCH_3, R′=COOH
2, R=OCH_3, R′=$COOCH_3$
3; R=COOH, R′=OCH_3
4; R=OCH_3, R′=COOH
5: R=COOH, R′=OCH_3



PONGAMOL FLEMICHAPPARIN B

doublet (δ 8.2) far down-field, structures **3** and **5** are ruled out. Since **1** (methylkaranjic acid) is reported in the literature[8] as a degradation product of pongamol, an attempt was made to compare compound-A with methylkaranjic acid. A direct comparison of compound-A with an authentic sample of methylkaranjic acid revealed that they are identical in all respects (m.p., m.m.p., superimposable ir). This is the first report of compound **1**, as a natural product, though such simple benzofurans with different substitution patterns are known to occur in plants belonging to Asteraceae[4].

Compound-B (0.0075%), m.p 140–42°. $C_{10}H_{10}O_4$, M^+ 194, did not give any colour test. Its ir, uv, nmr and mass spectral data was strikingly similar to those reported for terephthalic acid[5], which was