identity in absolute configuration was established by CD comparison—$\Delta\epsilon_{196}$ +7·2 from either source. The NMR spectrum of the isolated calamenene showed it to be the *cis*-isomer[8] essentially free of diastereomeric material. The negative ^1L_b band ($\Delta\epsilon_{278} = -0{\cdot}25$) suggests structure II.[8]

Acknowledgement—The work at U.W. was supported by NIH Grant GM-18143.

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FILICES, etc.

PHYTOSTEROLS IN PLANTS

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Key Word Index—*Cyathea spinulosa*; Filices; Fern; lupeol; *Antidesma diandra*; *Euphorbia jacquemontii*; *Gelonium bifarium*; Euphorbiaceae; Angiospermae taraxerone; sitosterol; epimultiflorenol; multiflorenol; bauerenol; *Soymida febrifuga*; Meliaceae; methyl angolensate; sitosterol.

Plant. Cyathea spinulosa Wall[1] (Syn. *Hemitelia decipines* J. Scott). Filices. *Occurrence.* Middle and upper hill forest, rarely found near Kalimpong and Darjeeling, India. *Previous work.* None.

Isolation and identification. The powdered whole plant was extracted with C_6H_6 and the neutral fraction gave *lupeol*,[2] m.p. 214–215°, $[\alpha]_D$ +26·4°, its acetate m.p. 216–217°, $[\alpha]_D$ +47·5° confirmed by m.m.p., IR and co-TLC with an authentic sample. The second solid has been identified as *sitosterol.*

Plant. Antidesma diandrum Roth.[3] Euphorbiaceae. *Occurrence.* Tropical Himalaya, from Garwhal eastwards and southwards to Travancore, India.

Isolation and identification. The powdered trunk was extracted with benzene and the neutral part afforded *sitosterol.*

Plant. Euphorbia jacquemontii Boiss; Euphorbiaceae.[4] *Occurrence.* Throughout the Western Himalayan region of India. *Previous work.* None.

Isolation and identification. The powdered trunk bark was extracted with C_6H_6 and the neutral part on chromatography first gave *taraxerone*, $C_{30}H_{50}O$,* m.p. 238–240°, $[\alpha]_D$ 10·8°[5] confirmed by IR, NMR and co-TLC with authentic specimen and by conversion to

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* Satisfactory analysis, $[\alpha]_D$ in $CHCl_3$, 60 Mc NMR in $CDCl_3$ with TMS as internal standard.

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[3] HOOKER, J. D. (1954) *Flora of British India*, Vol. 5, p. 361, Reeve, London.

[4] HOOKER, J. D. (1954) *Flora of British India*, p. 238, Reeve, London.

[5] POLLOCK, J. R. A. and STEVENS, R. (1965) *Dictionary of Organic Compounds*, *4th* Ed., Vol. 5, p. 2943, Eyre & Spottiswoode, London and references cited therein.

taraxerol, m.p. 278–280°, $[\alpha]_D$ +3·7°, acetate, m.p. 295–297°, $[\alpha]_D$ +9·16°. The second solid was an alcohol, $C_{23}H_{48}O$, m.p. 87–88°, $[\alpha]_D$ −22·42° (IR: 3275 cm^{-1}); acetate, $C_{25}H_{50}O_2$, m.p. 70–71° (IR: 1725 and 1245 cm^{-1}) but could not be identified for want of sufficient material. The last solid *sitosterol*, $C_{29}H_{50}O$, m.p. 137–138°, $[\alpha]_D$ −36° confirmed by m.m.p., IR and co-TLC with authentic specimen. Acetate, m.p. 127°, $[\alpha]_D$ −4°.

Plant. Gelonium bifarium Roxb;[6] Euphorbiaceae. *Occurrence.* Andaman islands, Malay islands. *Previous work.* Other sister species.[7,8]

Isolation and identification. The powdered trunk bark was extracted with C_6H_6. The neutral part gave a complex mixture of crystalline substances which on acetylation afforded a mixture of at least 3 acetates (TLC). On fractional crystallization it first afforded bauerenol acetate, $C_{32}H_{52}O_2$, m.p. 282–284°, $[\alpha]_D$ 0°, hydrolysis of which gave *bauerenol*, $C_{30}H_{50}O$, m.p. 208–209°, $[\alpha]_D$ −20° confirmed by m.m.p., IR and co-TLC with authentic specimen. From the mother liquor two other solids were separated by fractional crystallization. The first solid multiflorenol acetate $C_{32}H_{52}O_2$, m.p. 220–222°, $[\alpha]_D$ 0° and its corresponding alcohol, *multiflorenol*, $C_{30}H_{50}O$, m.p. 188–190°, $[\alpha]_D$ −30° confirmed by m.m.p. and IR comparison with authentic specimen. The third solid isolated from the mother liquor has been identified as epimultiflorenol acetate, $C_{32}H_{52}O_2$, m.p. 220–222°, $[\alpha]_D$ 0° and its corresponding alcohol *epi*multiflorenol, m.p. 206–208°, $[\alpha]_D$ 0° and its identity has been confirmed by preparing the alcohol from multiflorenone by the method of Paton *et al.*[9] The last solid m.p. 135–137° has been identified as *sitosterol.*

Plant. Soymida febrifuga A. Juss.[10] Meliaceae. *Occurrence.* Dry forests of Western Peninsula, extending northwards to Marwara, the Mirzapur Hill and Chot Nagpur of India. *Medicinal use.* Bark, astringent, bitter tonic, febrifuge, used in general debility, intermittent fevers, diarrhoea and dysentry. *Previous work.* bitter substances from bark.[11]

Isolation and identification. The powdered trunk bark was extracted with C_6H_6 and the chromatography of the neutral part over alumina first afforded *sitosterol*, m.p. 137–138°, $[\alpha]_D$ −36° confirmed by m.m.p. and IR comparison with authentic specimen. The second solid, m.p. 202–204°, $[\alpha]_D$ −42° coming out in C_6H_6–petrol. (4:1) showed in the NMR spectrum the presence of two α (δ 7·37) and one β-furanic protons (δ 6·35), the H-17 proton (δ 5·62) α-to the furan ring, two vinyl proton singlet $\sim\delta$5·00, characteristic of the vinylidene group exocyclic to a cyclohexane ring, two doublets (J 14 Hz) each one proton, assignable to the isolated geminal protons at C-15 and five three proton singlet assignable to one methyl ester and for quaternary methyls. All the above spectral data are in accord with *methyl angolensate*[12] and the compound has been found to be identical with the same confirmed by m.m.p. IR, co-TLC and NMR spectra with an authentic specimen.

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