393(17), 219(30), 204(37), 203(100), 191(72), 190(56), 189(96), 187(36), 177(28), 175(33), 163(37). La réduction de (3) par le $NaBH_4$ dans le MeOH fournit le composée (2) (R_f, SM, IR, RMN, F). De même, l'oxydation de (2) par la méthode de Jones conduit à l'acétyl-3 moraldéhyde (3) (R_f, RMN, IR, SM, F).

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TRITERPENESE OF *ISOCOMA WRIGHTII*

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Key Word Index—*Isocoma Wrightii* (*Haplopappus heterophyllus*); Compositae; friedelin, friedelan-3α-ol.

Plant. Isocoma Wrightii (*Haplopappus heterophyllus*). Source, general area of Roswell, New Mexico. Previous work, isolation of benzofurans [1–4], steroids [5, 6], mono [7] and sesquiterpenes [7, 8] and fatty acids [7].

Present Work. The entire dried, above ground plant was ground and continuously extracted with hexane. Steam distillation of the hexane extract (400 g) gave 385 g of non-volatile residue which yielded 360 g ether soluble material. The latter was paritioned with C_6H_6–EtOH–H_2O (3:0.75:0.25) to give a C_6H_6 rich fraction, which after washing with ice cold 5% NaOH yielded 90 g of neutral material. Chromatography of 20 g of this neutral fraction on 1 kg of activity II Merck neutral alumina gave 6.3 g in the hexane eluent, 3.8 g in the 1:1 hexane–C_6H_6 eluent, 5.3 g in the 1:4 hexane–C_6H_6 eluent, 1.0 g in the C_6H_6 eluent, 1.7 g in the $CHCl_3$ eluent and 1.5 g in the MeOH strip.

From the early fractions of the 1:1 hexane–C_6H_6 eluent a white solid was deposited on evaporation of the solvent. Recrystallization from hexane gave friedelin as white needles, single peak by GLC on 180 × 0.6 cm 3% OV17 column. Mp 255–257° (uncorr.), mp 256–257° (266–267° *in vacuo*) [9]; ν_{max}^{KBr} 1710 cm^{-1}, ν_{max}^{KBr} 1709 cm^{-1} [9]; $[\alpha]_D$ −21° (*c*, 1.1 $CHCl_3$), $[\alpha]_D$ −19 to −29° [9]; M^+ *m/e* 426 (3%). Oxime mp 277–278; $[\alpha]_D$ +58° (*c*, 0.91, $CHCl_3$); mp 280–282° [9], $[\alpha]_D$ +56° [9]. Enol benzoate mp 257–258°, $[\alpha]_D$ +57° (*c*, 0.85, $CHCl_3$); mp 255–256° [9], $[\alpha]_D$ +59° [9].

Later eluates from the 1:1 hexane–C_6H_6 fractions deposited a solid (mp 275–277° from hexane, contaminated with friedelin) which was similar to friedelin in the gross feature of its IR and NMR spectra but showed strong O-H absorption in the IR In addition, this solid was indistinguishable from friedelin by GLC on a 5% SE-30 column and by TLC on Si gel. However, the solid was clearly distinguishable from friedelin on a 3% OV-17 GLC column and was shown to be friedelan-3α-ol as follows. Jones oxidation of the alcohol gave friedelin, identical with an authentic sample by GLC (3% OV17 column), IR, NMR and mp. The alcohol was converted into its benzoate by heating with benzyol chloride in pyridine. Mp 248–250° (1:1 $CHCl_3$–MeOH); mp 247–248° [10], the mother liquor yielded a second crop, mp 247–248°. Hydrolysis of the benzoate with 8% ethanolic KOH gave friendelan-3α-ol. Mp 302–303°; mp 300–301 [10]; $[\alpha]_D^{28°}$ + 17° (*c*, 1.38 $CHCl_3$), $[\alpha]_D$ + 18° [11]; ν_{max}^{KBr} 3480, 3610 cm^{-1}: M^+ *m/e* 428 (5%), *m/e* 275 (15%) [12].

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STEROLS AND FATTY ACIDS OF SOME NON-PHOTOSYNTHETIC ANGIOSPERMS*

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Key Word Index—*Cuscuta campestris*; Convolvulaceae; *Monotropa uniflora*; *M. hypopitys*; Pyrolaceae; fatty acids; sterols; non-photosynthetic angiosperms.

Abstract—Sterols and fatty acids were extracted and identified from three parasitic angiosperms, *Cuscuta campestris*, *Monotropa uniflora* and *M. hypopitys*. Each plant contained the typical 16 and 18-carbon fatty acids of angiosperms, but the partially-photosynthetic *Cuscuta* contained much larger quantities of linolenic acid than the non-green *Monotropa* species which had smaller amounts of linolenic acid characteristic of non-photosynthetic tissue. Sterol quantity was three times higher in *Cuscuta* than in the *Monotropa* species. Sitosterol was the major sterol in all species with smaller amounts of campesterol and cholesterol.

INTRODUCTION

While the isolation and identification of sterols and fatty acids in photosynthetic higher plants has been under extensive study for the past decade, research on the fatty acids and sterols of non-photosynthetic higher plants has been almost completely ignored. One report, by Rhomer *et al.* [1], determined that the sterols of two non-photosynthetic higher plants, *Cuscuta epithymum* and *Orobanche lutea*, were similar to the sterols of photosynthetic higher plants. The purpose of this study was to extract and identify the fatty acids and sterols of three non-photosynthetic seed plants common to eastern North America.

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RESULTS AND DISCUSSION

The major fatty acid from *Cuscuta campestris* was linolenic acid, followed by linoleic acid and palmitic acid. Small amounts of stearic acid and oleic acid were also identified from the sample (Table 1).

Analyses of the sterols of *C. campestris* showed sitosterol as the major sterol, followed by campesterol and stigmasterol. A rather high concentration of cholesterol was identified in an amount similar to that of campesterol. In *C. epithymum*, cholesterol was found only in trace amounts [1].

Except for the presence of small amounts of hexadecenoic acid (16:1), the fatty acids of *Monotropa uniflora* were qualitatively similar to those of *Cuscuta*. However, the quantities of the individual fatty acids differed considerably. The major fatty acid for *M. uniflora* was linoleic acid, followed by palmitic acid.