showed it to be a mixture of eicosane (*m/e* 282), heneicosane (*m/e* 296), docosane (*m/e* 310), octacosane (*m/e* 394, traces) and triacontane (*m/e* 422, traces).

Fraction II obtained from petroleum (60–80°)-benzene (85:15) was crystallized from MeOH (1·2 g), $C_{30}H_{62}O$, m.p. 85–86°, ν_{max}^{KBr} 3450 cm^{-1}(OH); gave an acetate, m.p. 69–70°. Oxidation of the alcohol (600 mg) with conc. HNO_3 gave a monobasic acid, $C_{30}H_{60}O_2$, m.p. 92–93°. Thus the alcohol was identified as *n*-triacontanol[17] by mixed m.p. and co-chromatography on TLC with an authentic sample.

Fraction III obtained from petroleum–benzene (7:3) gave crystals (800 mg) from benzene, $C_{30}H_{50}O$, m.p. 197–198°, $[\alpha]_D^{30}$ +89° ($CHCl_3$), ν_{max}^{KBr} 3300 cm^{-1} (OH); gave positive tests with Liebermann–Burchardt reagent and tetranitromethane for unsaturated triterpene. It formed an acetate, m.p. 239–240°, $[\alpha]_D^{30}$ +78° ($CHCl_3$), a benzoate, m.p. 232–233°, $[\alpha]_D^{30}$ +105° ($CHCl_3$) and a *p*-nitrobenzoate, m.p. 256–258°, $[\alpha]_D^{30}$ +99° ($CHCl_3$). The triterpene was identified as β-amyrin by mixed m.p. and TLC with an authentic sample.

Fraction IV obtained from petrolcum–benzene (1:1) gave a diol (1·56 g), $C_{26}H_{54}O_2$, m.p. 110° (C_6H_6–Me_2CO), ν_{max}^{KBr} 3450 cm^{-1} (OH), acetyl derivative, m.p. 76–77°, which was identified as *n*-hexacosane-1, 26-diol by mixed m.p. and TLC with an authentic sample.

Fraction V obtained from petroleum-benzene (4:6) (2·2 g), m.p. 136–137° (MeOH–$CHCl_3$), $[\alpha]_D^{28}$ −36° ($CHCl_3$) was found homogeneous by TLC and responded to the colour reactions of sterols. It formed an acetate, m.p. 126–127°, $[\alpha]_D^{28}$ −40° ($CHCl_3$) and was identified as β-sitosterol by mixed m.p. and TLC with an authentic sample.

Fraction VI obtained from C_6H_6–$CHCl_3$ (1:1) and $CHCl_3$ eluates showed two spots on TLC in $CHCl_3$ (R_f 0·18 and 0·30). Efforts to separate them by fractional crystallization of their mixed benzoates were successful. The benzoate (600 mg), m.p. 248–249°, which separated first from $CHCl_3$–MeOH (1:1) on hydrolysis yielded a triterpene, $C_{30}H_{52}O$, m.p. 302–303° (C_6H_6), $[\alpha]_D^{30}$ +22° ($CHCl_3$), acetyl derivative, m.p. 311–312°, $[\alpha]_D^{30}$ −11° ($CHCl_3$). The residual benzoate (500 mg), m.p. 252–253° gave on hydrolysis a triterpene, $C_{30}H_{52}O$, m.p. 290–291° (C_6H_6), $[\alpha]_D^{30}$ +13° ($CHCl_3$), acetyl derivative, m.p. 294–295°, $[\alpha]_D^{30}$ +28° $CHCl_3$). Chromic acid oxidation of these two triterpenes in acetic acid medium at 30° for 4 hr yielded friedelin, $C_{30}H_{50}O$, m.p. 258–260°, $[\alpha]_D^{30}$ −27° ($CHCl_3$), the identity of which was confirmed by mixed m.p. with an authentic sample. Thus the triterpenes were identified as friedelan-3-α-ol and friedelan-3-β-ol respectivcly.

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[17] D. CHAKRAVARTY, S. BHATTACHARYA and R. DAS, *J. Indian Chem. Soc.* **48**, 297 (1971); Ref [10]. Vol. IV, p. 538.

Key Word Index—Pterospermum acerifolium; Sterculiaceae; phytosterols; triterpenes; waxes; alkanes.

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MONOCOTYLEDONAE

GRAMINEAE

CYANIDIN 3-GLUCOSIDE FROM *OROPETIUM THOMAEUM*

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CLIFFORD and Harborne[1] showed that cyanidin glucosides were present in 21 species of grasses belonging to some 19 genera, but have indicated that anthocyanins of only 8 grass

[1] H. T. CLIFFORD and J. B. HARBORNE, *Proc. Linnean Soc. Lond., Bot.* **178**, 125 (1967).

species have been fully identified. Of these, cyanidin 3-glucoside has been confirmed in six species, i.e. *Hordeum vulgare*, *Oryza sativa*, *Pennisetum japonica*, *Poa annua*, *Sorghum vulgare*, and *Zea mays*.[2]

Cyanidin 3-glucoside has now been identified in leaves of *Oropetium thomaeum* (L.f.) Trin., a dominant component of the ground cover vegetation of Delhi Ridge, and the neighbouring rocky and hilly tracts (Dakshini and Tandon[3]). This grass is quite peculiar in changing its colour from green to pink-violet when dry, and can withstand the extreme conditions of drought. It is possible that the presence of cyanidin 3-glucoside in *O. thomaeum* and other grasses is of value in their adaptability to drought resistance, either by shielding the chloroplasts from intense sunlight and protecting them from degeneration, or through some other mechanism.

EXPERIMENTAL

Plant source. Leaves of *Oropetium thomaeum* were collected from the Old Delhi Ridge, opposite the University campus, from Delhi, India, and were air dried before extraction.

Flavonoid identification. The flavonoid was isolated and identified, by standard procedures,[2] by direct comparison with authentic pigment and by identification of the products of acid hydrolysis.

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[2] J. B. HARBORNE. *Comparative Biochemistry of the Flavonoids*, Academic Press, New York (1967).
[3] K. M. M. DAKSHINI and R. K. TANDON, *Flora, Jena* **158B**, 631 (1969).

Key Word Index—Oropetium thomaeum; Gramineae; cyanidin-3-glucoside.

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LILIACEAE

γ-METHYLENEGLUTAMIC ACID FROM *LILIUM CANDIDUM* BULBS

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γ-METHYLENEGLUTAMIC ACID was first isolated from *Arachis hypogea*[1] and later from *Tulipa gesneriana*,[2,3] *Phyllitis scolopendrium*,[4] *Amorpha fruticosa*,[5] *Tetrapleura tetraptera*[6]

[1] J. DONE and L. FOWDEN, *Biochem. J.* **51**, 451 (1952).
[2] R. M. ZACHARIUS, J. K. POLLARD and F. C. STEWARD, *J. Am. Chem. Soc.* **76**, 1961 (1954).
[3] J. BLAKE and L. FOWDEN *Biochem. J.* **92**, 136 (1964).
[4] A. I. VIRTANEN and A. BERG, *Acta Chem. Scand.* **9**, 553, (1955).
[5] B. TSCHIERSCH, *Phytochem.* **1**, 103 (1962).
[6] R. GMELIN and P. OLESEN LARSEN, *Biochim. Biophys. Acta* **136**, 572 (1967).