A Locust Phagorepellent from Two Melia Species

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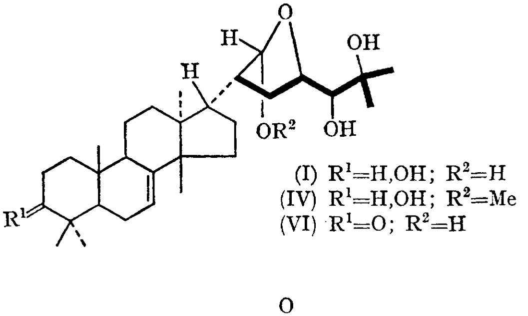
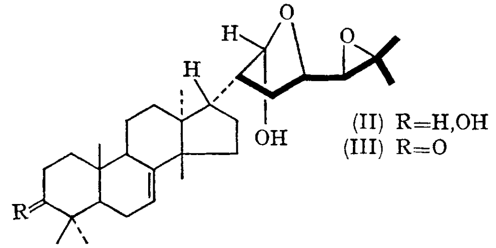
AT least two species of the Meliaceae are known to be unpalatable to and not eaten by the desert locust (*Schistocerca gregaria* Forsk).[1] Experimentally it has been shown that crude extracts of various part of *Melia azedarach* L.[2] as well as of *Melia azadirachta* L. (syn. *M. indica* and *Azardiachta indica* A. Juss)[3] have shown distinct antifeeding activity against locusts under controlled laboratory conditions. In order to isolate and identify the active principle present in these two species, a systematic chemical analysis supported by entomological tests was undertaken. To measure the persistance of repellency, fifth mid-stadium hoppers, starved for 24 hr., were given filter paper (Whatman No. 1 soaked with 0·25 M-sucrose) treated with different concentrations of all the fractions.

Freshly crushed fruit of *M. azedarach* were percolated in chloroform and treated as described earlier.[4] During the chromatography of the crude extract on a column packed with Florisil, the chloroform–acetone (9 : 1) eluate possessed all the activity. This fraction was then resolved on a second column of silica H (E. Merck) in chloroform, and the eluate which contained most of the activity showed one spot on a chromatoplate at R_F 0·33 in acetone–chloroform (3 : 7). This fraction was further purified and it showed 100% antifeeding activity at a level of 3γ per cm.^{2}.

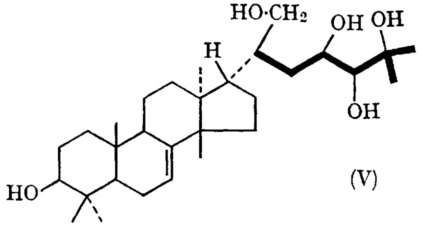
From this fraction a compound crystallised reluctantly from acetone–pentane, m.p. 176—178°, $[\alpha]_D$ $-23°$ [c 1·6 (CHCl$_3$)] $C_{30}H_{50}O_5$,M^+ 490 (100% antifeeding activity at a level of 8 γ per cm.^{2}). It was identified as meliantriol (I) on the following grounds. The n.m.r. spectrum showed the presence of seven methyl signals between δ 0·7—1·4, while the methylene methyl region of the spectrum is very close to that of melianol (II),[4] at low-field there are 6 protons between δ 3 and 3·6 and two others at δ 5·35. The mass spectrum was most informative. In addition to the prominent molecular peak *m/e* 490, four peaks were observed for the successive loss of the elements of water. Indications for the presence of a hemiacetal grouping in (I), as previously disclosed in melianone (III) and some of its derivatives,[4] were obtained by comparable n.m.r. evidence as well as by the loss of formic acid seen in the mass spectrum ($M-15-46$). In addition, the ion types derived from the cleavages (a) $M-59$ and (b) $M-89$ were observed. Furthermore the hemiacetal grouping was confirmed by preparing the methyl acetal derivative (IV), m.p. 115—118°, $[\alpha]_D$ $-43°$ [*c* 1·1 ($CHCl_3$)] $C_{31}H_{52}O_5$, M^+ 504.



(I) R¹=H,OH; R²=H
(IV) R¹=H,OH; R²=Me
(VI) R¹=O; R²=H



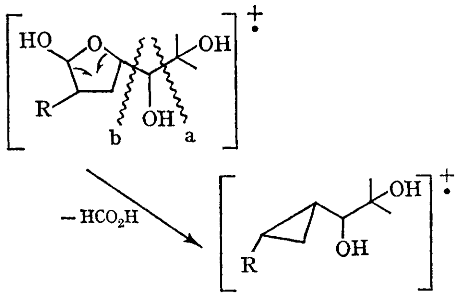
(II) R=H,OH
(III) R=O



(V)

Chemical evidence for the suggested structure was adduced by treating the compound with sodium borohydride yielding the pentaol (V) m.p. 255—258°, $[\alpha]_D$ $-42°$ [*c* 1·1 (dioxan)] $C_{30}H_{52}O_5$, M^+ 492. This compound (V) was also obtained by hydrolytic opening of the 24,25-epoxide of melianone (III) followed by reduction with lithium aluminium hydride.

Direct proof for the suggested structure of meliantriol (I) was obtained through partial synthesis. Treatment of melianone (III) with perchloric acid in dioxan solution affords the melianodiol (VI), which upon reduction with sodium borohydride of the 3-ketone gave a compound identical in all respect with the natural meliantriol (I). The synthetic compound crystallised readily. It showed comparable biological activity. Melianodiol (VI), m.p. 230—232°, $[\alpha]_D$ $-60°$ [*c* 1·1 ($CHCl_3$)], o.r.d. [*c*, 1·0 (dioxan)] at 21° $[\Phi]_{315}$ $-1483°$ and $[\Phi]_{275}$ $+585°$, $C_{30}H_{48}O_5$, M^+ 488 has been previously isolated from *M. azedarach*.



The active antifeeding principle meliantriol (I) could also be obtained by fractionation of the seed oil (Neem oil) of the fruit of *M. azadirachta*.

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[2] S. R. Shpan-Gabrielith, "Proceedings XII Congress on Entomology," London, 1965, Section 9a: Agricultural Entomology, p. 549.

[3] S. Pradham, M. G. Jotwani, and B. K. Rai, *Regional Res. Lab. Bull.* (*India*), 1963, **1**, 149. For a review *cf.* C. R. Mitra, "Neem" Indian Central Oil Seed Committee, Himayatnagar, Hyderabad, 1963.

[4] D. Lavie, M. K. Jain, and I. Kirson, *J. Chem. Soc.* (*C*), 1967, 1347.