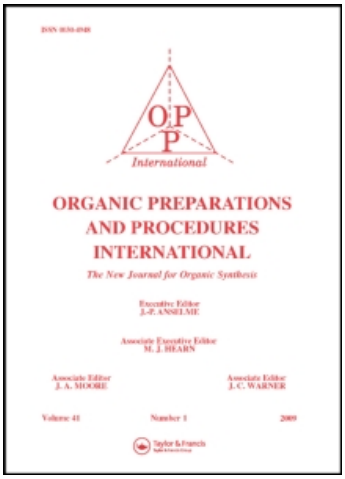

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SYNTHESIS OF METHYL-2-OXO-3-PENTYLCYCLOPENTYL-1-ACETATE

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SYNTHESIS OF METHYL-2-OXO-3-PENTYLCYCLOPENTYL-1-ACETATE

Submitted by (7/8/75)

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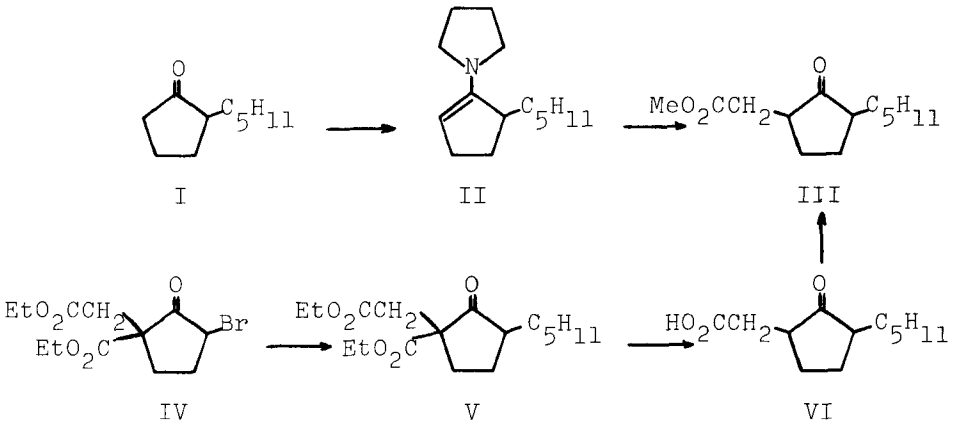
The title compound (III), substituted at positions 2 and 5 has been synthesized by two routes in order to evaluate the effect of structural alterations of the jasmone molecule on odor and plant-growth inhibitory properties.[1,2]



Route A involved the alkylation of the pyrrolidine-enamine of 2-pentylcyclopentan-1-one (II) with methyl bromoacetate. Hydrolysis of the product led to the desired compound in 21% yield. Route B proceeded *via* intermediate IV[3] which was treated with tripentylborane and potassium *tert*-butoxide[4] yielding V which was hydrolyzed to VI. Esterification of VI with methanol formed III. Methyl 2-oxo-3-pentyl-1-acetate (III), prepared by either method had identical spectroscopic (ir, nmr) and chromatographic properties. Furthermore, the product possesses the same jasmone-like odor.

EXPERIMENTAL

Method A: *Methyl 2-oxo-3-pentylcyclopentyl-1-acetate (III)*. - A mixture of 2-pentylcyclopentan-1-one (IV, 61.8 g, 0.04 mole), pyrrolidine (3.7 g, 0.052 mole), dry benzene (50 ml) and *p*-toluenesulfonic acid (0.05 g) was heated to reflux for 2 hrs. in a Dean-Stark azeotropic distillation apparatus. Benzene was removed *in vacuo* and replaced by dry dioxane (50 ml). Methyl bromoacetate (6.74 g, 0.044 mole) in dry dioxane (10 ml) was added and the mixture was heated to reflux for 4 hrs. The red reaction mixture was cooled, water (15 ml) and conc. hydrochloric acid (1.5 ml) was added and was again heated to reflux for 30 min. The reaction mixture was poured into a conc. solution of sodium chloride and was extracted with ether. The organic layer was washed with a solution of sodium carbonate and water and was dried over sodium sulfate. Distillation of the residue afforded 1.9 g (21%) of methyl 2-oxo-3-pentylcyclopentyl-1-acetate, bp. 102-104°/0.3 mm. IR. (neat) 1736 (C=O), 1440, 1255, 1175 cm^{-1}.

^{1}H-N.M.R. ($CDCl_3$): δ = 0.88 (3H, t, $-C\underline{H}_3$), 1.08-1.51 (8H, m), 2.08-2.73 (8H, m), 3.62 (3H, s, $-OC\underline{H}_3$).

Anal. Calcd. for $C_{13}H_{22}O_3$: C, 68.99; H, 9.80
Found: C, 69.43; H, 10.07

Method B: Ethyl 1-carbethoxy-2-oxo-pentylcyclopentyl-1-acetate (V). - Tripentylborane[4] (20 ml, 1 M, THF solution) was added (with a syringe) at 0° under a nitrogen atmosphere, to ethyl 1-carbethoxy-2-oxo-3-bromocyclopentyl-1-acetate (IV, 3.21 g, 10 mmole) with stirring. Potassium tert-butoxide (purified by double sublimation) (10 ml of 1 M THF solution) was then added dropwise from a syringe over a period of 5 min. Stirring was contunued overnight at room temperature and the reaction mixture was then treated with sodium acetate solution (2 g in 10 ml water) and hydrogen peroxide (6 ml, 31%). After 1.5 hr., the reaction mixture was extracted with ether and then was washed successively with a solution of sodium carbonate and sodium chloride. The solution was dried over sodium sulfate and the residue obtained after evaporation of the solvent was distilled to yield 1.5 g (48%), bp. 128°/0.1 mm.

Anal. Calcd. for $C_{17}H_{28}O_5$: C, 65.39; H, 8.97
Found: C, 65.18; H, 8.72

2-Oxo-3-pentylcyclopentyl-1-acetic acid (VI). - Ethyl 1-carbethoxy-2-oxo-3-pentylcyclopentyl-1-acetate (V, 1.3 g, 0.004 mole) was heated to reflux with glacial acetic acid (30 ml) and conc. hydrochloric acid (30 ml) for 48 hrs. The reaction mixture was diluted with water and extracted with ether, the organic layer washed with sodium bicarbonate and sodium

chloride solutions and then dried over sodium sulfate. The solvents were removed in vacuo and the crude product was used for the next step. IR. (neat), 3300-3100 (-OH), 1740 (C=O), 1453 cm^{-1}.

^{1}H-N.M.R. ($CDCl_3$); δ = 0.84 (3H, t, $-CH_3$), 1.24 (8H, m), 1.83-2.70 (8H, m), 11.5 (1H, s, -COOH).

Methyl 2-oxo-3-pentylcyclopentyl-1-acetate (III). - 2-Oxo-3-pentylcyclopentyl-1-acetic acid, (VI, 0.8 g, 0.004 mole, crude), dry methanol (40 ml) and p-toluenesulfonic acid (0.05 g) were heated to reflux overnight. Methanol was distilled and the residue was extracted with ether. The ether solution was washed successively with solutions of sodium chloride and sodium bicarbonate and then dried over sodium sulfate. Distillation afforded 0.6 g (67%) of methyl 2-oxo-3-pentylcyclopentyl-1-acetate, bp. 70°/0.1 mm. IR and nmr were identical with those reported in Method A.

REFERENCES

1. U. Ravid, R. Ikan, R. M. Sachs, J. Agr. Food Chem., 1975 (in press).

2. D. C. Aldridge, S. Galt, O. Giles, W. B. Turner, J. Chem. Soc., (C), 1623 (1971).

3. U. Ravid, D. Hoffer, R. Ikan, Isr. J. Chem., 1975 (in press).

4. H. C. Brown, G. W. Kabalka, J. Am. Chem. Soc., 92, 714 (1970).