

The Biosynthesis of Gibberellic Acid

By B. E. CROSS and K. NORTON

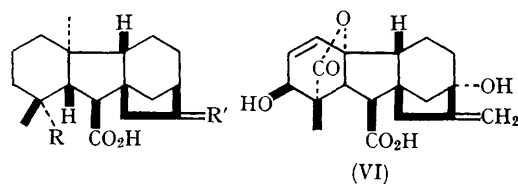
(Department of Organic Chemistry, The University, Leeds, 2)

WE have previously suggested^{1,2} that gibberellin A₁₂ (I),³ one of the new class of C₂₀-gibberellins,^{2,3} might be an intermediate in the biosynthesis of gibberellic acid (VI). Recent results are reported here which support this proposal.

The nor-ketone (II) was prepared from the half-ester⁴ (III) by oxidation with osmium tetroxide followed by cleavage of the resultant diol with sodium metaperiodate; it reacted with the Wittig reagent ¹⁴CH₂=PPh₃ (derived from ¹⁴CH₃I and triphenylphosphine) to give the ¹⁴C-labelled half-ester (IV). Demethylation of the half-ester with lithium in liquid ammonia² gave [¹⁴C]gibberellin A₁₂ (V) which was added to a fermentation of *Gibberella fujikuroi*. After the fermentation had run for a further five days, the gibberellic acid was isolated and shown to be labelled. Degradation⁵ of the [¹⁴C]gibberellic acid showed that all the radioactivity resided in the terminal methylene group.

The incorporation (0.7%) (*cf.* ref. 5) of [¹⁴C]-gibberellin A₁₂ into gibberellic acid was disappointingly low and since it was considered that this might be due to factors such as low permeability of the fungal cell walls to the diacid, or to the compound being at the wrong oxidation

level, the corresponding labelled diol (VII) was prepared by reduction of [¹⁴C]gibberellin A₁₂ with



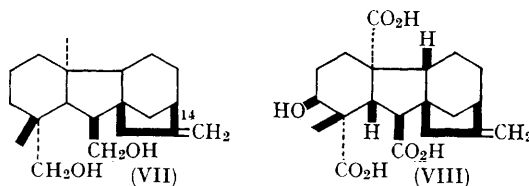
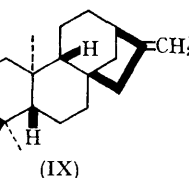
(I) R=CO₂H, R'=CH₂

(II) R=CO₂Me, R'=O

(III) R=CO₂Me, R'=CH₂

(IV) R=CO₂Me, R'=¹⁴CH₂

(V) R=CO₂H, R'=¹⁴CH₂



¹ B. E. Cross, R. H. B. Galt, and J. R. Hanson, "Régulateurs Naturels de la Croissance Végétale," Centre National de la Recherche Scientifique, Paris, 1964, p. 265.

² B. E. Cross and K. Norton, *J. Chem. Soc.*, 1965, 1570.

³ R. H. B. Galt, *J. Chem. Soc.*, 1965, 3143.

⁴ R. H. B. Galt and J. R. Hanson, *J. Chem. Soc.*, 1965, 1565.

⁵ B. E. Cross, R. H. B. Galt, and J. R. Hanson, *J. Chem. Soc.*, 1964, 295.

lithium aluminium hydride. When the [^{14}C]diol (VII) was added to a fermentation of *G. fujikuroi*, carried out under the same conditions as were used for [^{14}C]gibberellin A_{12} , it was incorporated into gibberellic acid to the extent of 7.5%. All the radioactivity was shown to be present in the exocyclic methylene group of the gibberellic acid.

[^{14}C]Gibberellin A_{13} (VIII)^{1,3} was isolated from both of the above fermentations, thus supporting

the proposal¹ that gibberellin A_{13} is an intermediate between gibberellin A_{12} and gibberellic acid.

Gibberellin A_{12} and the diol (VII) can therefore act as precursors of gibberellic acid, and these compounds together with gibberellin A_{13} may be intermediates, or closely related to intermediates, in the biosynthetic transformation of (-)-kaurene (IX) into gibberellic acid.⁵

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