

THE PREPARATION OF TWO FLUOROGIBBERELLINS  
FROM GIBBERELLIC ACID

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Only two fluoro analogues of the C<sub>19</sub> gibberellins have been described<sup>1</sup> and they are not preparable from the gibberellins by chemical reactions. In view of the interesting biological activity of the fluorogibberellins,<sup>2</sup> the fluorination of methyl gibberellate (I) with 1.1 moles of diethyl(2-chloro-1,1,2-trifluoroethyl)amine (fluoroamine) in CH<sub>2</sub>Cl<sub>2</sub> at 0° was investigated. The fluoro-esters (II) and (VII) were formed in yields of 31% and 44% respectively and the chlorofluoroacetates (III) and (VIII) were isolated as minor products. The structures of ring A of the fluoro-esters followed from their NMR spectra. Although in each case the ring A protons were further coupled to the fluorine atom, the spectrum of (II) showed the ring A olefinic protons as separate signals ( $\tau$  3.62 and 4.06) characteristic<sup>3</sup> of gibberellins containing a 3,4-ene. In contrast the spectrum of (VII) showed both ring A olefinic protons as one complex multiplet at  $\tau$  3.98, i.e. as found in gibberellin 2,3-enes.<sup>3</sup> The structure of ring A in (VII) was confirmed by its UV spectrum ( $\lambda_{\text{max}}$  222 nm,  $\epsilon$  1160).<sup>4</sup> In both fluoro-esters the fluorine was shown to be  $\beta$ -oriented by virtue of 1,3-diaxial deshielding of the 10 $\alpha$ -protons.<sup>5</sup> Thus, in the NMR spectrum of (II) the 10 $\alpha$ -proton signal was found 0.48 ppm downfield from that in the methyl ester of gibberellin A<sub>9</sub><sup>5</sup> and showed long range coupling ( $J$  1.5 Hz) with the 2 $\beta$ -fluorine, and in (VII) it appeared 0.44 ppm downfield from that of the methyl ester of gibberellin A<sub>5</sub>,<sup>5</sup> and was broadened by long range coupling with the 4 $\beta$ -fluorine.

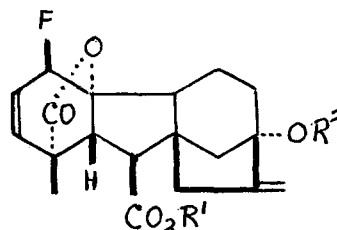
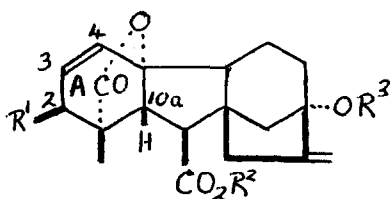
The mechanism by which methyl gibberellate (I) gives the fluoro-esters (II) and (VII) is under investigation.

Attempts to prepare the fluorogibberellins (VI) and (X) by demethylation of the fluoro-esters (II) and (VII) with lithium *n*-propylmercaptide in HEP<sup>6</sup> failed in both cases

because the allylic fluorines were displaced by propylmercaptide ions. However treatment of the *p*-bromophenacyl ester (IV) of gibberellic acid with the fluoroamine afforded the fluoroesters (V) and (IX) whose structures were verified by their IR spectra. De-esterification of these esters with zinc dust in glacial acetic acid gave the new fluorogibberellins (VI) and (X). Their structures were confirmed by methylation with diazomethane which yielded the esters (II) and (VII), identical with the specimens prepared above.

The biological activity of the fluorogibberellins (VI) and (X) will be reported elsewhere.

All new compounds gave satisfactory analyses and spectral data in agreement with the structures assigned to them.



	R <sup>1</sup>	R <sup>2</sup>	R <sup>3</sup>		R <sup>1</sup>	R <sup>2</sup>
(I)	OH	Me	H	(VII)	Me	H
(II)	F	Me	H	(VIII)	Me	CO <sub>2</sub> CHClF
(III)	F	Me	CO <sub>2</sub> CHClF	(IX)	<i>p</i> -BrC <sub>6</sub> H <sub>4</sub> CO <sub>2</sub> CH <sub>2</sub>	H
(IV)	OH	<i>p</i> -BrC <sub>6</sub> H <sub>4</sub> CO <sub>2</sub> CH <sub>2</sub>	H	(X)	H	H
(V)	F	<i>p</i> -BrC <sub>6</sub> H <sub>4</sub> CO <sub>2</sub> CH <sub>2</sub>	H			
(VI)	F	H	H			

### References

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