Tetrahedron Letters No.43, pp. 4293-4295, 1967. Pergamon Press Ltd. Printed in Great Britain.

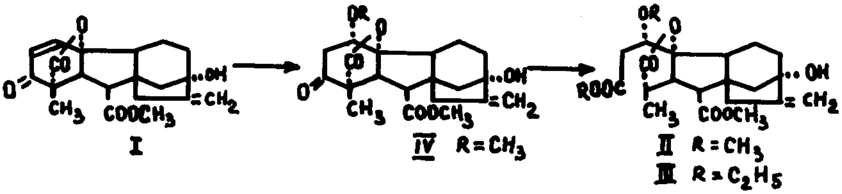
A NOVEL TYPE OF CLEAVAGE IN GIBBERELLIN SERIES

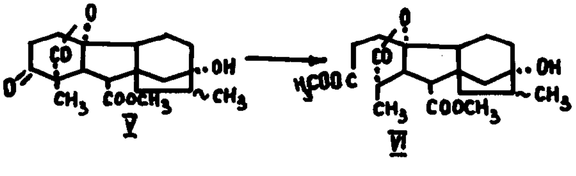
I.A.Gurvich, I.M.Milstein, V.F.Kucherov
(Zelinsky Institute of Organic Chemistry,
USSR Academy of Sciences, Moscow)

(Received in UK 24 February 1967)

The high reactivity of ring A in the gibberellins bearing a hydroxyl at C-2 is well known (1). However, the possibility of a base-catalyzed cleavage of ring A was so far considered only for the case of epimerization of gibberellin A_1 at C-2 which was thought to proceed via retroaldol scission (2).

We found that some 2-keto-derivatives of gibberellins undergo readily the retro-Claisen cleavage of ring A. Thus, α,β-unsaturated Ketone (I) in alcoholic solution in the presence of catalytic amounts of alkali (2 mg of NaOH per 100 mg of the Ketone) opens ring A under very mild conditions (0°, 1 hr) to give alkoxy lacto-diesters (II) or (III).





Diester (II), m.p. 152-153°, $[\alpha]_D^{20}$ +17° in CH_3OH (C 62.05; H 7.10. $C_{22}H_{30}O_8$ requires C 62.54; H 7.16%), shows no UV-absorbtion. Its IR-spectrum reveals the presence of a γ-lactonic group (1771 cm^{-1}), of carbomethoxy groups (1731 cm^{-1}) and also an exocyclic double bond (1660 cm^{-1}). In the mass spectrum of (II) the molecular ion appears at m/e 422 which corresponds to the addition of two molecules of methanol to the starting ketone (I). The analogous characteristics (ν_{max} 1791, 1742 and 1665 cm^{-1}, M^+ at m/e 450) were found for lacto-diester (III) which was obtained as a chromatographically pure oil. Lacto-diester (II) was also obtained from the earlier described (3) methoxy ketone (IV) under the same conditions. This fact implies that the first stage of transformation is the addition of an alcohol molecule to the α,β-conjugated double bond of the starting ketone (I) and hence the cleavage of ring A may occur with other 2-keto-derivatives of gibberellins. In fact, when ketone (V), obtained as a mixture of epimers at C-8 (m.p. 220-221°) (4), was treated as above a crystalline product was obtained after chromatography on silicagel (m.p. 109-110°) which according to its mass spectrum (M^+ at m/e 394) and IR-spectrum (ν_{max} 1762 and 1730cm^{-1}) must be assigned structure (VI).

The structure of lacto-diesters (II), (III) and (VI) follows from their pattern of fragmentation upon electron impact. Thus, both (II) and (III) display in their mass spectra the same highly intense peak at m/e 305 (ion a) which is due to the ejection of the side chain from the molecular ion. The fragments corresponding to the ejected side chain (m/e 117 and 145, respectively) are also well pronounced. In the spectrum of (VI) the mass number of ion a is shifted to m/e 307. Although the cleavage of ring A at C-2 proceeds very easily, the lactonic bridge in all three products, (II), (III) and (VI), remains unaffected. Thus, the cleavage of ring A provides an example of a retro-Claisen reaction of β-keto lactones and its ability to take place under mild conditions seems to be due to the release of the steric strain.

Mass spectra of compounds (II), (III) and (VI) will be published and discussed elsewhere.

Acknowledgment. We thank Dr. V.I.Zaretskii and Mrs. I.B.Papernaja for determination and interpretation of mass spectra and Dr. E.P.Serebryakov for helpful suggestions.

References

1. N.Ya.Grigorjeva, V.F.Kucherov, Usp.Khim., **35**, 2044 (1966).
2. B.E.Cross, J.F.Grove, A.Morrison, J.Chem.Soc., 2498 (1961).
3. I.A.Gurvich, I.M.Milstein, V.F.Kucherov, Izv.Akad.Nauk SSSR, Ser.Khim. 184 (1966).
4. B.E.Cross, J.Chem.Soc. 3022 (1960).