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SYNTHETIC STUDIES IN STEROIDAL ALKALOIDS AND SAPOGENINS. VIII. SYNTHESIS OF TOMATID-5- ENE - 3β-ol and SOLASODINE

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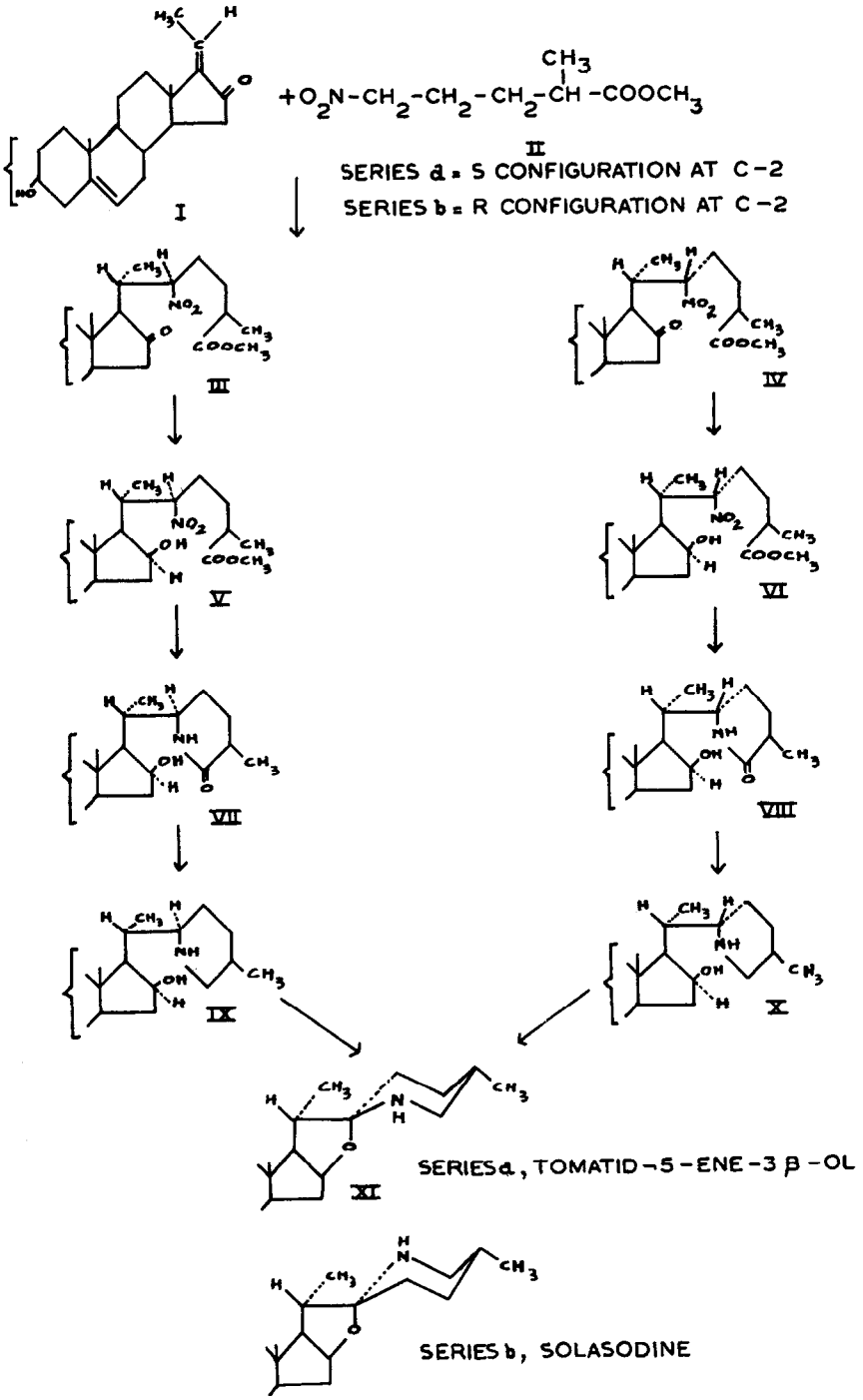
A synthetic route developed in this laboratory has already led to typical steroidal sapogenins(1) and solanidane(2) alkaloids. With the present work on spirosolanes, synthesis of all the three structural types in this family is achieved.

Michael reaction(2) of the nitroester II a with unsaturated ketone I gives a mixture of IIIa and IVa. Treatment of these nitroketones with sodium borohydride in acidic medium afforded the corresponding alcohols Va ($C_{28}H_{45}NO_6$, m.p. 131-132°, $[\alpha]_D^{30}$ - 39°) and VIa ($C_{28}H_{45}NO_6$ m.p. 126-127, $[\alpha]_D^{30}$ - 30°) which on zinc and acetic acid reduction gave cyclic amides VIIa ($C_{27}H_{43}NO_3$, m.p. 250-253° $[\alpha]_D^{30}$ + 80°) and VIIIa ($C_{27}H_{43}NO_3$, m.p. 262-264° $[\alpha]_D^{30}$ + 60°) respectively. Further reduction with lithium aluminium hydride led to amino alcohols IX a and Xa. N-chloroderivatives from both of these on reaction with sodium methoxide(3) furnished tomatid-5-ene-3β-ol identical with the natural alkaloid(4) (mixed m.p., I.R., T.L.C.). This sequence also establishes that nitroketone IVa is a C-22 isomer of IIIa and the cyclic base obtained from it earlier(2) is 22-isosolanidine.

The nitroester IIb ($C_7H_{13}NO_4$, b.p. 105-108°/3mm, $[\alpha]_D^{28}$ -13°) was obtained from partially resolved R- 2-allyl propionic acid ($[\alpha]_D^{24}$ - 6.5°, 88% optical purity) in four steps. Its reaction with unsaturated ketone I also gave a mixture of adducts which could be separated into


+O2N-CH2-CH2-CH2-CH(CH3)-COOCH3
II
SERIES d = S CONFIGURATION AT C-2
SERIES b = R CONFIGURATION AT C-2
I
III
IV
V
VI
VII
VIII
IX
X
XI
SERIES d, TOMATID-5-ENE-3β-OL
SERIES b, SOLASODINE

C-22 isomeric nitroketones ($C_{28}H_{43}NO_6$, m.p. 162-163°; $C_{28}H_{43}NO_6$, m.p. 166-167°) by thick layer chromatography. As this procedure is laborious and the assymetric centre at C-22 is eliminated in a subsequent step, the mixture as such was carried through the above synthetic sequence to obtain solasodine, identical with the natural alkaloid (mixed m.p., I.R. and T.L.C.) in 15% yield.

References

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