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GIBBERELLINS FROM MANGROVE PLANTS

S. N. GANGULY and S. M. SIRCAR

Bose Institute, Calcutta-9, India

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Key Word Index—*Sonneratia apetala*; Sonneraliaceae; Rhizophora mucranata; Rhizophoraceae; Mangrove plants; Gibberellins A_1, A_3, A_4, A_5, A_7 and A_9; comparative biological activity.

Abstract—Gibberellins were isolated from three mangrove plants: A_1 and A_3 from *Sonneratia apetala*; A_3, A_5 and A_9 from *Rhizophora mucranata* and A_3, A_4 and A_7 from *Bruguiera gymnorhiza*. Biological activity of these gibberellins were examined using three bioassays.

IN CONTINUATION of our investigation on plant growth regulators,[1-5] we now report the isolation of gibberellins from three mangrove plants, *Sonneratia apetala*, *Rhizophora mucranata* and *Bruguiera gymnorhiza* and their characterization and biological activity. The isolation of a new naturally occurring gibberellin from the leaves of *S. apetala* was reported by us.[3,4]

Defatted leaves of *S. apetala* were extracted with methanol. The methanol solution was evaporated to afford an aqueous residue from which the ethyl acetate–soluble acidic extract was obtained. Chromatography of the acidic fraction gave three spots, one of which was identical with tetrahydrogibberellic acid A_3 previously isolated by us.[3,4] Repeated chromatography over silica gel afforded two compounds, m.p. 252–56° (A) and m.p. 228–230° (B) besides tetrahydrogibberellic acid. Compound A had TLC R_f 0·26 in the lower phase of CCl_4–HOAc–H_2O (8 : 3 : 5), containing 10% EtOAc. The IR spectrum showed peaks ν_{max}^{Nujol} 3495, 3360, 1760, 1705 and 980 cm^{-1}. The MS of its methyl ester showed molecular ion peak at *m/e* 362. In addition to molecular ion peak there are peaks at *m/e* 344, 330, 316, 302, 284, 258, 256 and 240 which are in accord with the peaks of GA_1-methyl ester reported earlier.[6,7] Finally the identity of (A) with GA_1 was established from its m.p., m.m.p., superimposable IR spectrum with authentic GA_1 and co-chromatography with the authentic sample. Compound (B) was homogeneous on TLC and had a yellow fluorescence with bluish tinge in UV light (R_f 0·15 same solvent as above after spraying with 5% H_2SO_4 in EtOH followed by heating the plate at 120° for 5 min). The identity of (B) with GA_3 was established by direct comparison of physical properties viz., IR, MS and co-chromatography with authentic GA_3.

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Chromatography of the acid fraction of the methanolic extract of the defatted leaves of *R. mucranata* gave three compounds, (C)(D) and (E). Compound C, m.p. 206–209° was homogeneous in TLC and gave purple UV-fluorescent spot at R_f 0·77 (solvent) EtOAc–$CHCl_3$–HOAc, 15:1:1) after spraying with 5% H_2SO_4 in EtOH followed by heating at 120° for 5 min. The compound showed IR absorption at 3098, 1755, 1720, 1665 and 890 cm^{-1}. The MS of its methyl ester showed a molecular ion peak at *m/e* 330 and the other peaks were observed at *m/e* 298, 284, 260, 252, 226, 224 and 208 which are in accord with peaks of GA_9 methyl ester reported earlier.[8] Finally the identity of C with GA_9 was established from its m.p., m.m.p., superimposable IR spectrum with authentic GA_9 and also by co-chromatography with authentic GA_9. Compound D, m.p. 258–261, homogeneous in TLC (R_f 0·58, same solvent as above), gave a blue UV-fluorescent spot on spraying with ethanol H_2SO_4 followed by heating the plate at 120°. The IR spectrum of the compound showed peaks ν_{max}^{Nujol} 3435, 2710, 1760, 1730, 1660 and 895 cm^{-1}. The MS of its methyl ester showed the molecular ion peak at *m/e* 344. In addition to the molecular ion peak there are peaks at *m/e* 312, 298, 284, 282, 266, 240, 238 and 222 similar to the peaks of authentic GA_5 methyl ester.[7] The identity of the compound D with GA_5 was established from its m.p. co-chromatography with authentic GA_5 and superimposable IR spectrum with authentic sample. Compound E, m.p. 228–229 was homogeneous in TLC (R_f 0·38, same solvent as above). The compound was identified as GA_3 on the basis of physical measurements and biological activity.

The fruits of *Bruguiera gymnorhiza* was extracted with methanol. The acidic fraction of the methanolic extract was chromatographed to yield two highly active amorphous

TABLE 1. COMPARATIVE POTENCY OF DIFFERENT GIBBERELLINS ISOLATED FROM MANGROVE PLANTS WITH THAT OF GA_3 AS STANDARD

Gibberellins	Lettuce hypocotyl test[9]	Cucumber hypocotyl test[10,11]	Rice second leaf sheath test[12,13]
GA_1	1/10th of GA_3	13/10 times more active than GA_3	3/4th of GA_3
Tetrahydro-gibberellic acid A_3	—	Almost inactive	1/10th of GA_3
GA_4	4/5th of GA_3	10 times more active than GA_3	1/2 of GA_3
GA_5	1/10th of GA_3	1/10th of GA_3	3/5th of GA_3
GA_7	Six times more active than GA_3	10 times more active than GA_3	7/10th of GA_3
GA_9	3/5th of GA_3	10 times more active than GA_3	Almost inactive

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solids, F and G. Compound G was homogeneous on TLC and had a yellow–green fluorescence with a bluish tinge on spraying with 5% H_2SO_4 in EtOH followed by heating at 120° for 5 min. This was identical with GA_3. Compound F was not homogeneous in TLC and gave two spots. Due to extreme poor yield of the mixture F, we could not isolate the two components individually. However on the basis of PC and TLC and also by studying their biological activity, the two components in the mixture F were identified as GA_4 and GA_7.

The results of the biological activity of the isolated compounds are presented in Table 1. Comparative potency of different gibberellins was studied earlier.[14,15] The activity was found similar to that of published data.[14–16]

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