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APPENDICES

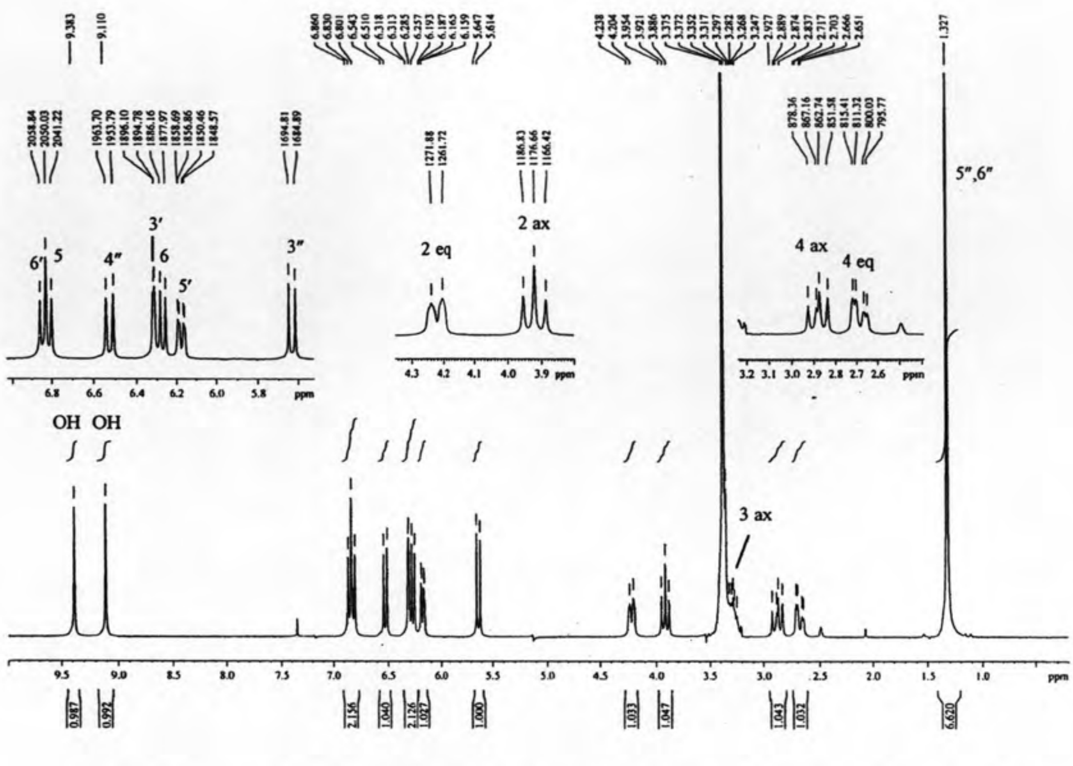

Figure 21. The 300 MHz ¹H-NMR spectrum of glabridin (**4**) in DMSO-d6.

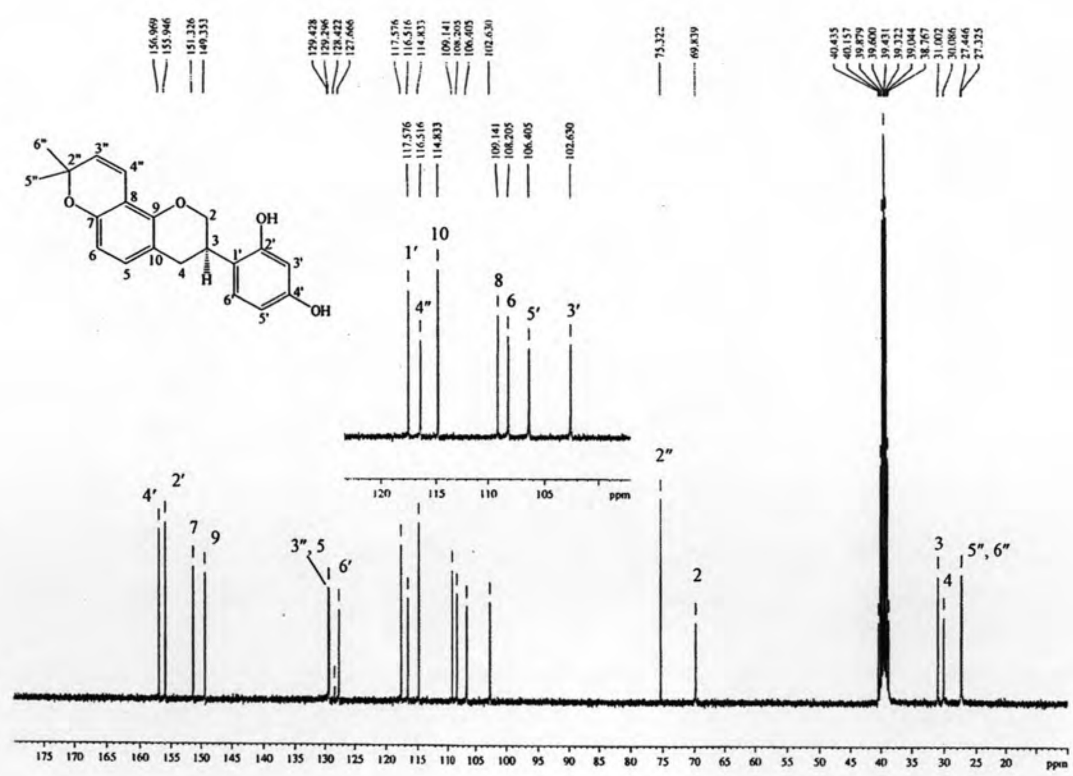

Figure 22. The 75 MHz ¹³C-NMR spectrum of glabridin (**4**) in DMSO-d6.

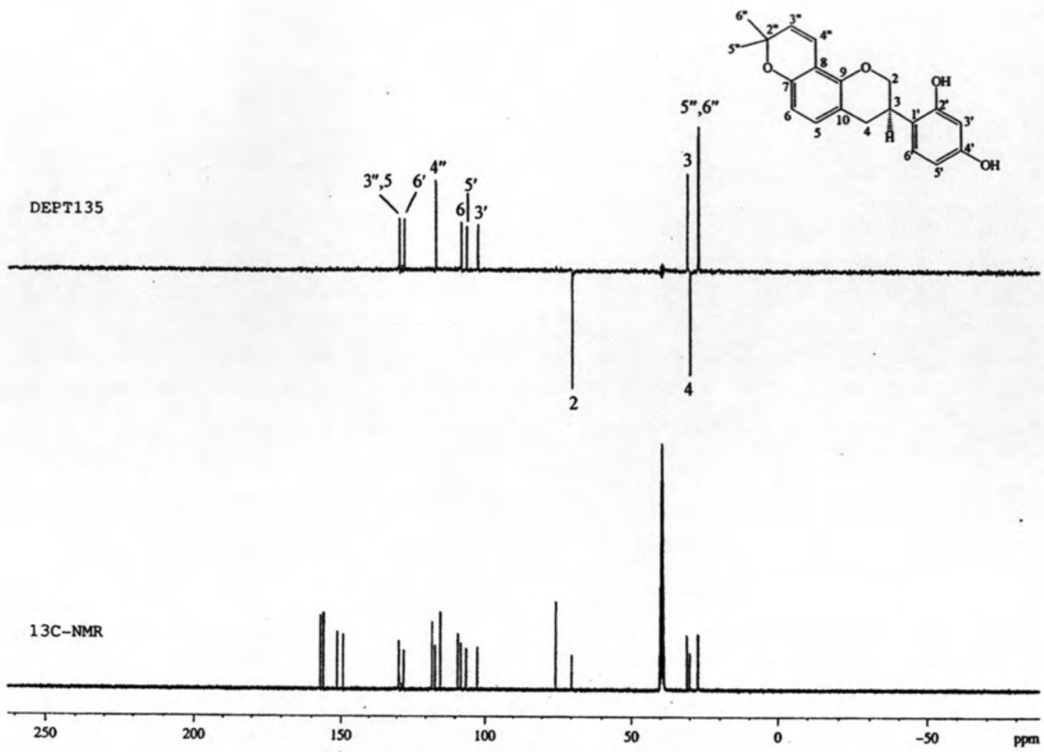

Figure 23. The DEPT 135° spectrum of glabridin (**4**) in DMSO-d6.

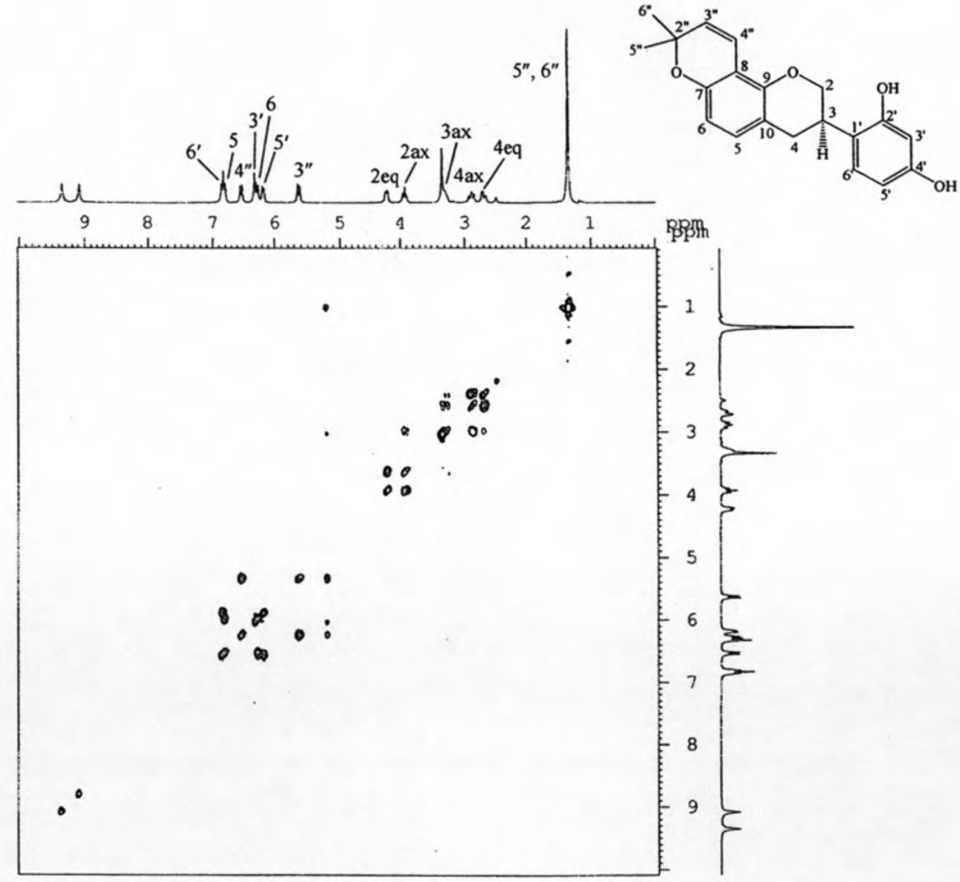

Figure 24. The ¹H-¹H COSY spectrum of glabridin (**4**) in DMSO-d6.

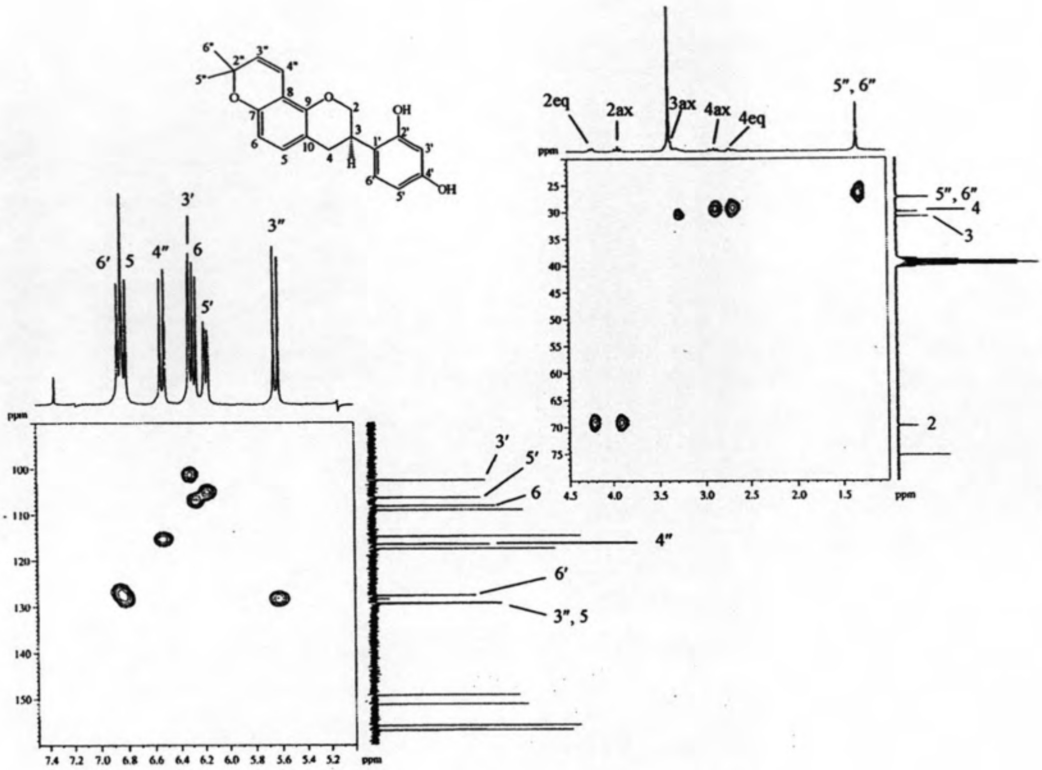

Figure 25. The HMQC spectrum of glabridin (**4**) in DMSO-d6.

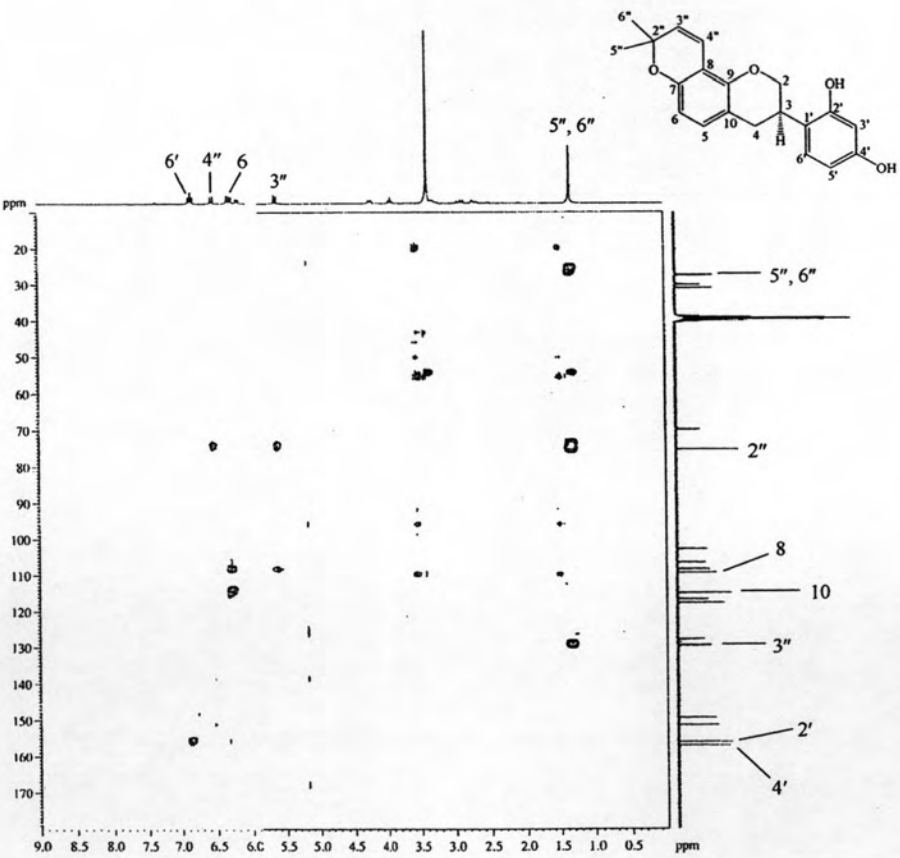

Figure 26. The HMBC spectrum of glabridin (**4**) in DMSO-d6.

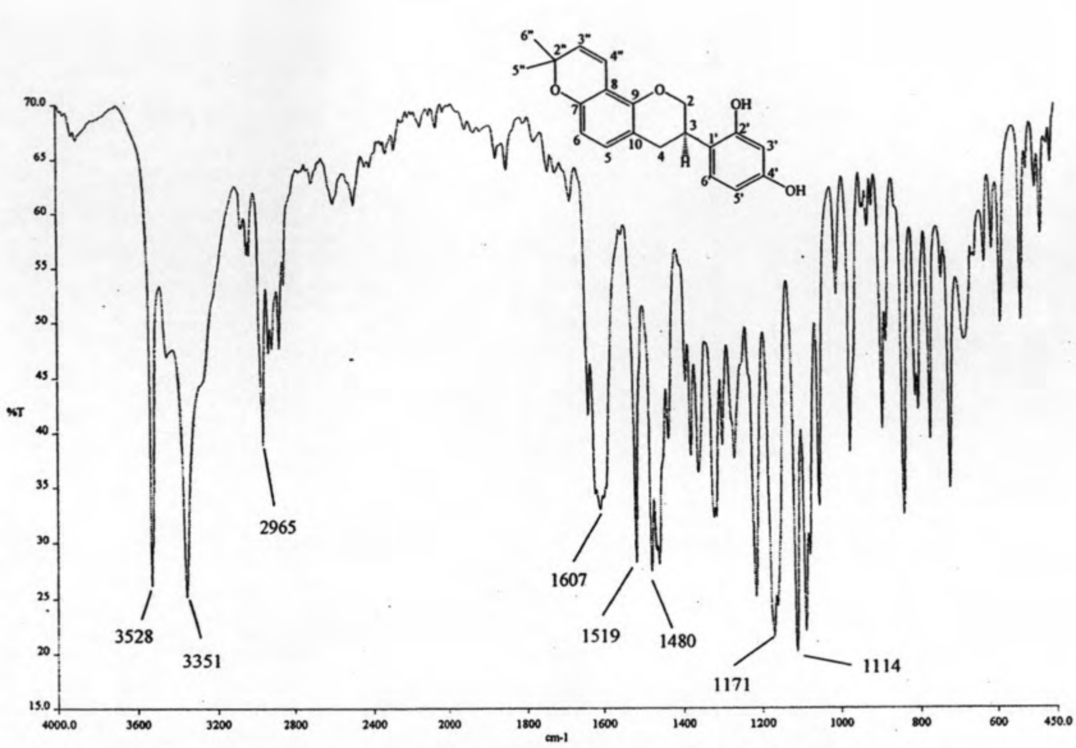

Figure 27. The infrared spectrum of glabridin (**4**).

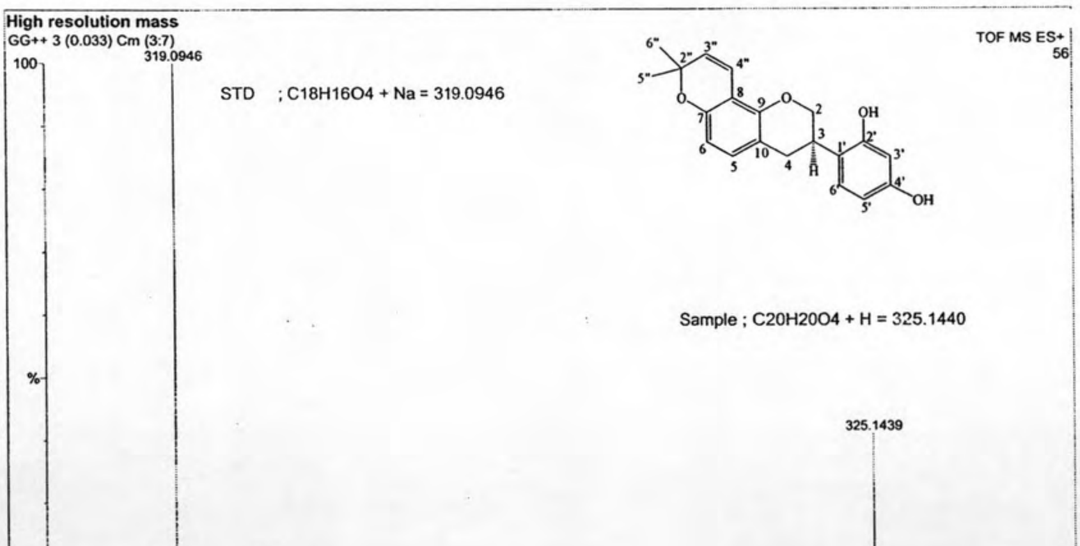

Figure 28. The TOF Mass spectrum of glabridin (**4**).

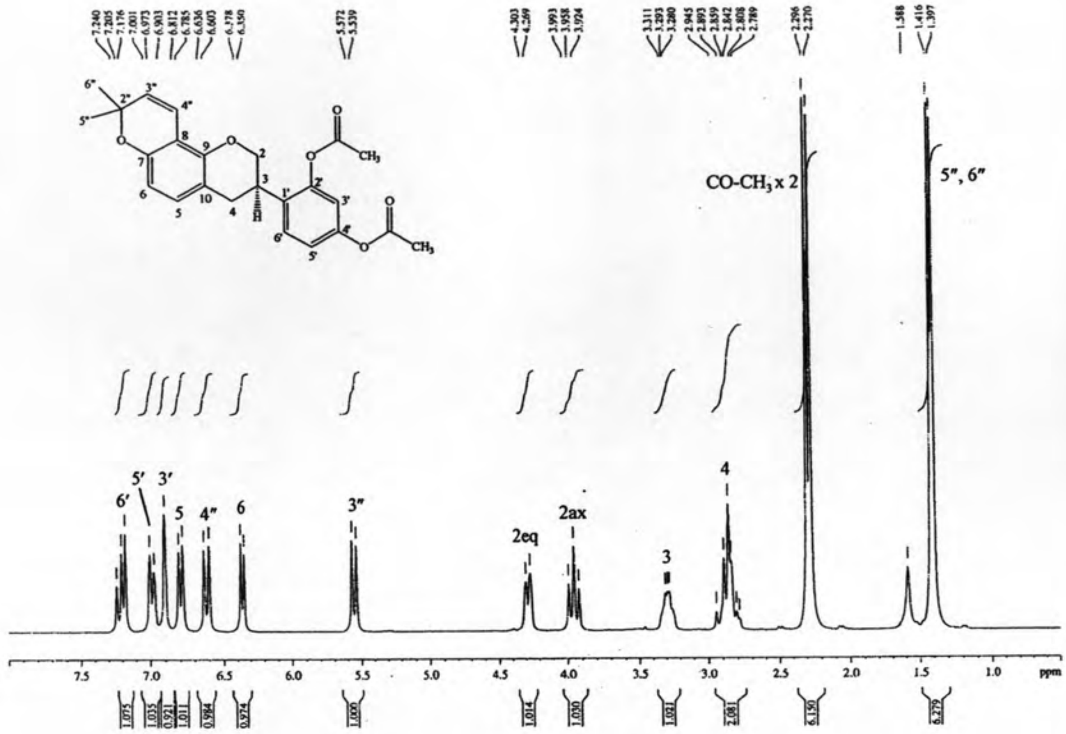

Figure 29. The 300 MHz ^{1}H-NMR spectrum of glabridin diacetate (**16**) in $CDCl_3$.

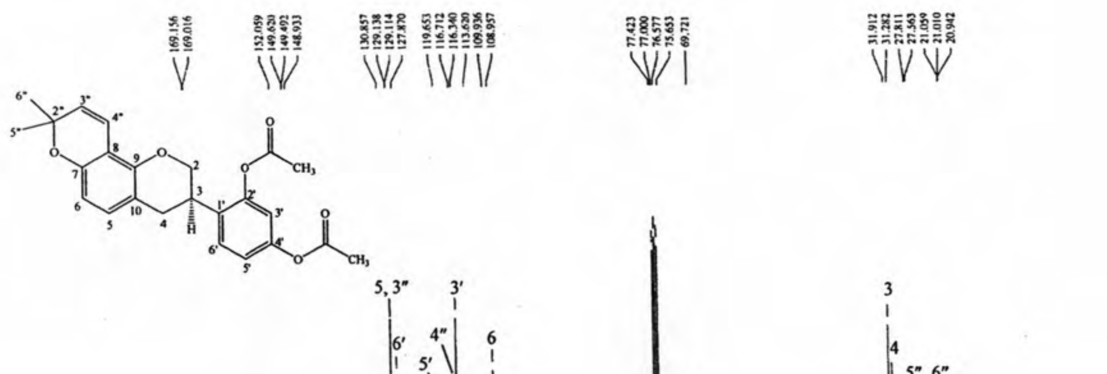

Figure 30. The 75 MHz ^{13}C-NMR spectrum of glabridin diacetate (**16**) in $CDCl_3$.

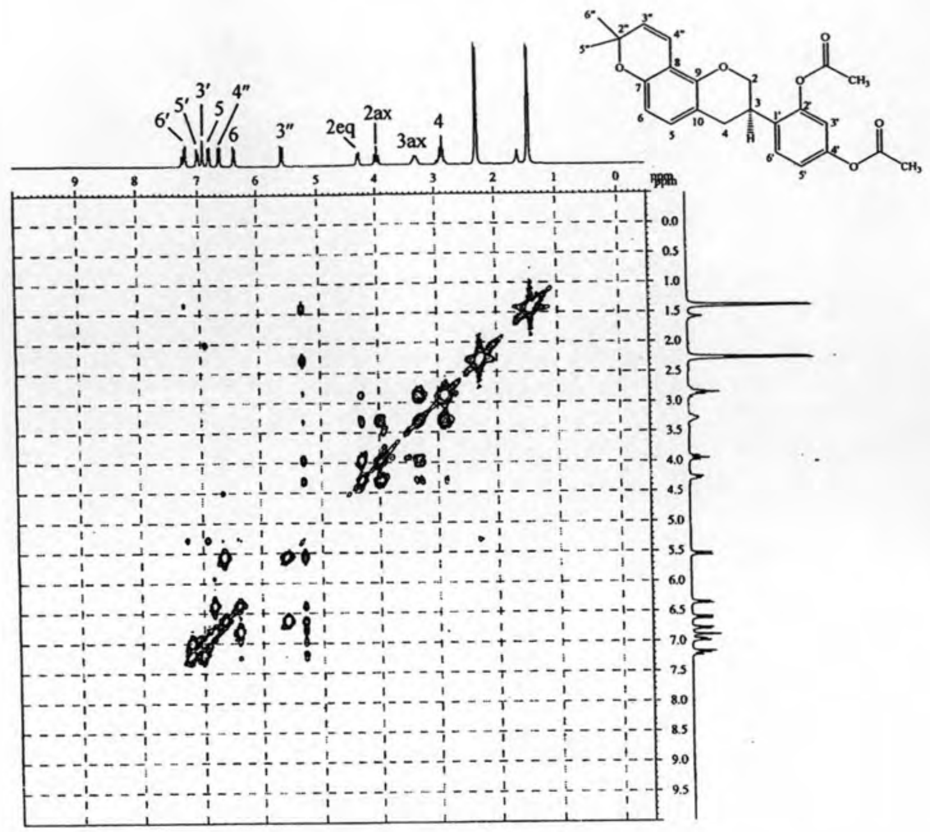

Figure 31. The ^1H-^1H COSY spectrum of glabridin diacetate (**16**) in $CDCl_3$.

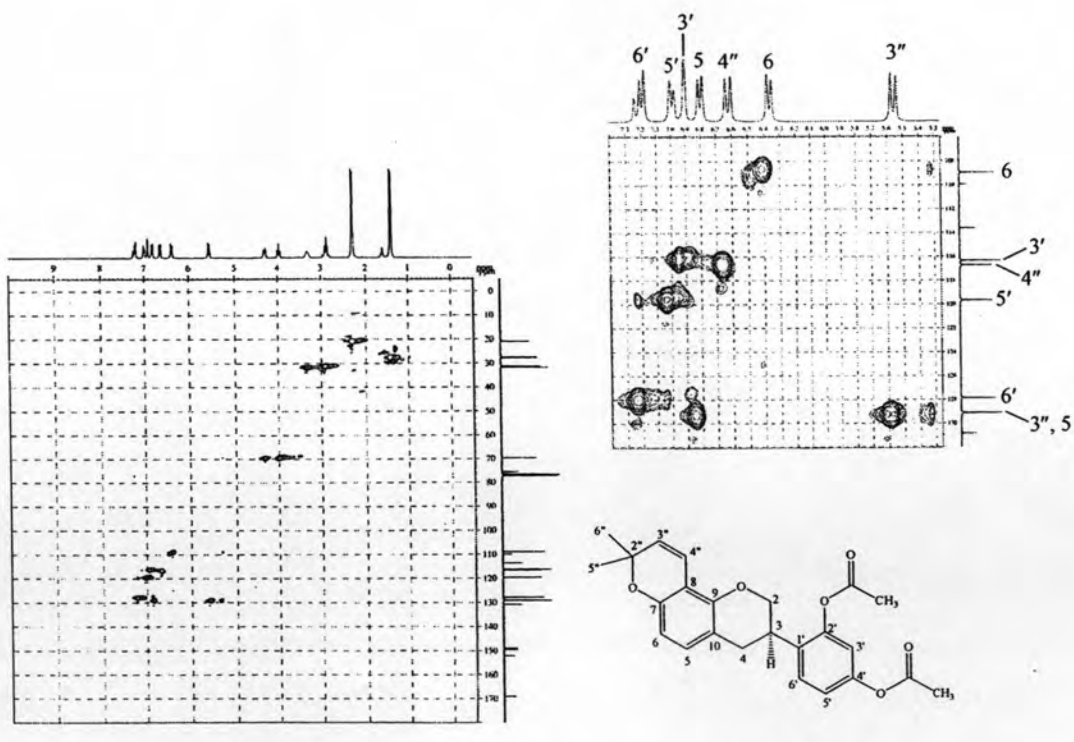

Figure 32. The HMQC spectrum of glabridin diacetate (**16**) in$CDCl_3$.

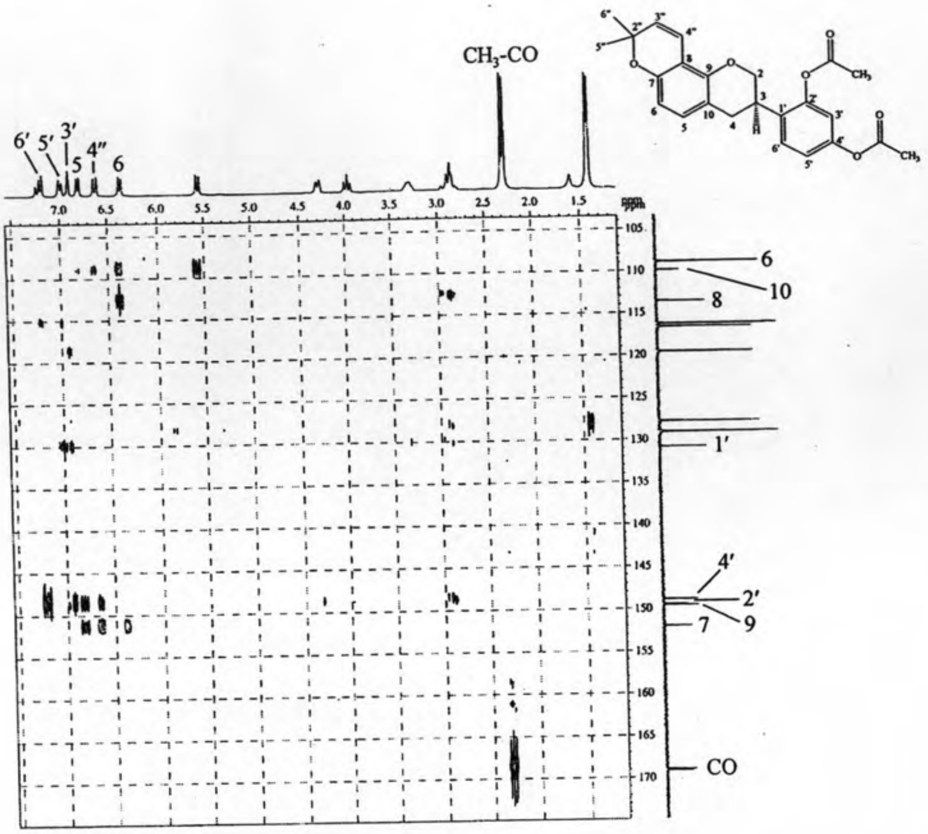

Figure 33. The HMBC spectrum of glabridin diacetate (**16**) inCDCl$_3$.

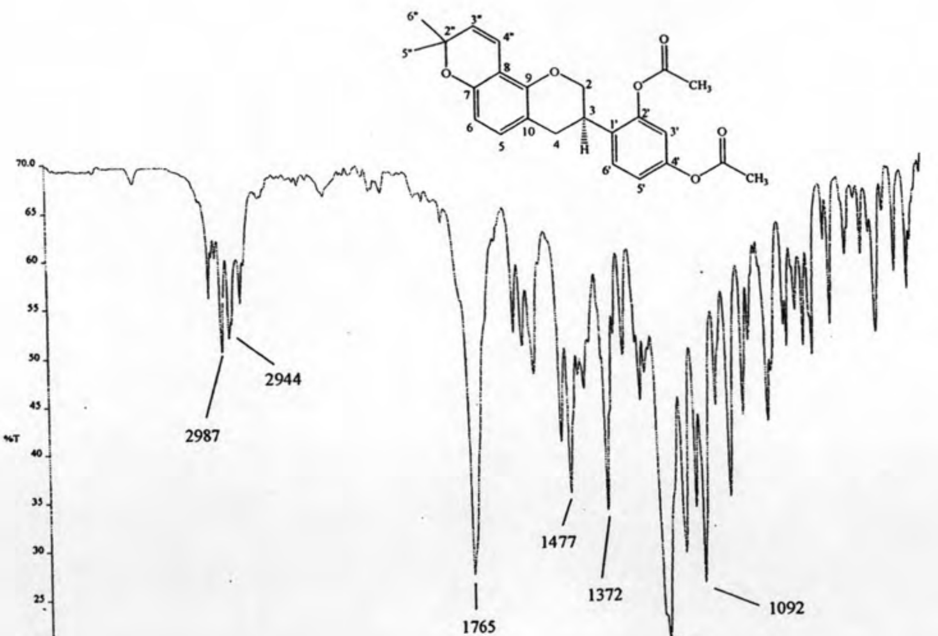

Figure 34. The infrared spectrum of glabridin diacetate (**16**).

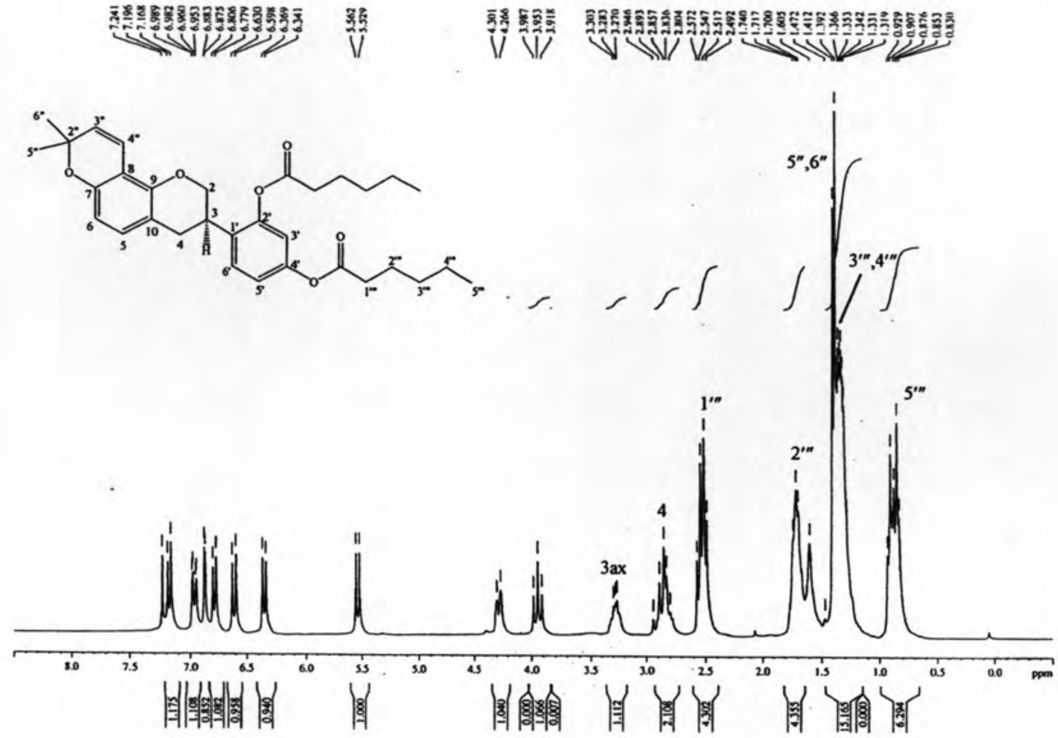

Figure 35. The 300 MHz ^{1}H-NMR spectrum of glabridin dihexanoate (**17**) in $CDCl_3$.

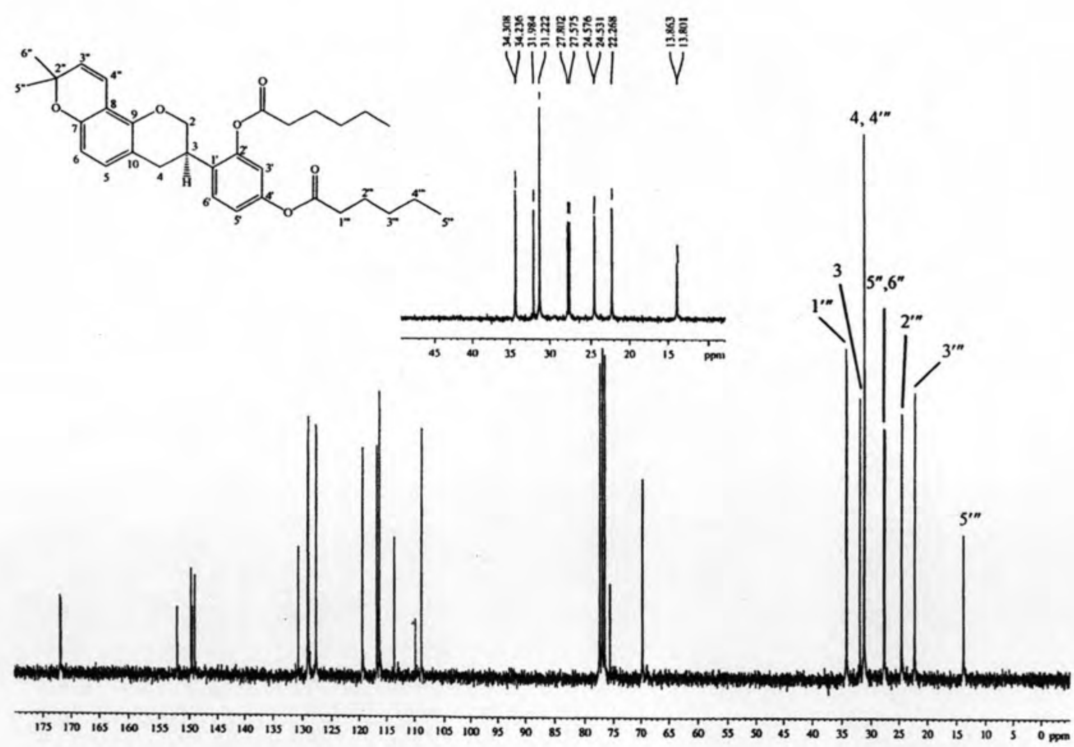

Figure 36. The 75 MHz ^{13}C-NMR spectrum of glabridin dihexanoate (**17**) in $CDCl_3$.

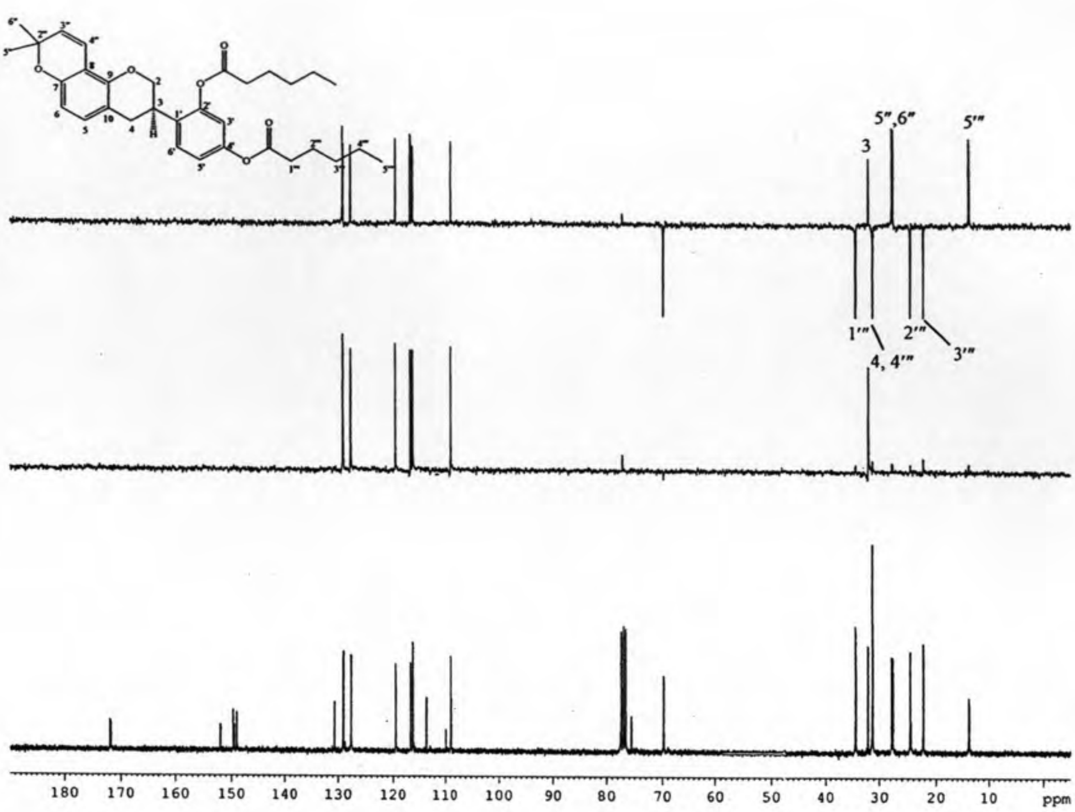

Figure 37. The DEPT 90° and 135° spectrum of glabridin dihexanoate (**17**) in $CDCl_3$.

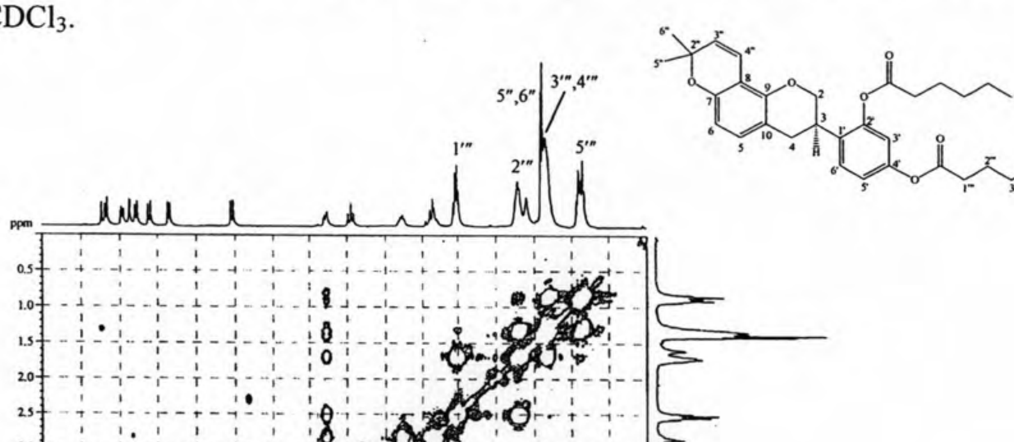

Figure 38. The ^1H-^1H COSY spectrum of glabridin dihexanoate (**17**) in $CDCl_3$.

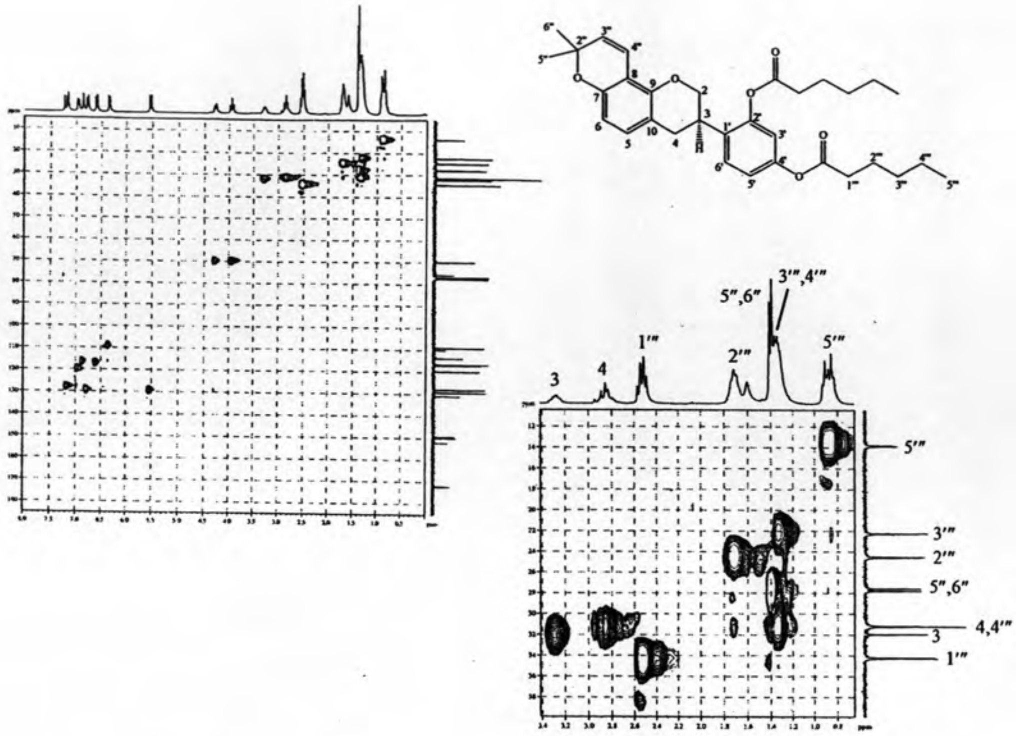

Figure 39. The HMQC spectrum of glabridin dihexanoate (**17**) in $CDCl_3$.

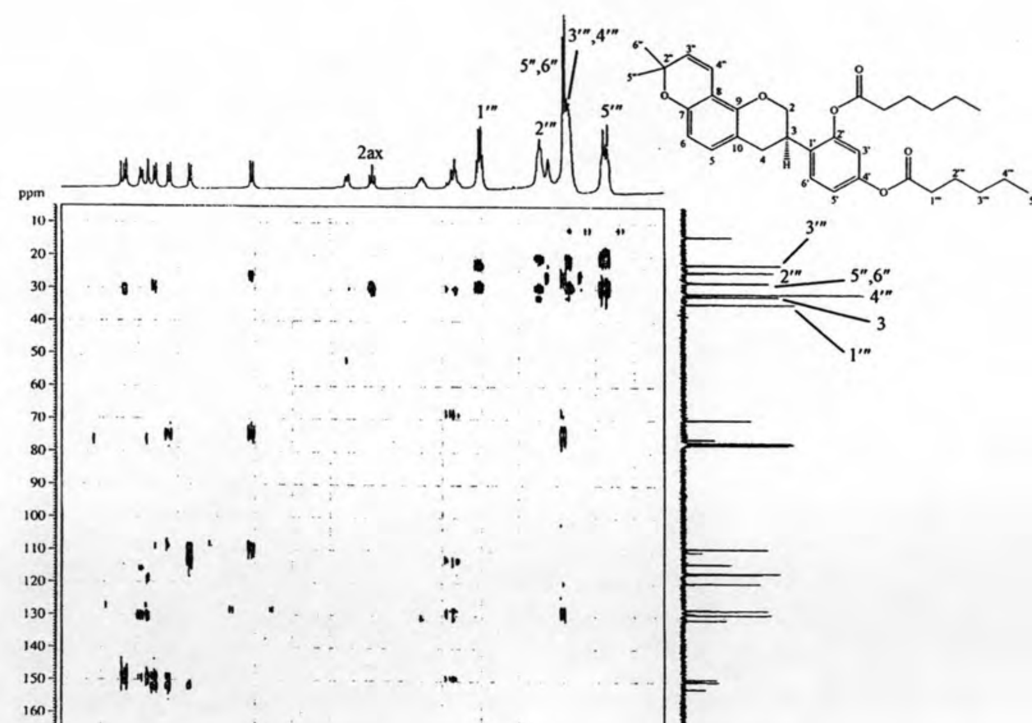

Figure 40. The HMBC spectrum of glabrin dihexanoate (**17**) in $CDCl_3$.

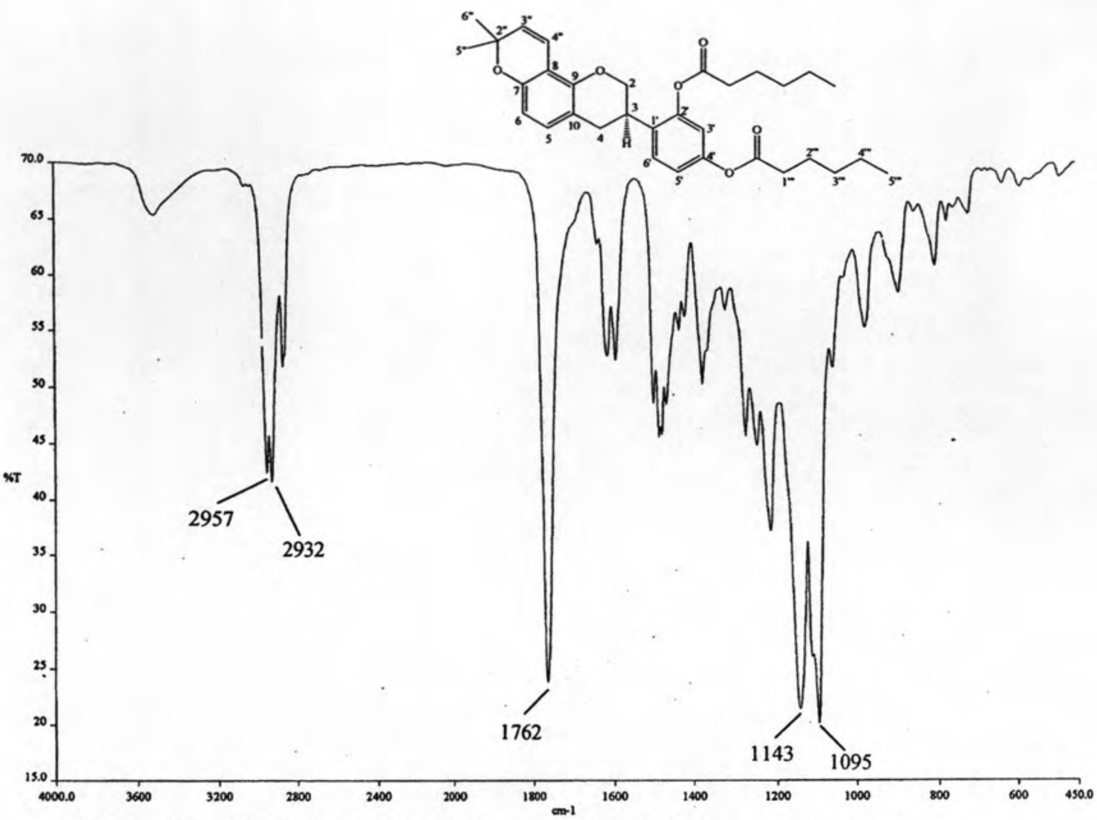

Figure 41. The infrared spectrum of glabridin dihexanoate (**17**).

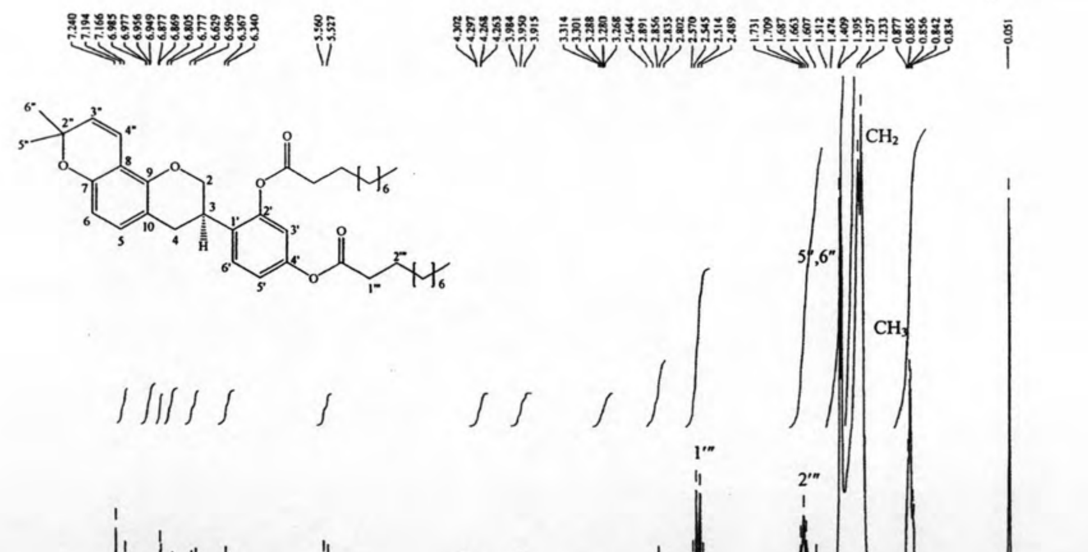

Figure 42. The 300 MHz ^{1}H-NMR spectrum of glabridin didecanoate (**18**) in $CDCl_3$.

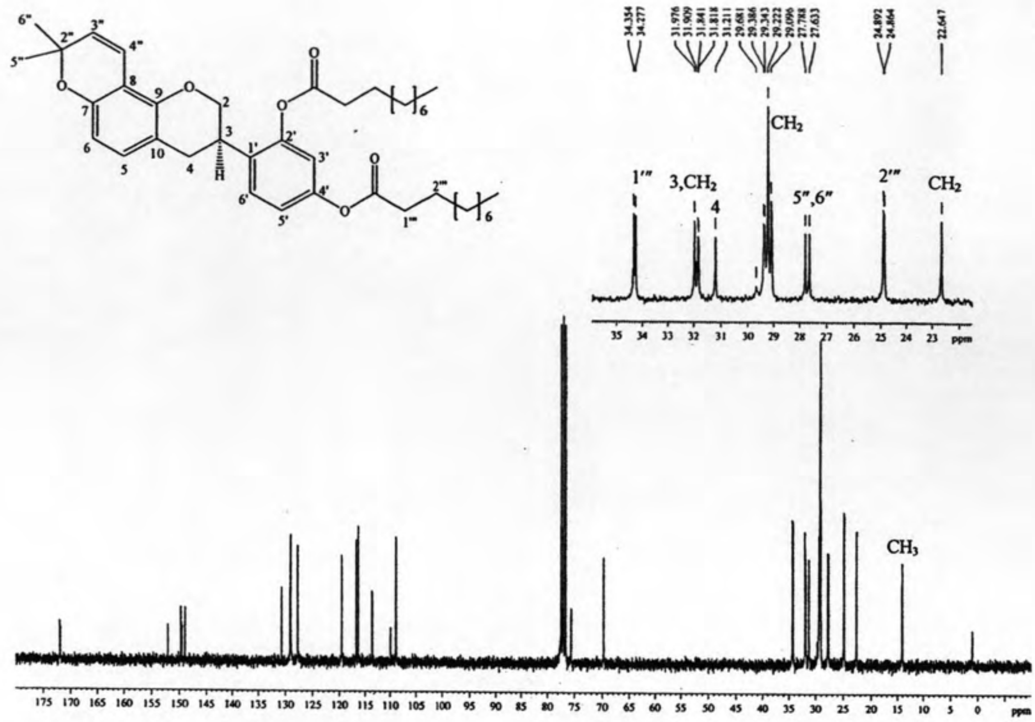

Figure 43. The 75 MHz ^{13}C-NMR spectrum of glabridin didecanoate (**18**) in $CDCl_3$.

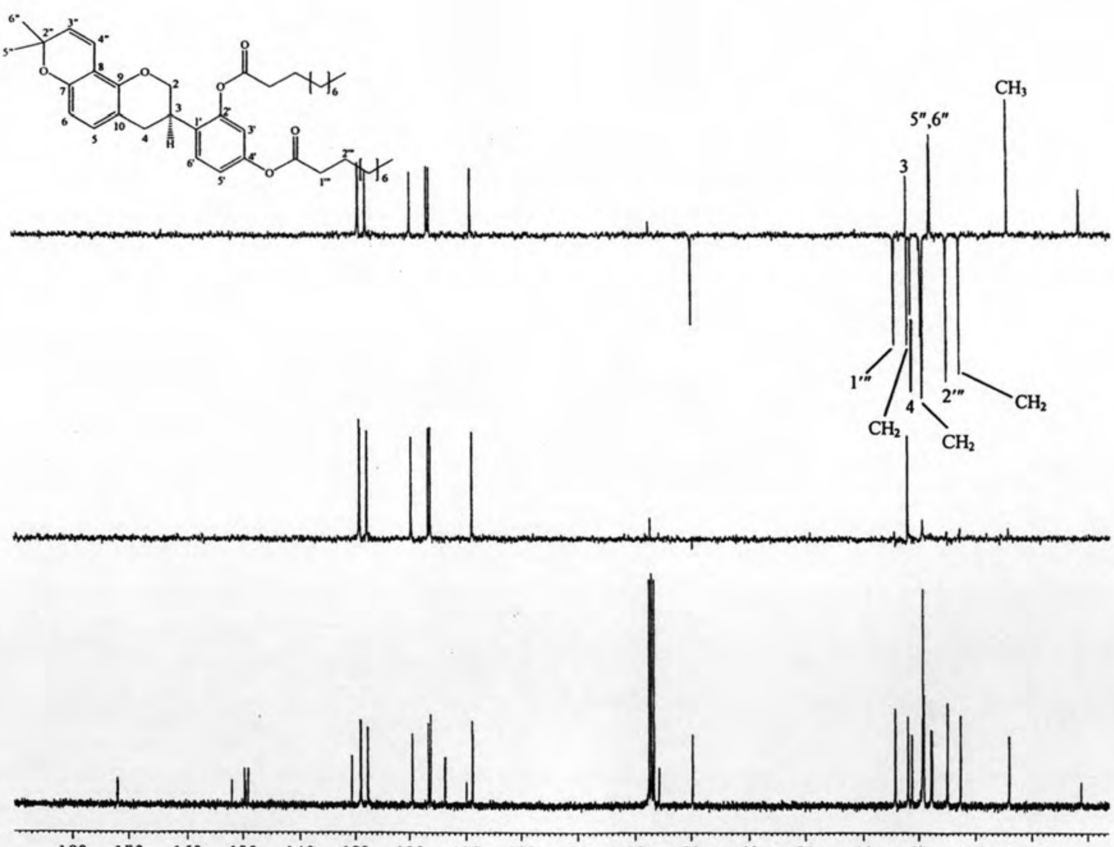

Figure 44. The DEPT 90° and 135° spectrum of glabridin didecanoate (**18**) in $CDCl_3$.

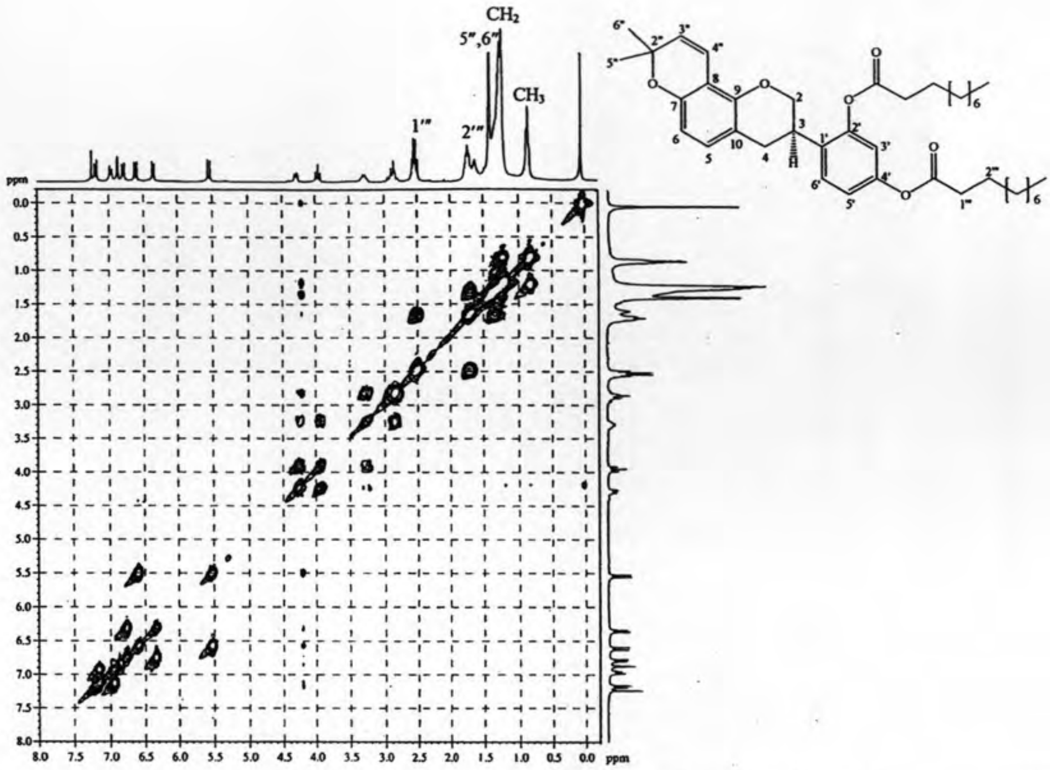

Figure 45. The ^{1}H-^{1}H COSY spectrum of glabridin didecanoate (**18**) in $CDCl_3$.

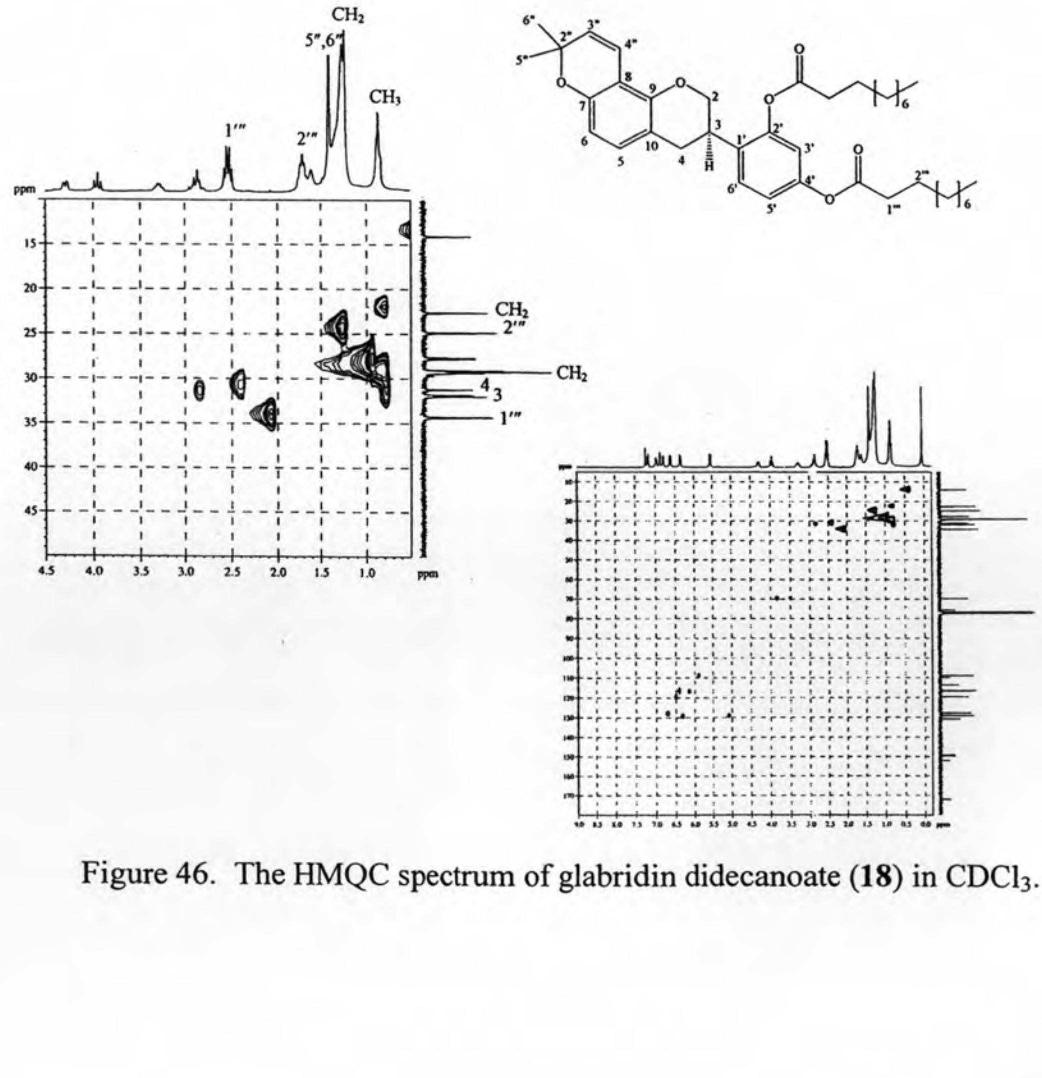

Figure 46. The HMQC spectrum of glabridin didecanoate (**18**) in $CDCl_3$.

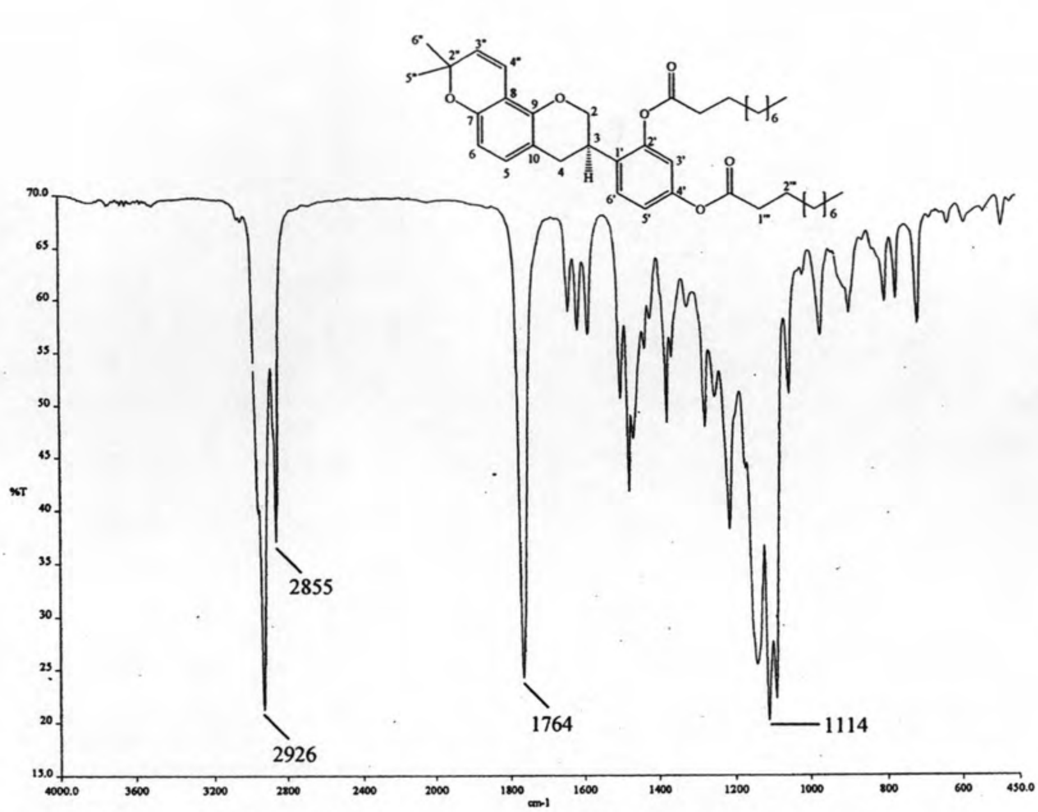

Figure 47. The infrared spectrum of glabridin didecanoate (**18**).

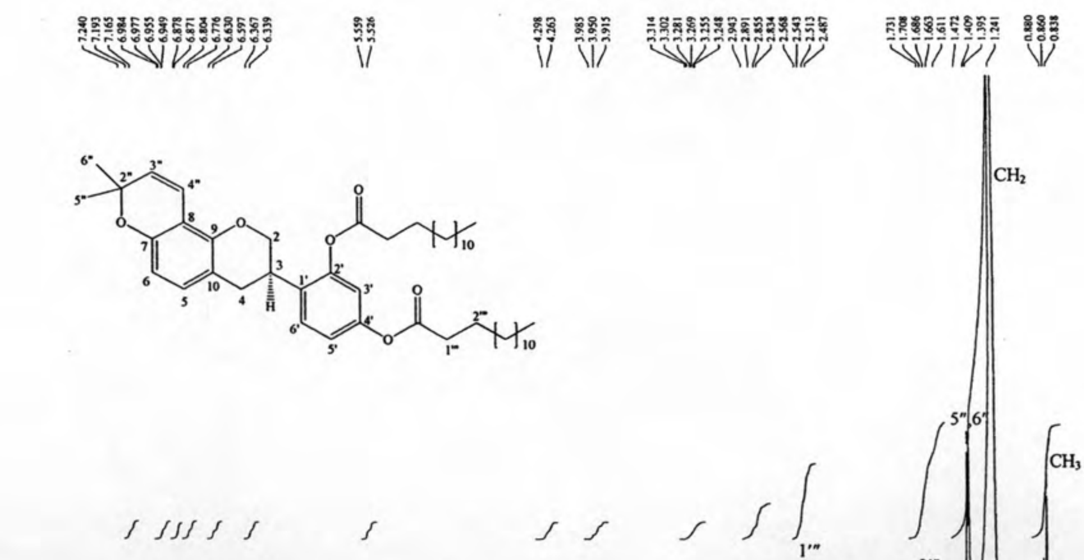

Figure 48. The 300 MHz ^{1}H-NMR spectrum of glabridin dipalmitate (**19**) in $CDCl_3$.

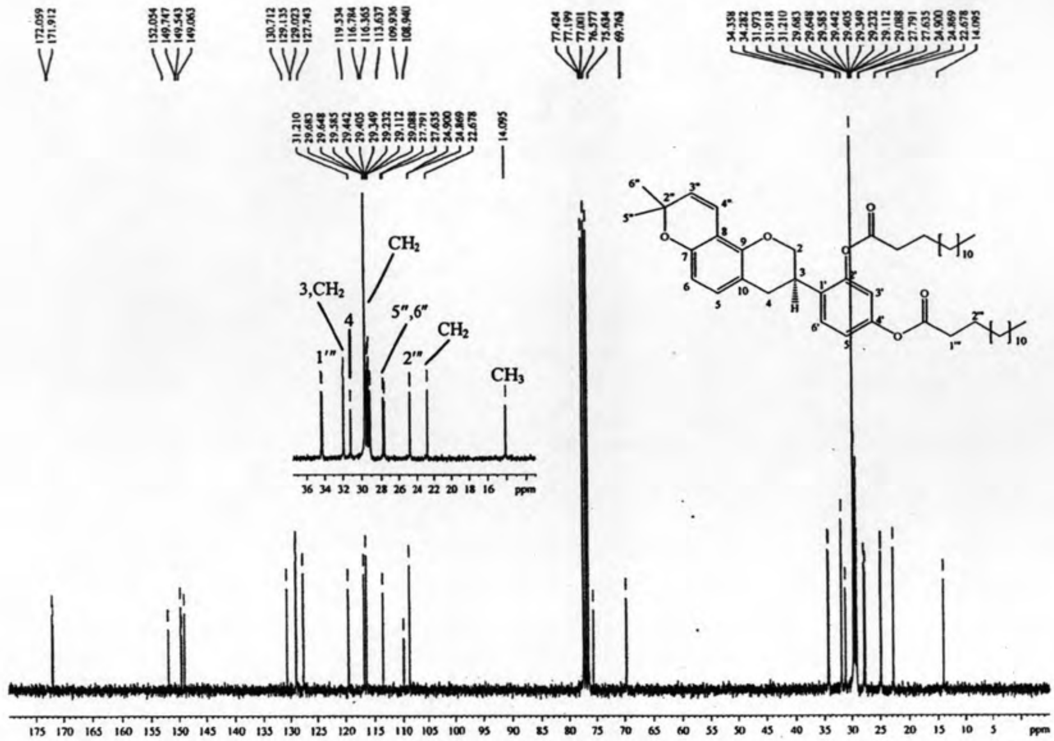

Figure 49. The 75 MHz ^{13}C-NMR spectrum of glabridin dipalmitate (**19**) in $CDCl_3$.

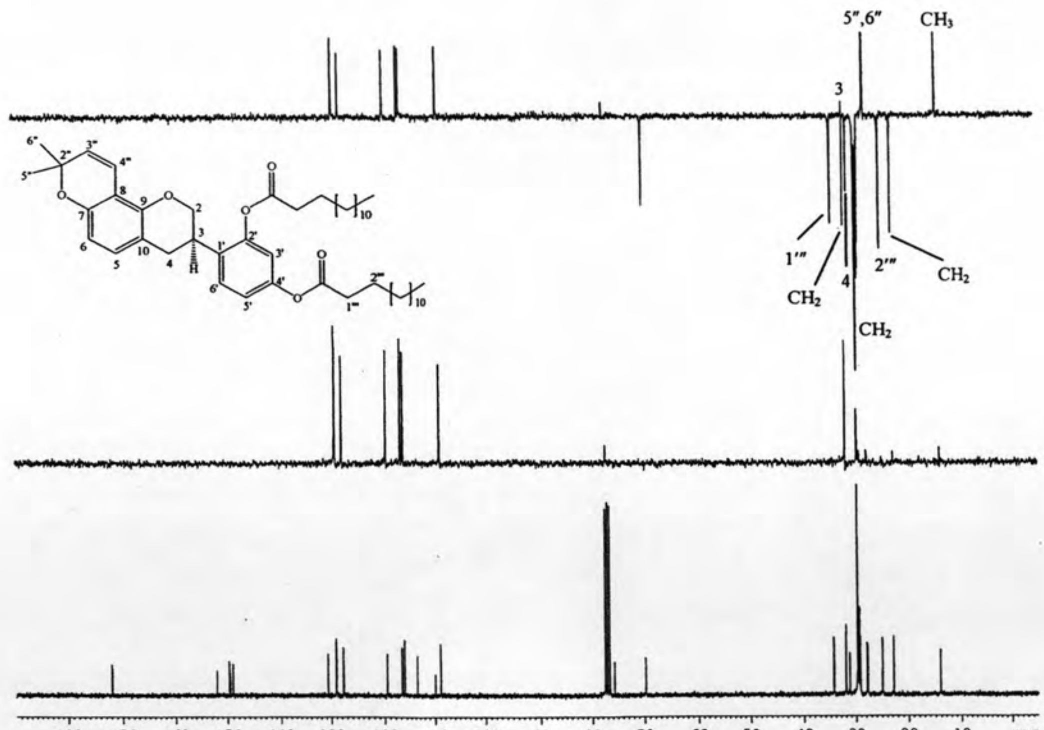

Figure 50. The DEPT 90° and 135° spectrum of glabridin dipalmitate (**19**) in $CDCl_3$.

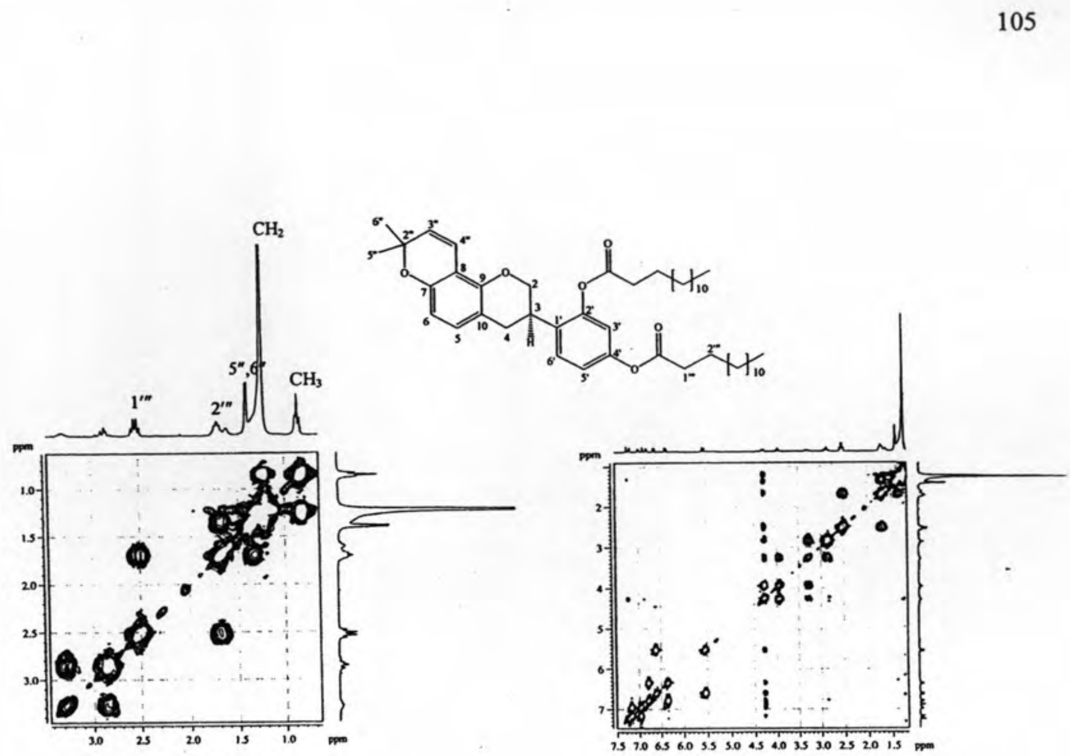

Figure 51. The ^{1}H-^{1}H COSY spectrum of glabridin dipalmitate (**19**) in $CDCl_3$.

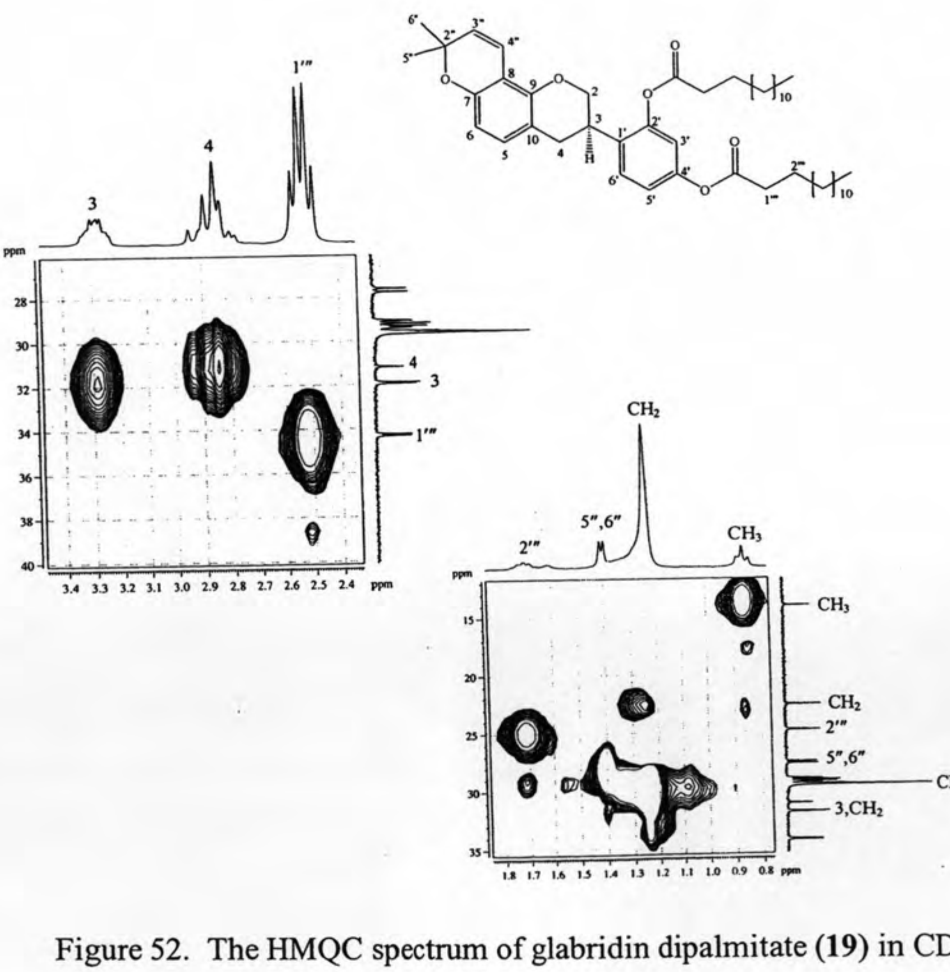

Figure 52. The HMQC spectrum of glabridin dipalmitate (**19**) in $CDCl_3$.

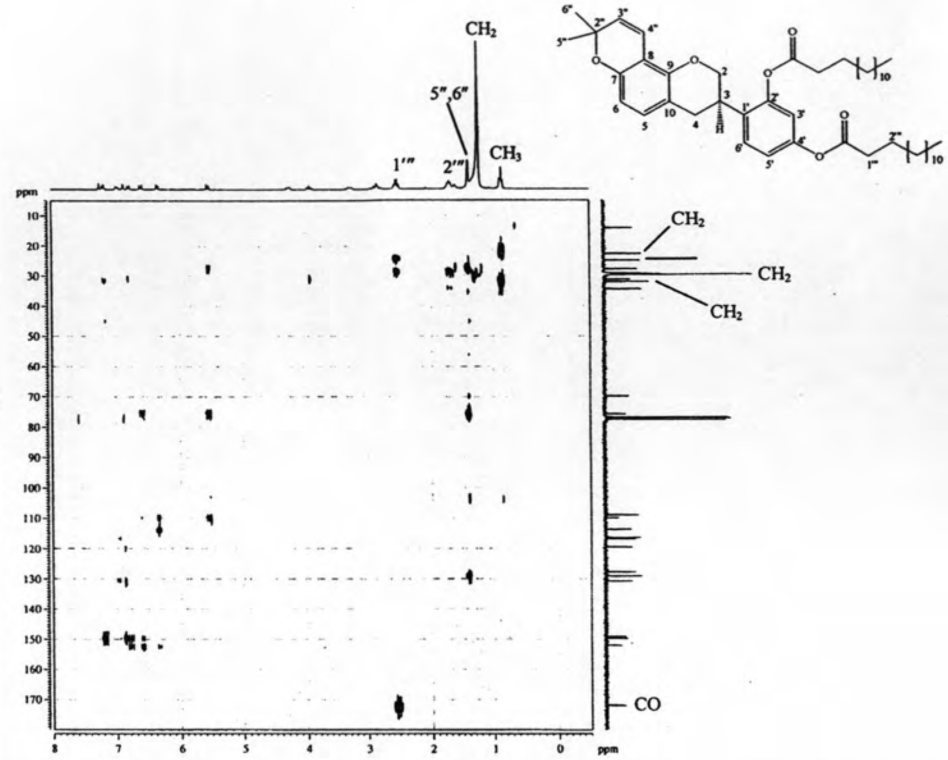

Figure 53. The HMBC spectrum of glabridin dipalmitate **(19)** in $CDCl_3$.

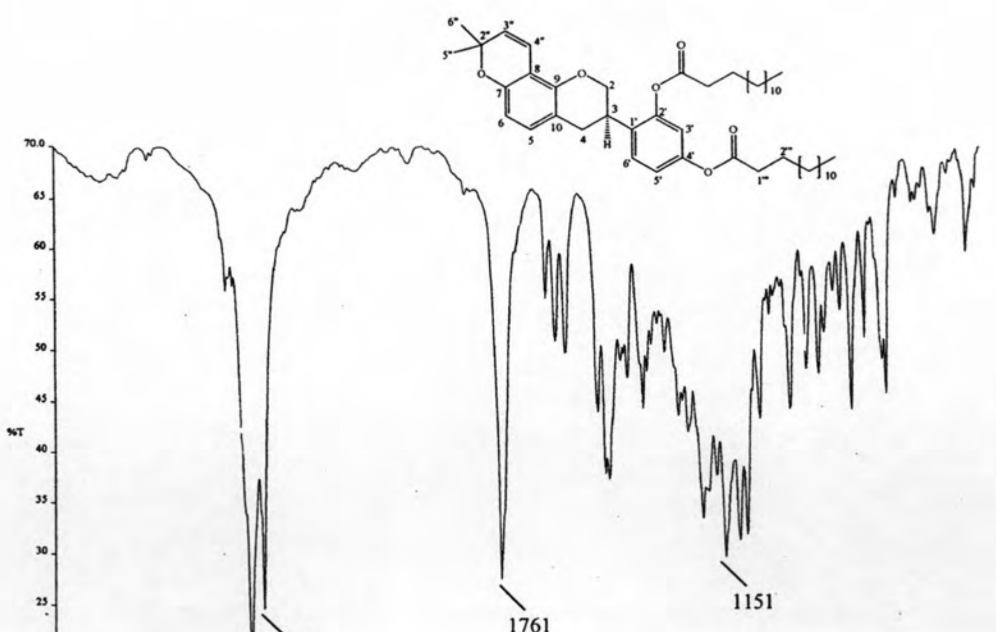

Figure 54. The infrared spectrum of glabridin dipalmitate **(19)**.

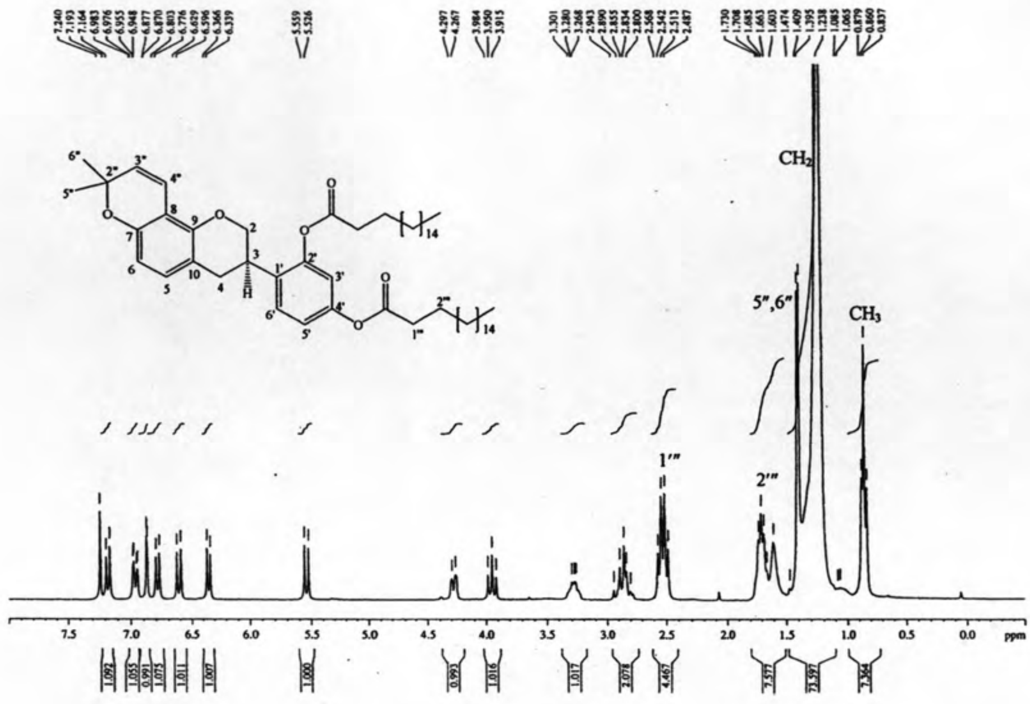

Figure 55. The 300 MHz [1]H-NMR spectrum of glabridin distearate (**20**) in $CDCl_3$.

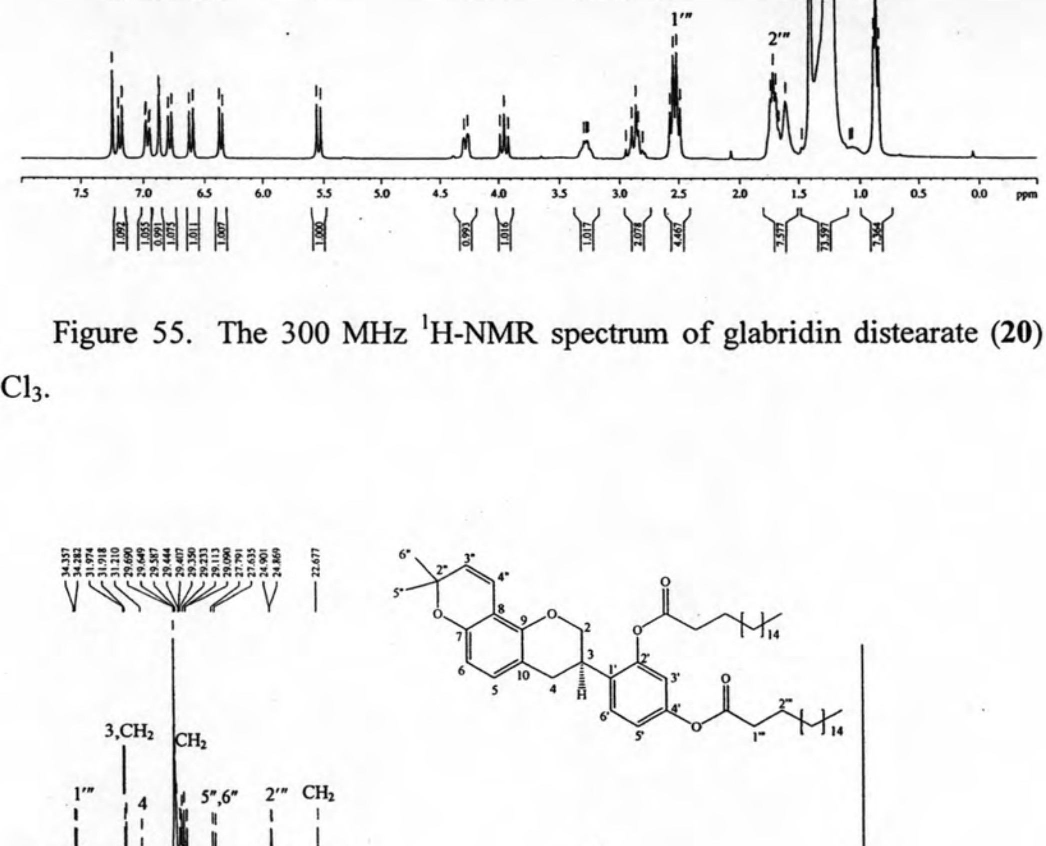

Figure 56. The 75 MHz [13]C-NMR spectrum of glabridin distearate (**20**) in $CDCl_3$.

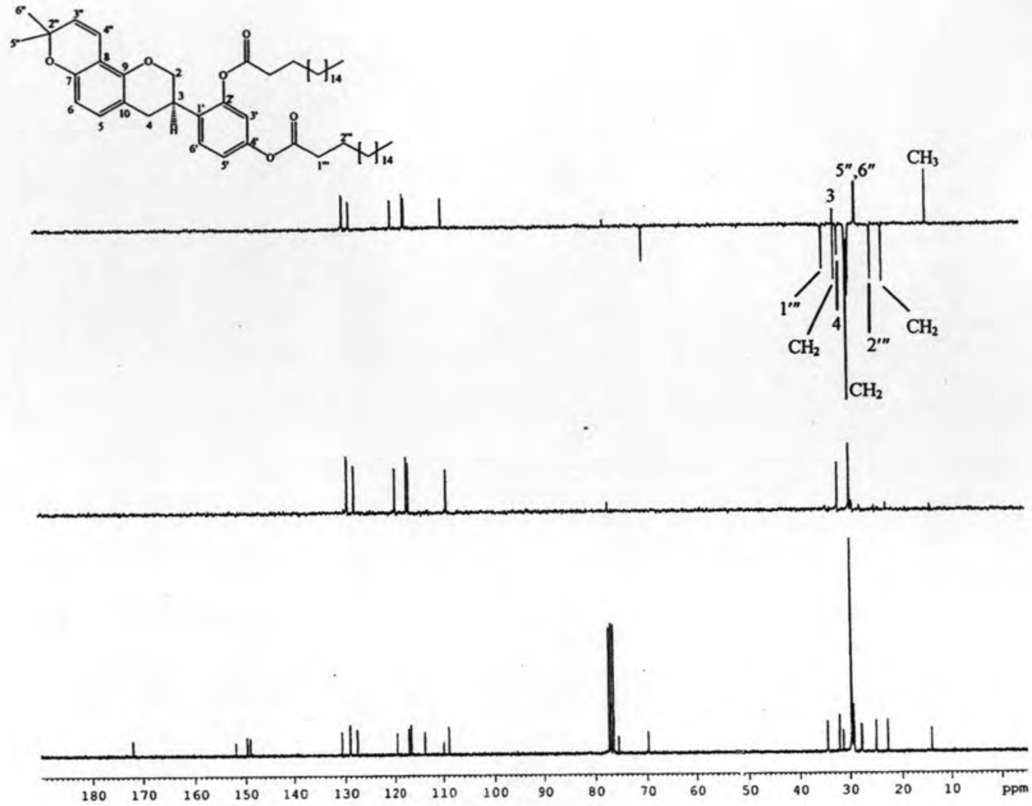

Figure 57. The DEPT 90° and 135° spectrum of glabridin distearate (**20**) in $CDCl_3$.

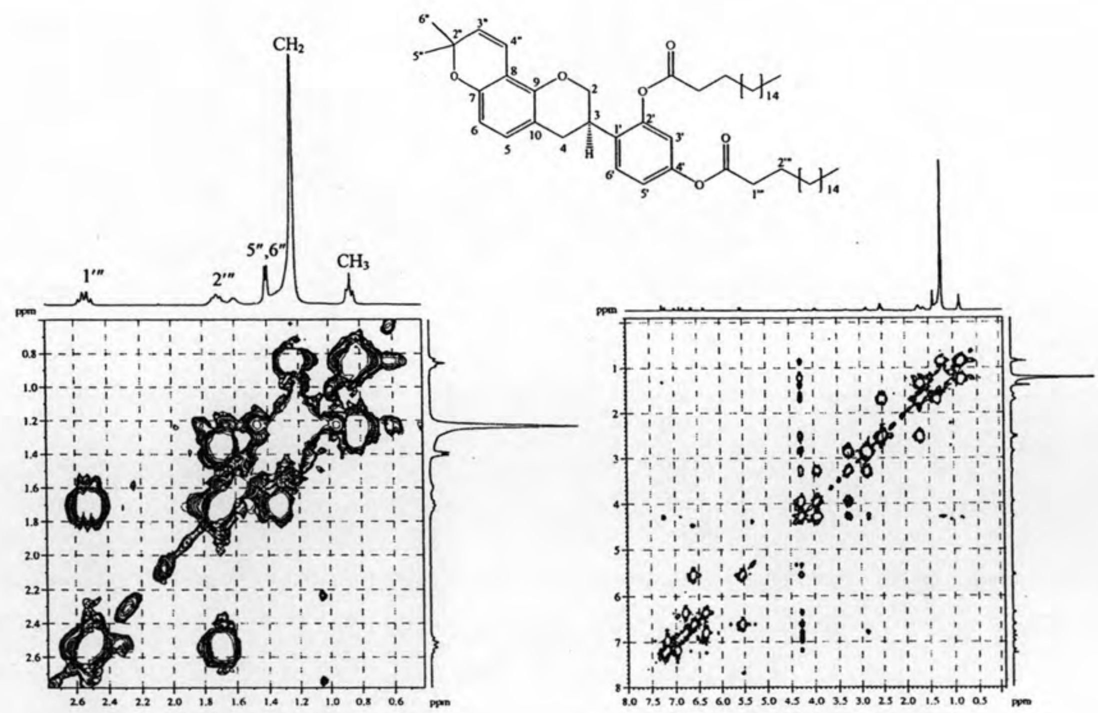

Figure 58. The ^1H-^1H COSY spectrum of glabridin distearate (**20**) in $CDCl_3$.

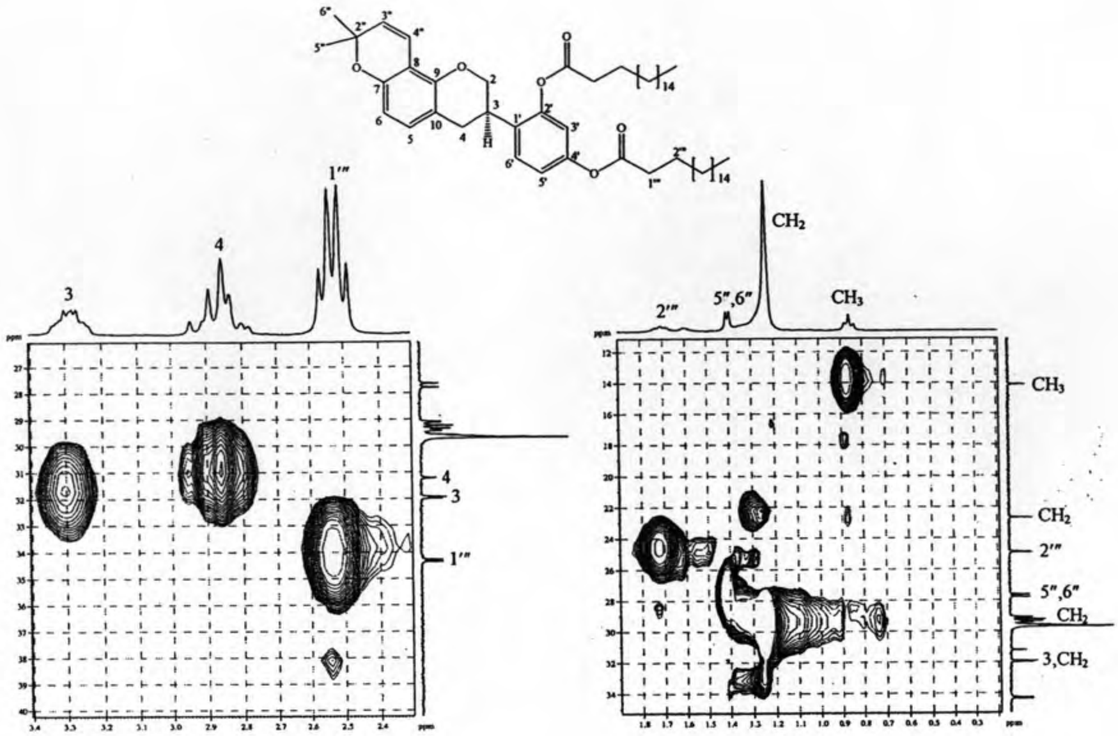

Figure 59. The HMQC spectrum of glabridin distearate (**20**) in $CDCl_3$.

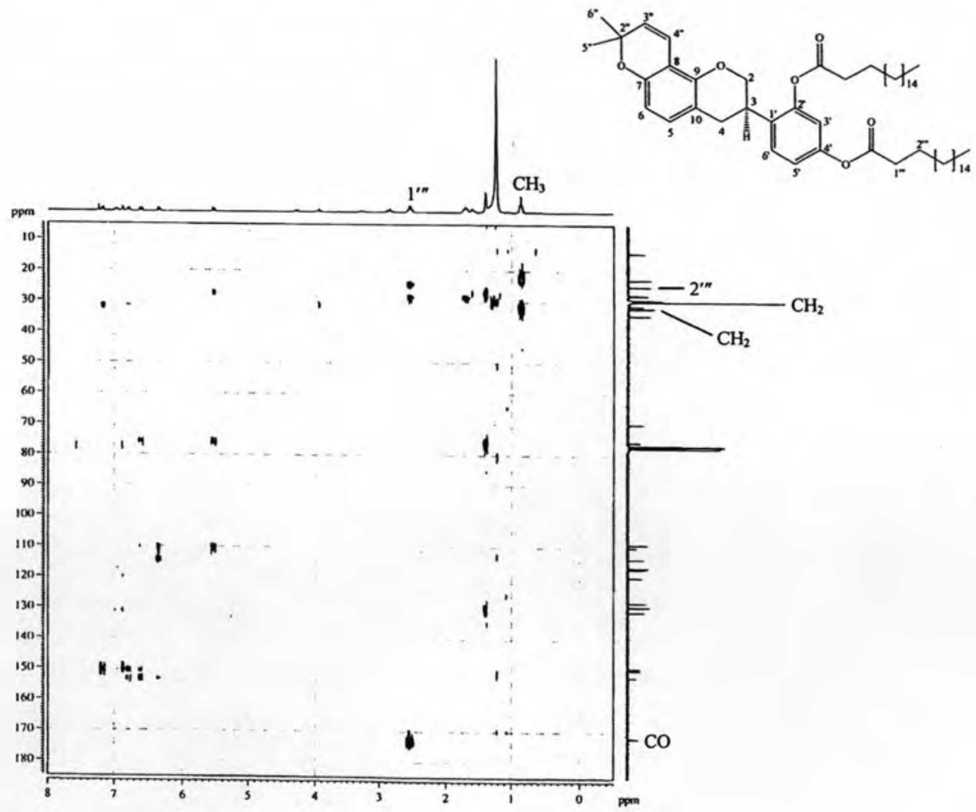

Figure 60. The HMBC spectrum of glabridin distearate (**20**) in $CDCl_3$.

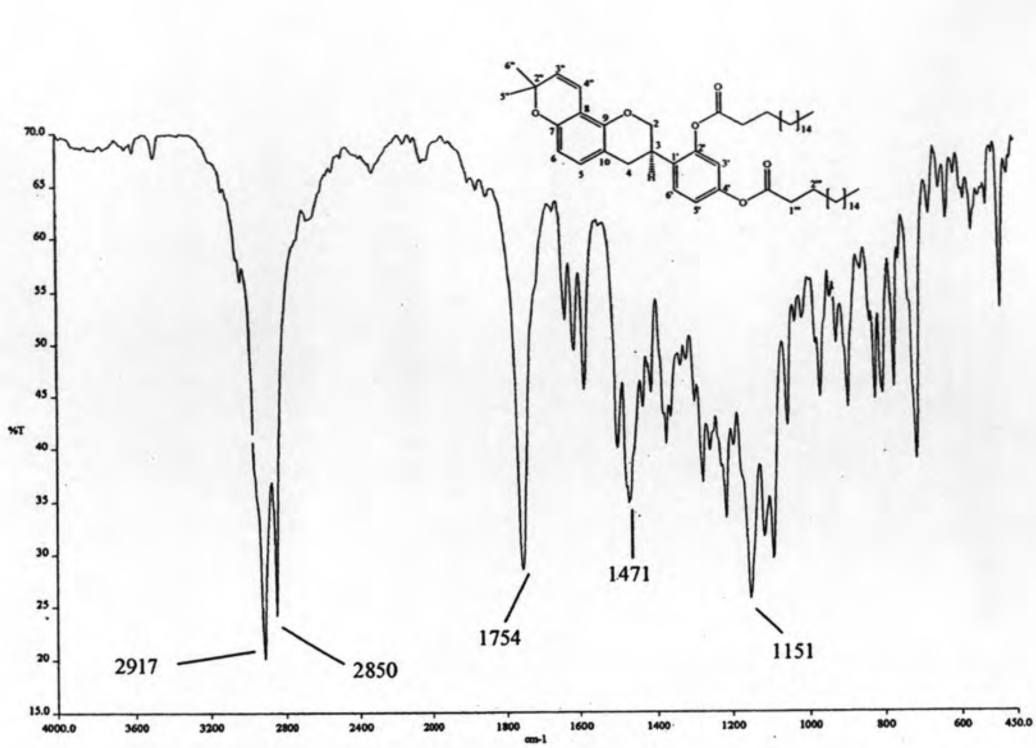

Figure 61. The infrared spectrum of glabridin distearate (**20**).

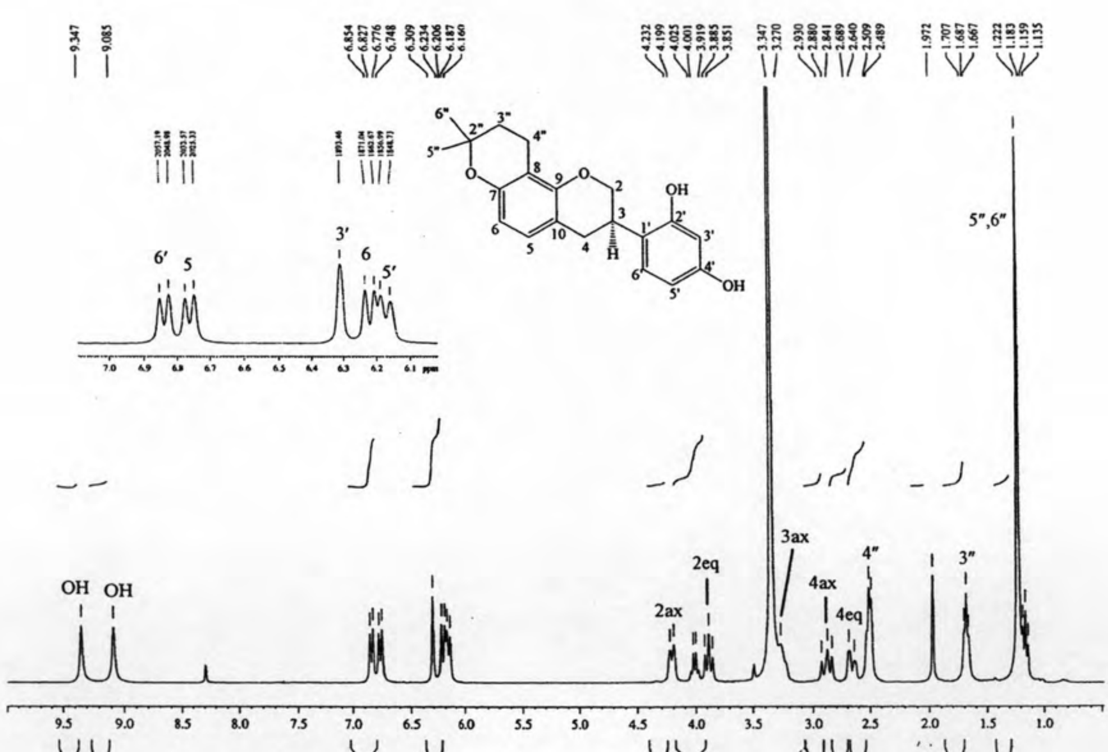

Figure 62. The 300 MHz ^{1}H-NMR spectrum of 3″,4″-dihydroglabridin (**21**) in DMSO-d_6.

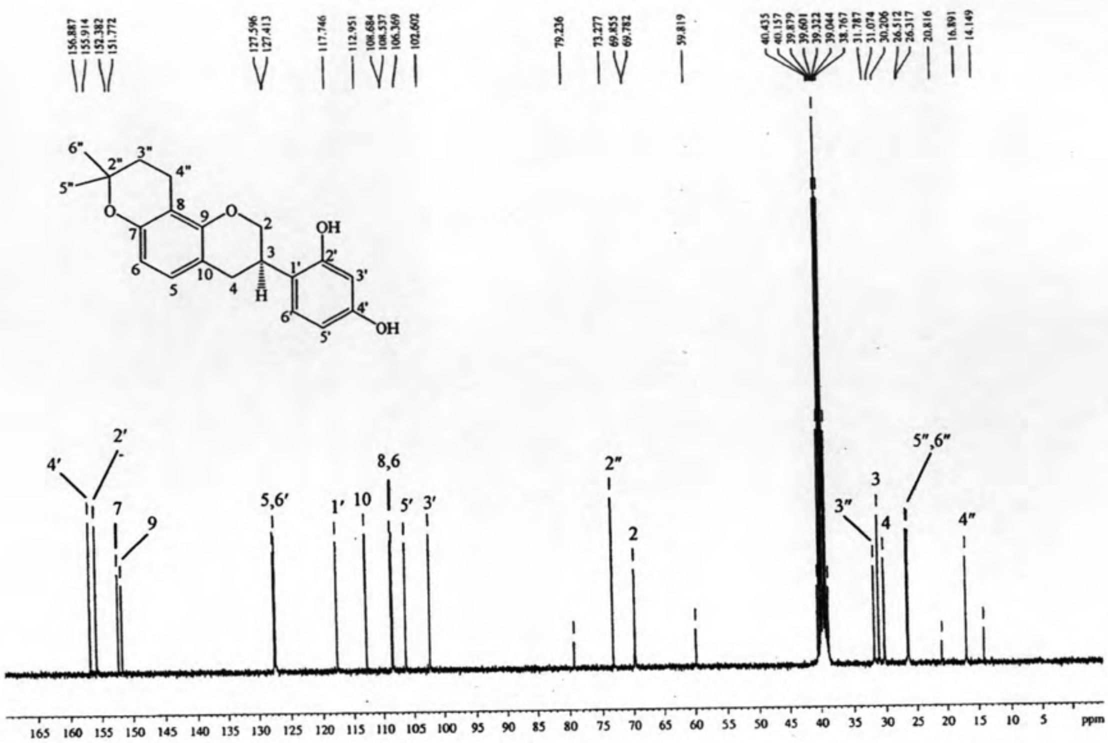

Figure 63. The 75 MHz ^{13}C-NMR spectrum of 3″,4″-dihydroglabridin (**21**) in DMSO-d_6.

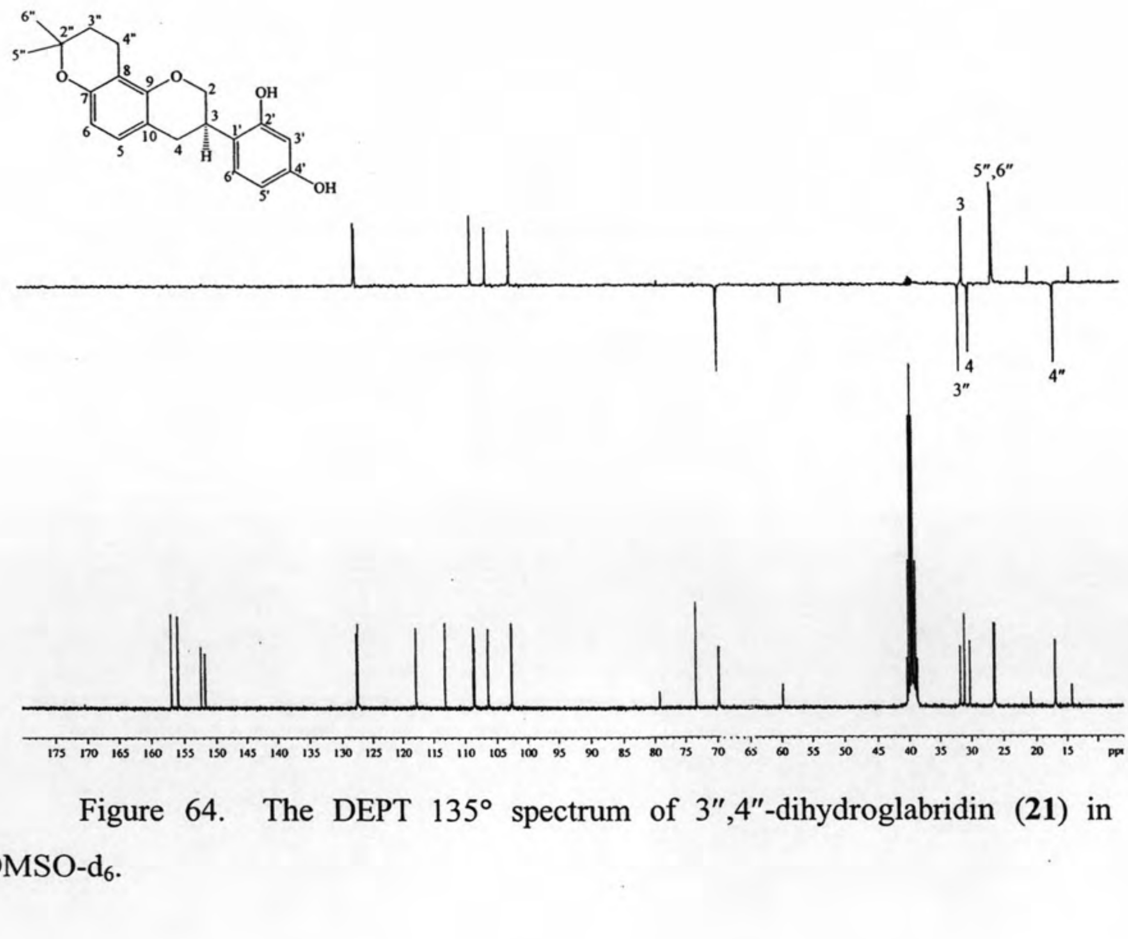

Figure 64. The DEPT 135° spectrum of 3″,4″-dihydroglabridin (**21**) in DMSO-d_6.

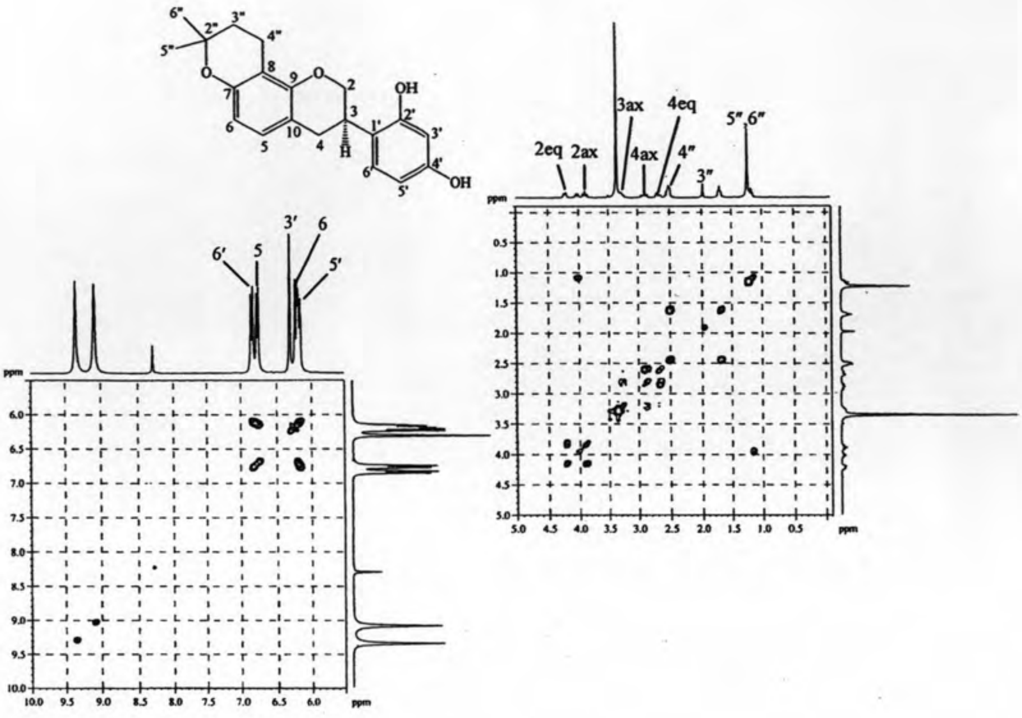

Figure 65. The ^1H-^1H COSY spectrum of 3″,4″-dihydroglabridin (**21**) in DMSO-d_6.

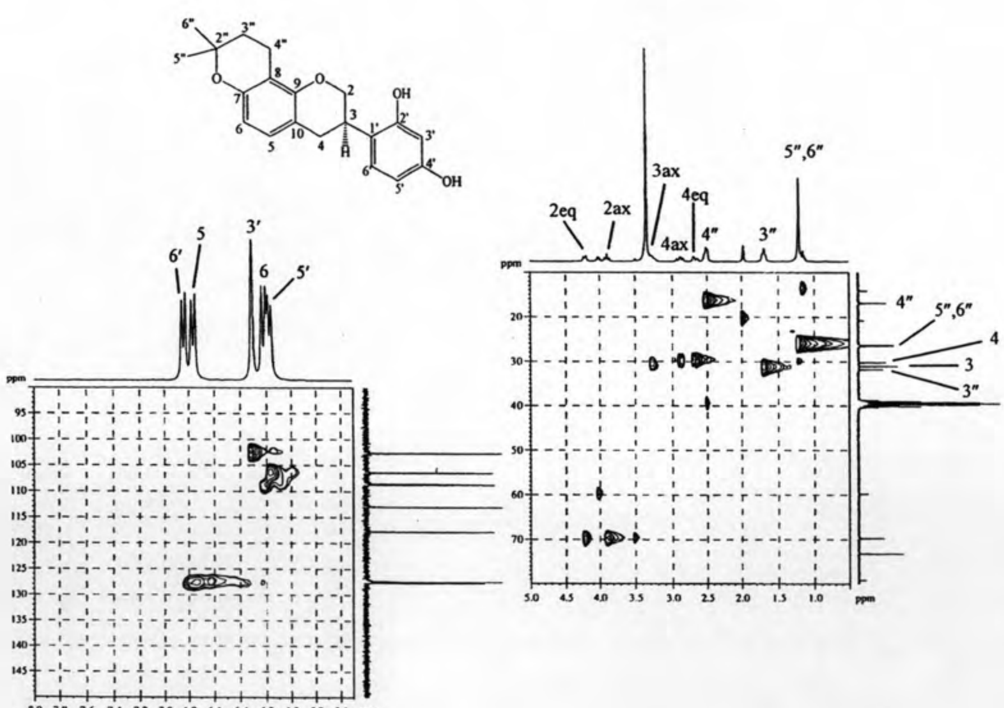

Figure 66. The HMQC spectrum of 3″,4″-dihydroglabridin (**21**) in DMSO-d_6.

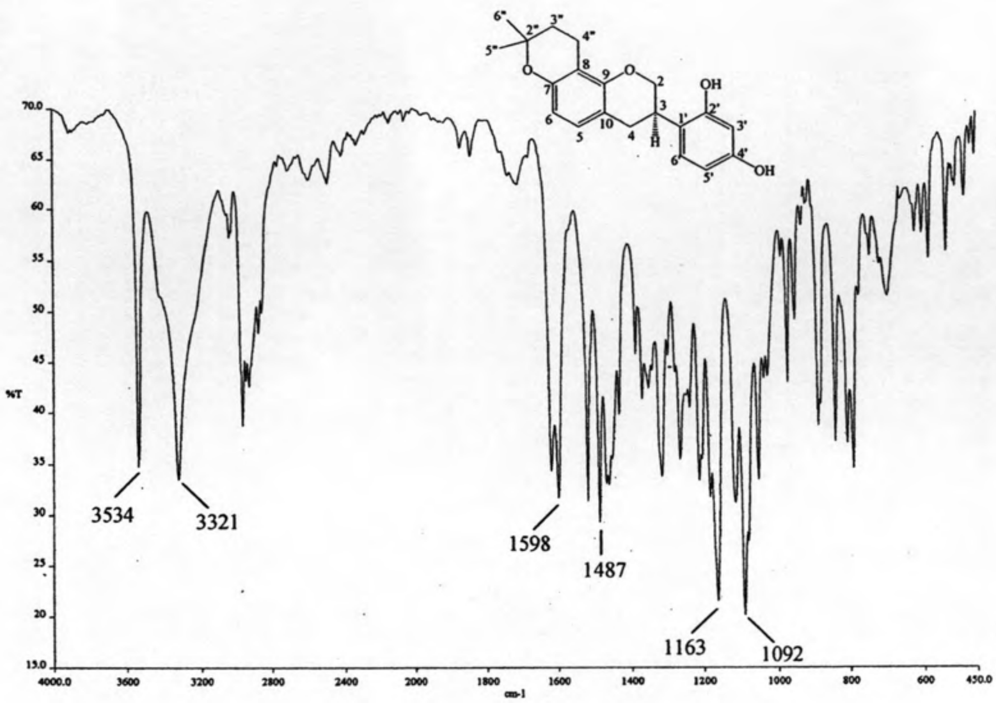

Figure 67. The infrared spectrum of 3″,4″-dihydroglabridin (**21**).

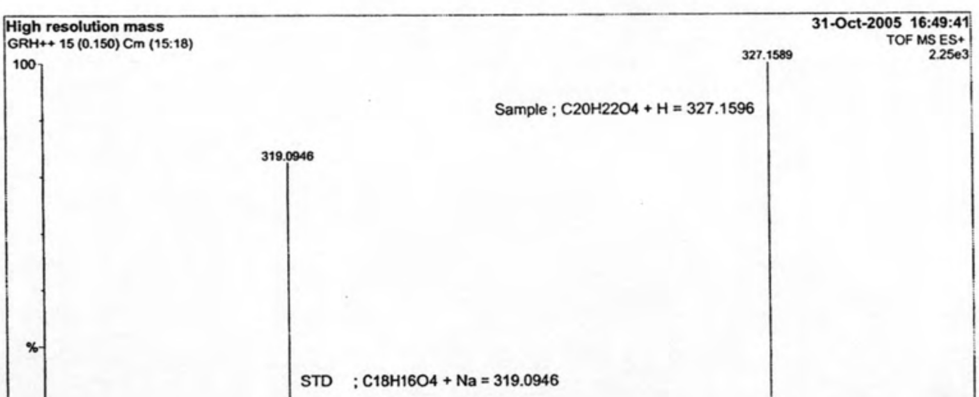

Figure 68. The TOF Mass spectrum of 3″,4″-dihydroglabridin (**21**).

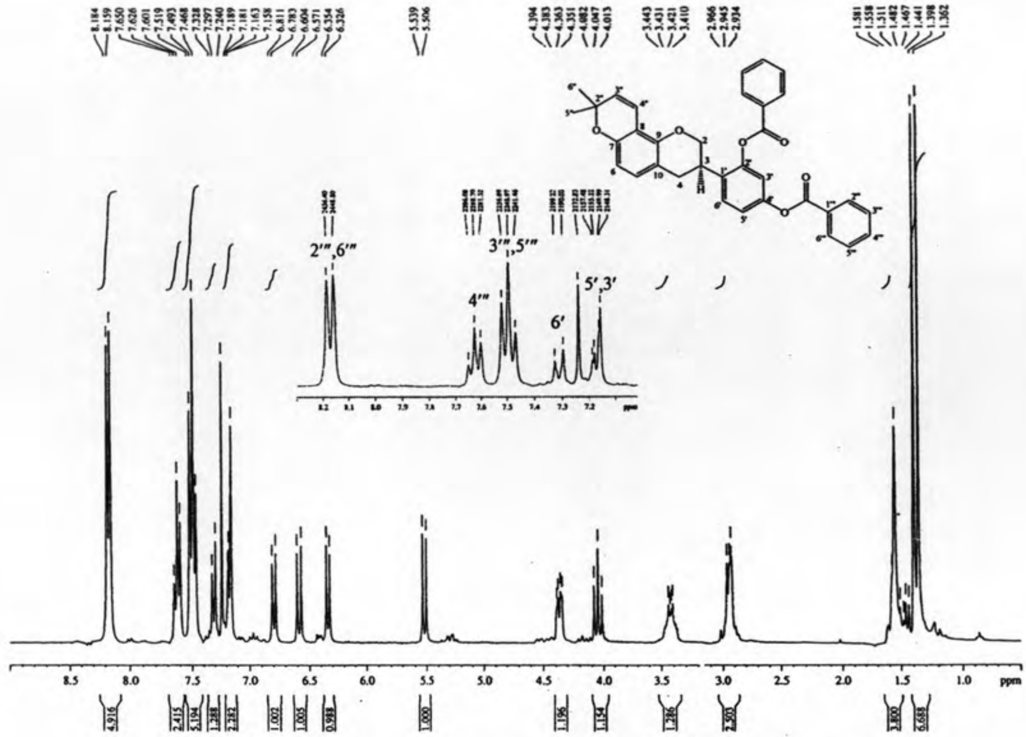

Figure 69. The 300 MHz ^{1}H-NMR spectrum of glabridin-2′,4′-O-dibenzoate (**22**) in $CDCl_3$.

Figure 70. The 75 MHz ^{13}C-NMR spectrum of glabridin-2′,4′-O-dibenzoate (**22**) in $CDCl_3$.

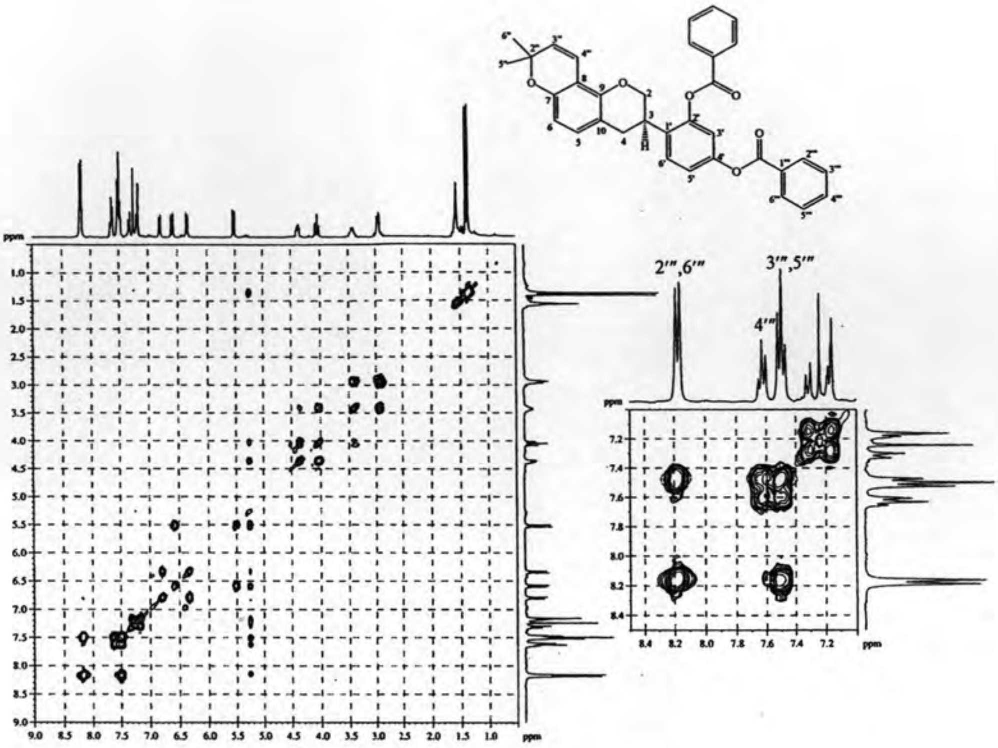

Figure 71. The ^{1}H-^{1}H COSY spectrum of glabridin-2′,4′-O-dibenzoate (**22**) in $CDCl_3$.

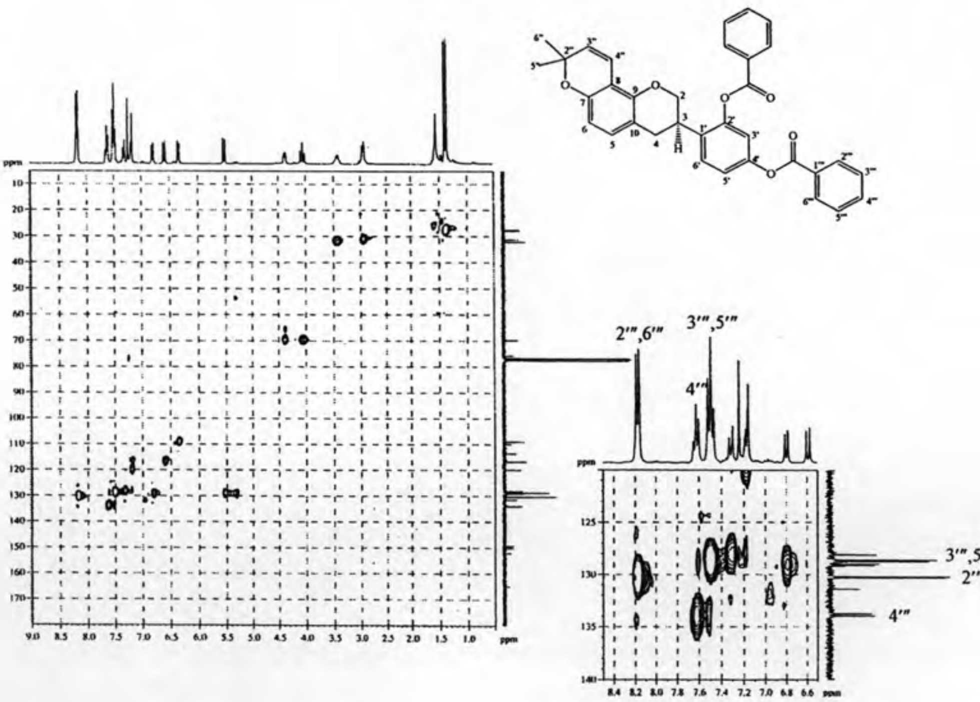

Figure 72. The HMQC spectrum of glabridin-2′,4′-O-dibenzoate (**22**) in $CDCl_3$.

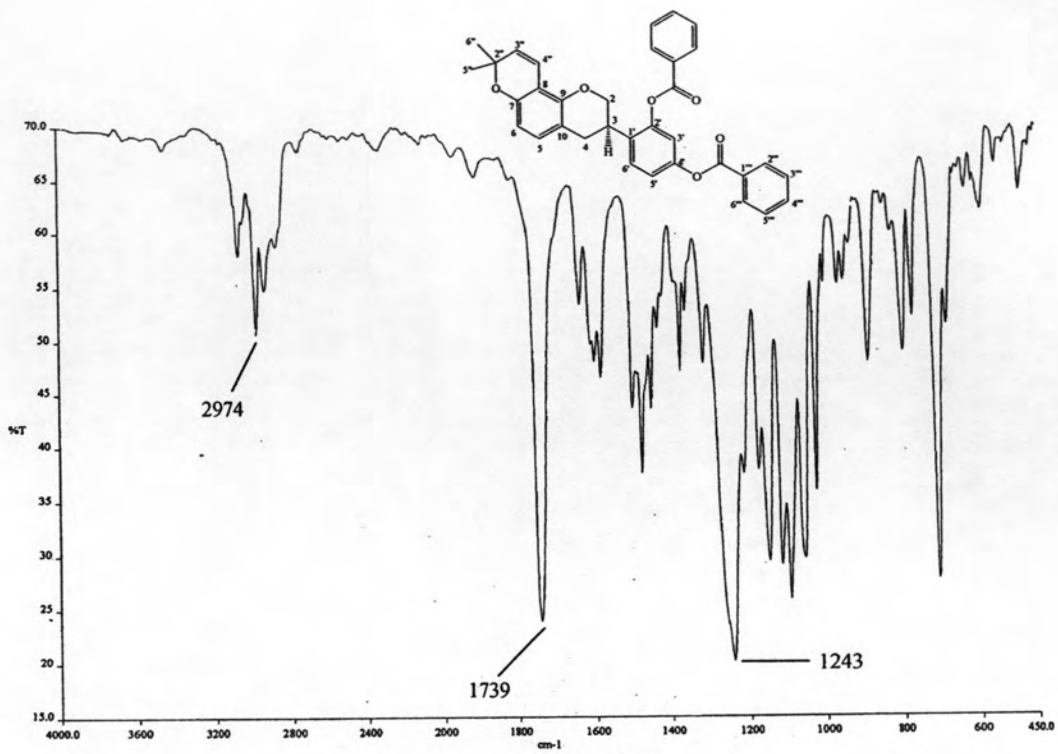

Figure 73. The infrared spectrum of glabridin-2′,4′-O-dibenzoate (**22**).

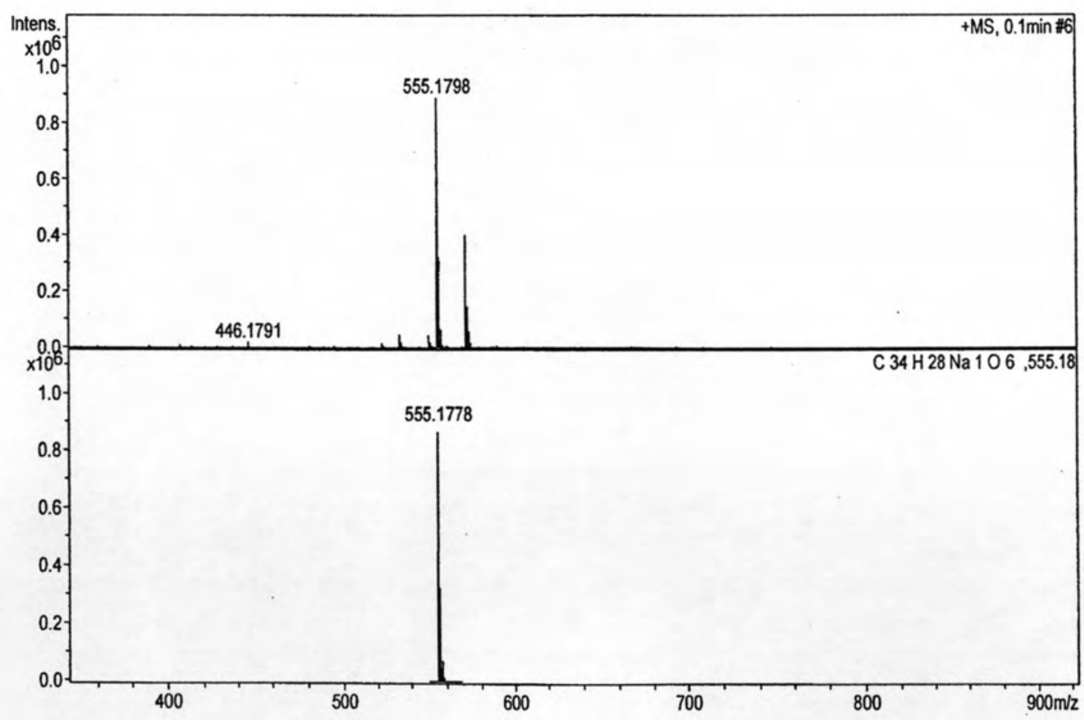

Figure 74. The TOF Mass spectrum of glabridin-2′,4′-O-dibenzoate (**22**)

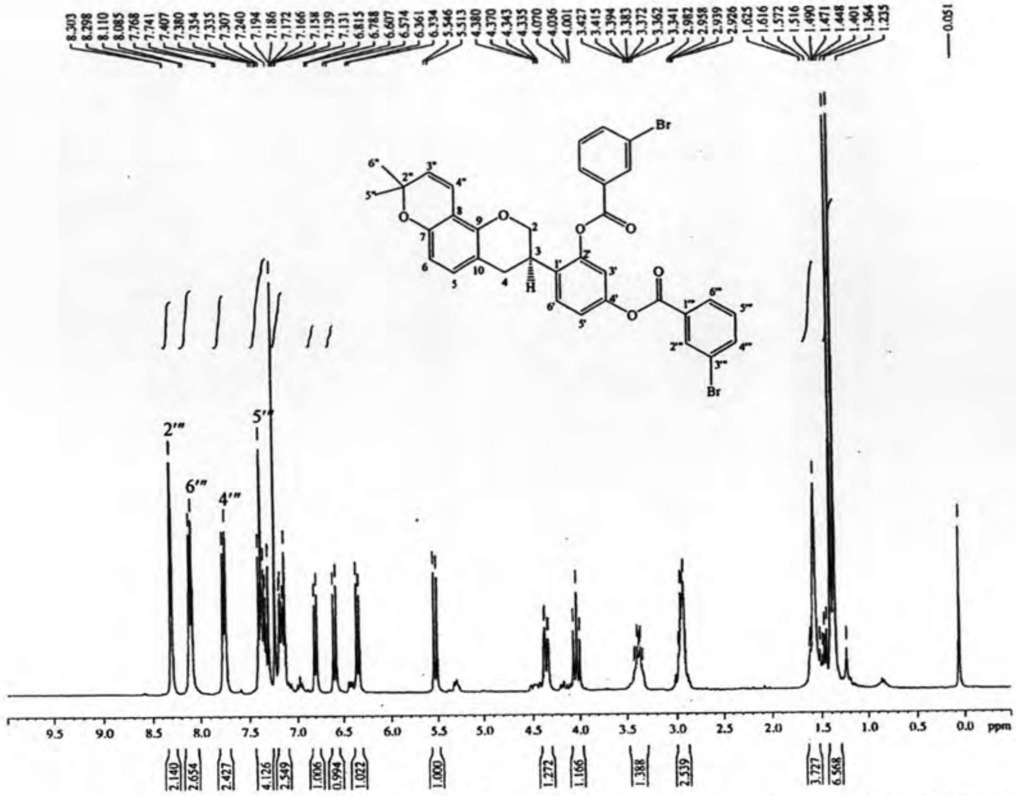

Figure 75. The 300 MHz ^{1}H-NMR spectrum of glabridin-2′,4′-O-di-3‴-bromobenzoate (**23**) in $CDCl_3$.

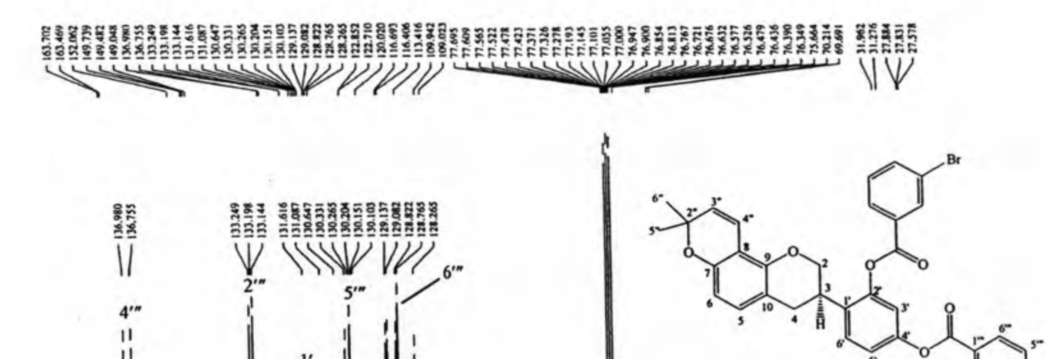

Figure 76. The 75 MHz ^{13}C-NMR spectrum of glabridin-2′,4′-O-di-3‴-bromobenzoate (**23**) in $CDCl_3$.

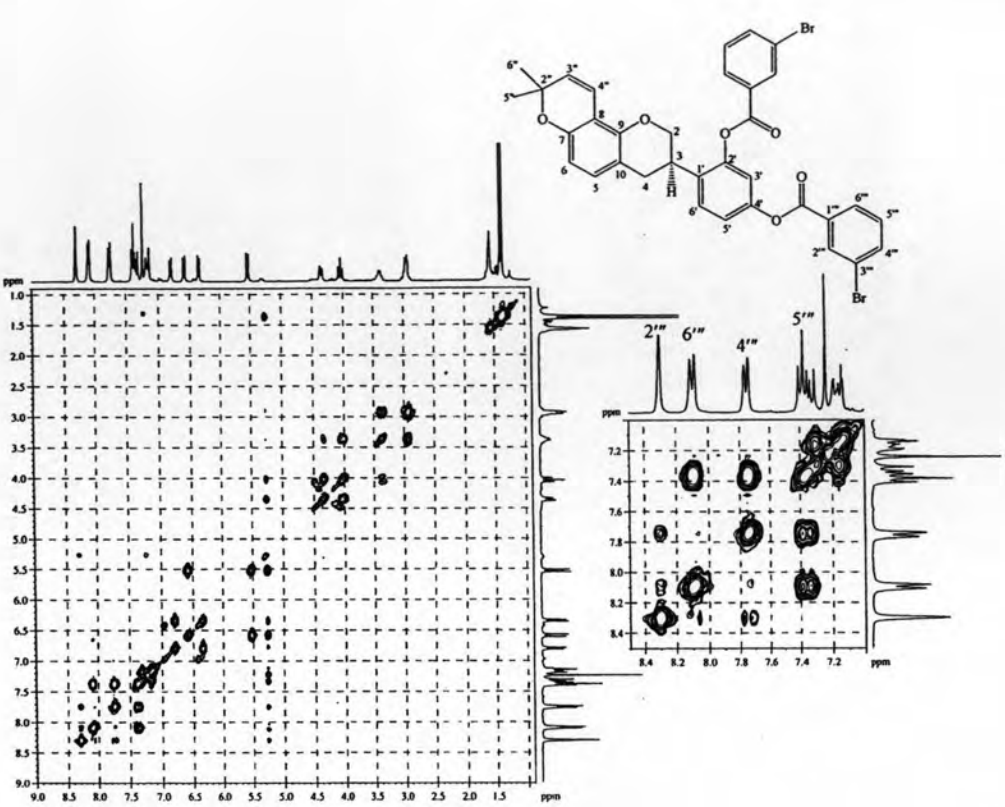

Figure 77. The ^1H-^1H COSY spectrum of glabridin-2′,4′-O-di-3‴-bromobenzoate (**23**) in $CDCl_3$.

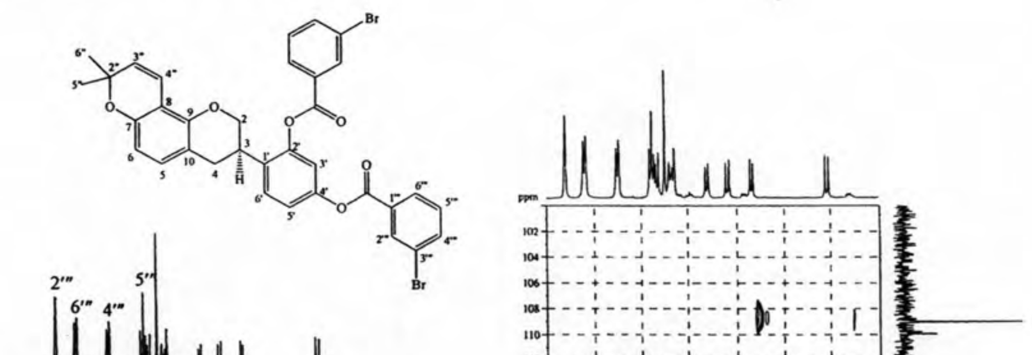

Figure 78. The HMQC spectrum of glabridin-2′,4′-O-di-3‴-bromobenzoate (**23**) in $CDCl_3$.

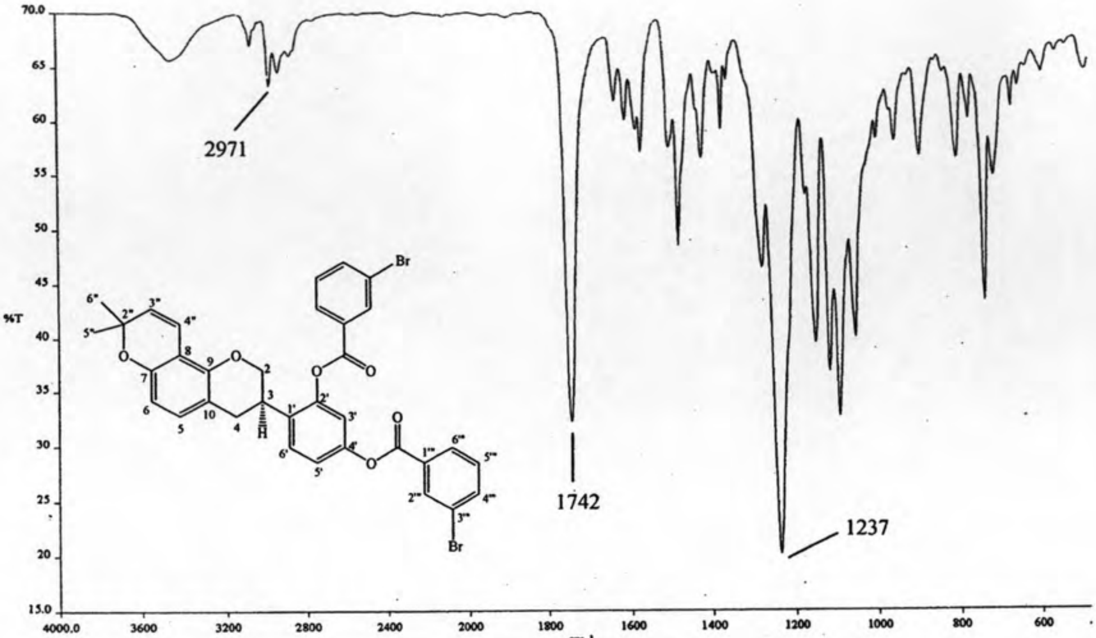

Figure 79. The infrared spectrum of glabridin-2′,4′-O-di-3′′′-bromobenzoate (**23**).

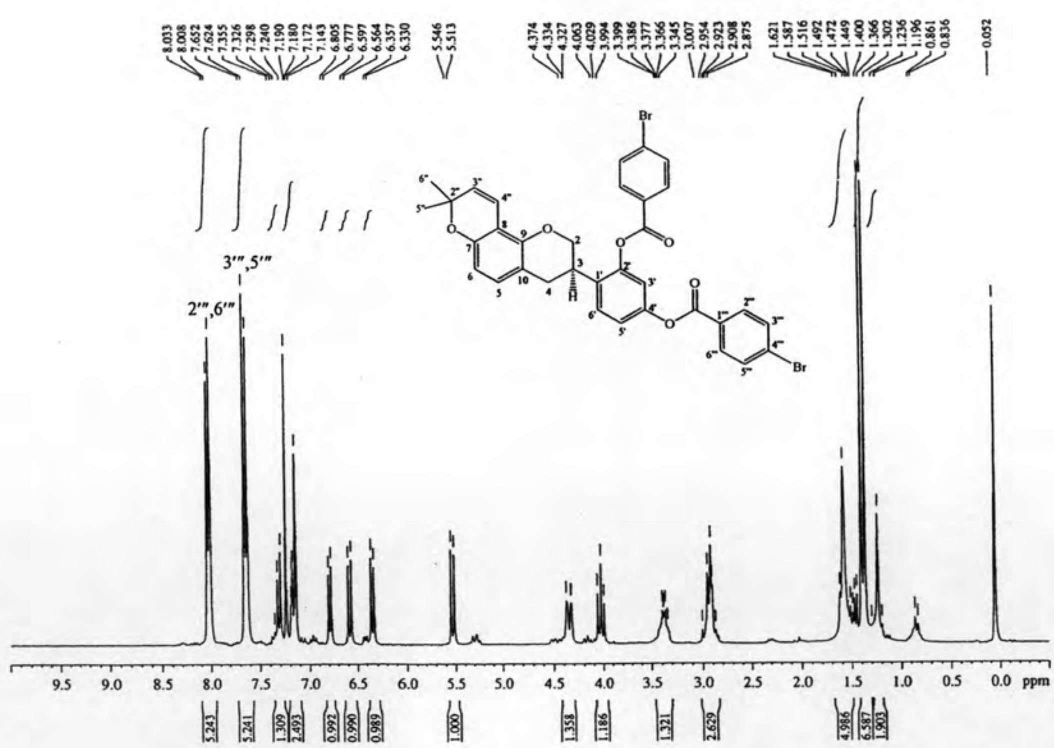

Figure 80. The 300 MHz ^{1}H-NMR spectrum of glabridin-2′,4′-O-di-4′′′-bromobenzoate (**24**) in $CDCl_3$.

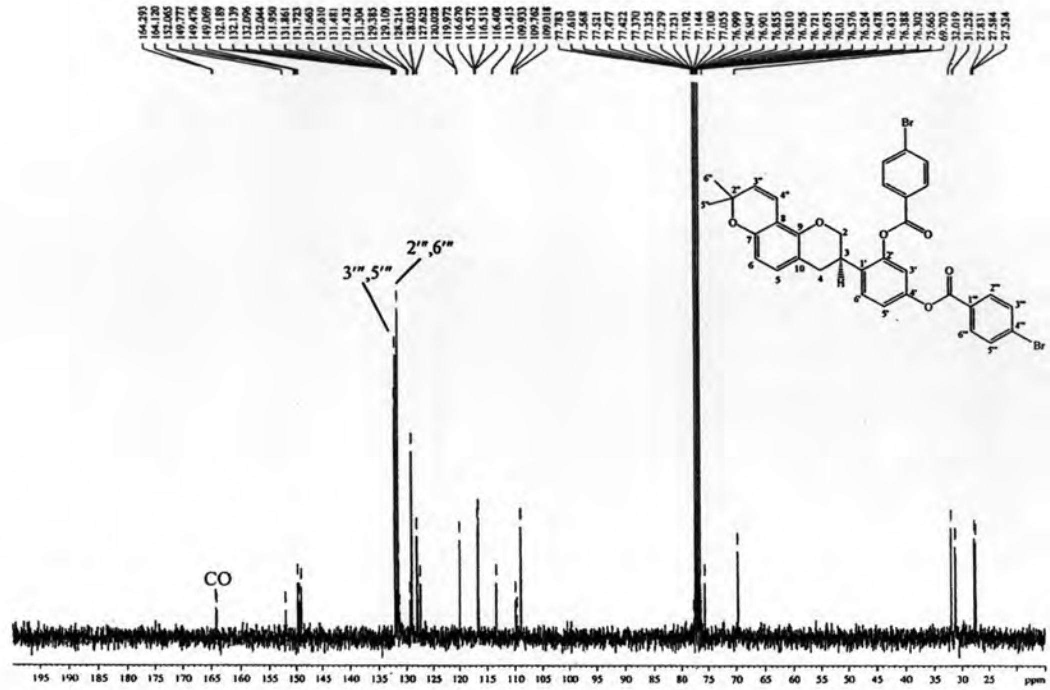

Figure 81. The 75 MHz ^{13}C-NMR spectrum of glabridin-2′,4′-O-di-4‴-bromobenzoate (**24**) in $CDCl_3$.

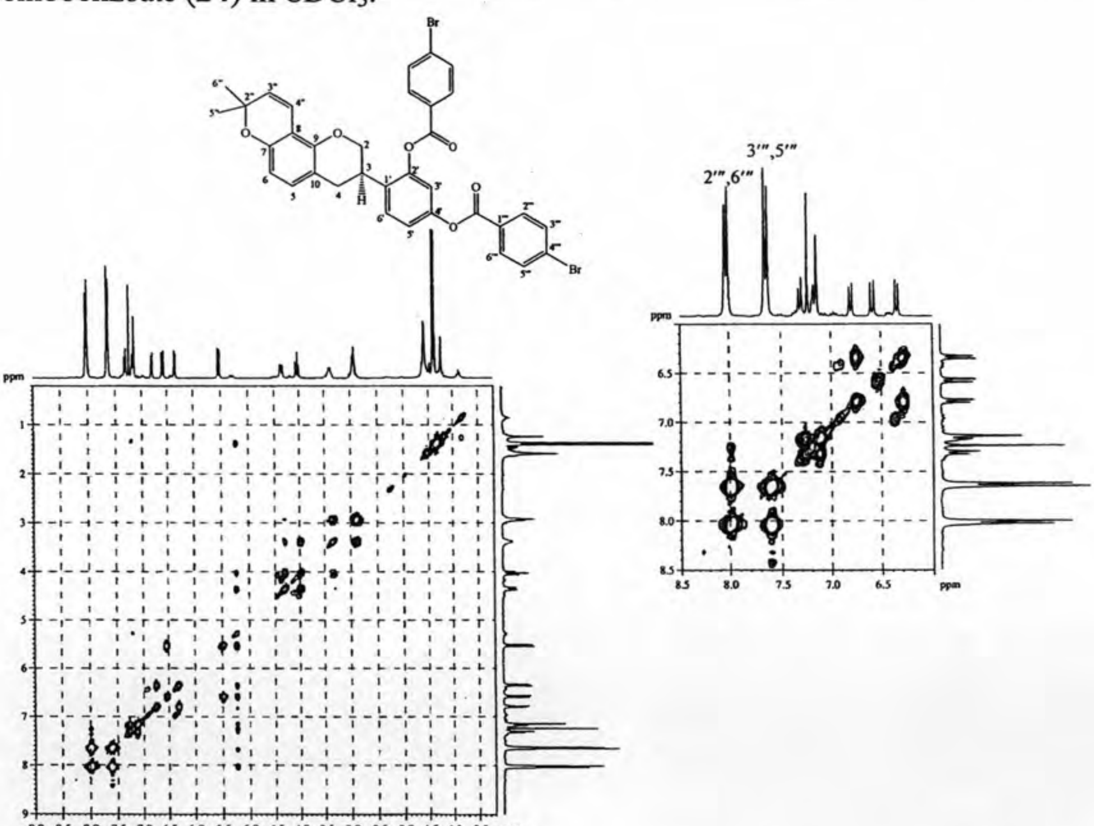

Figure 82. The ^{1}H-^{1}H COSY spectrum of glabridin-2′,4′-O-di-4‴-bromobenzoate (**24**) in $CDCl_3$.

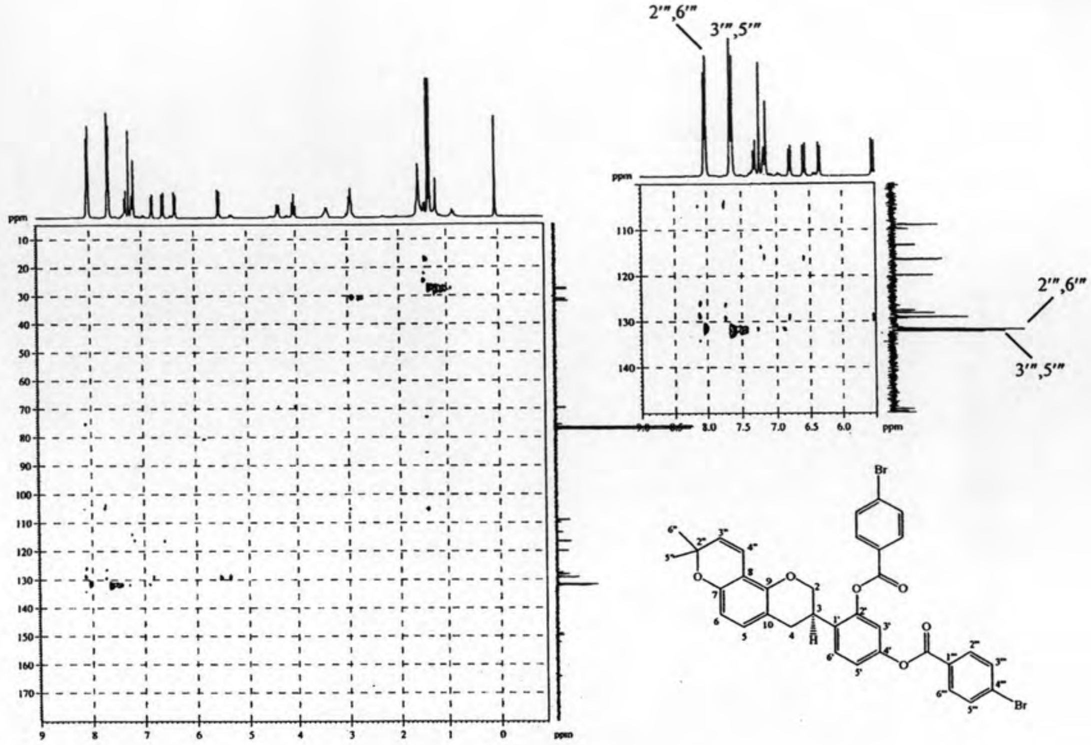

Figure 83. The HMQC spectrum of glabridin-2′,4′-O-di-4′′′-bromobenzoate (**24**) in $CDCl_3$.

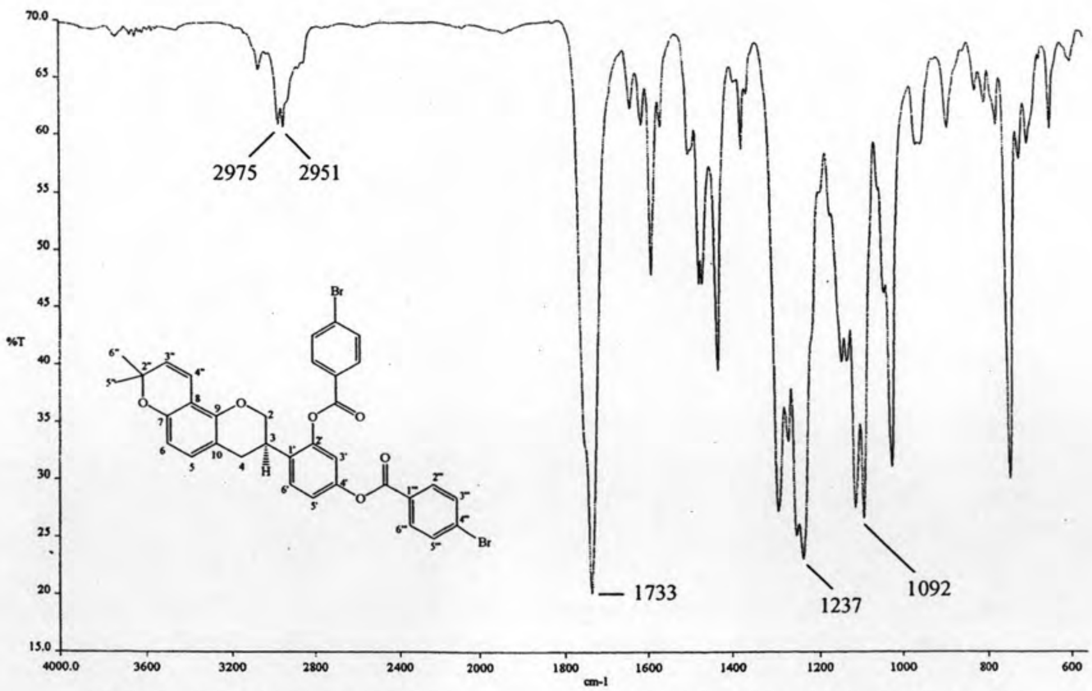

Figure 84. The infrared spectrum of glabridin-2′,4′-O-di-4′′′-bromobenzoate (**24**).

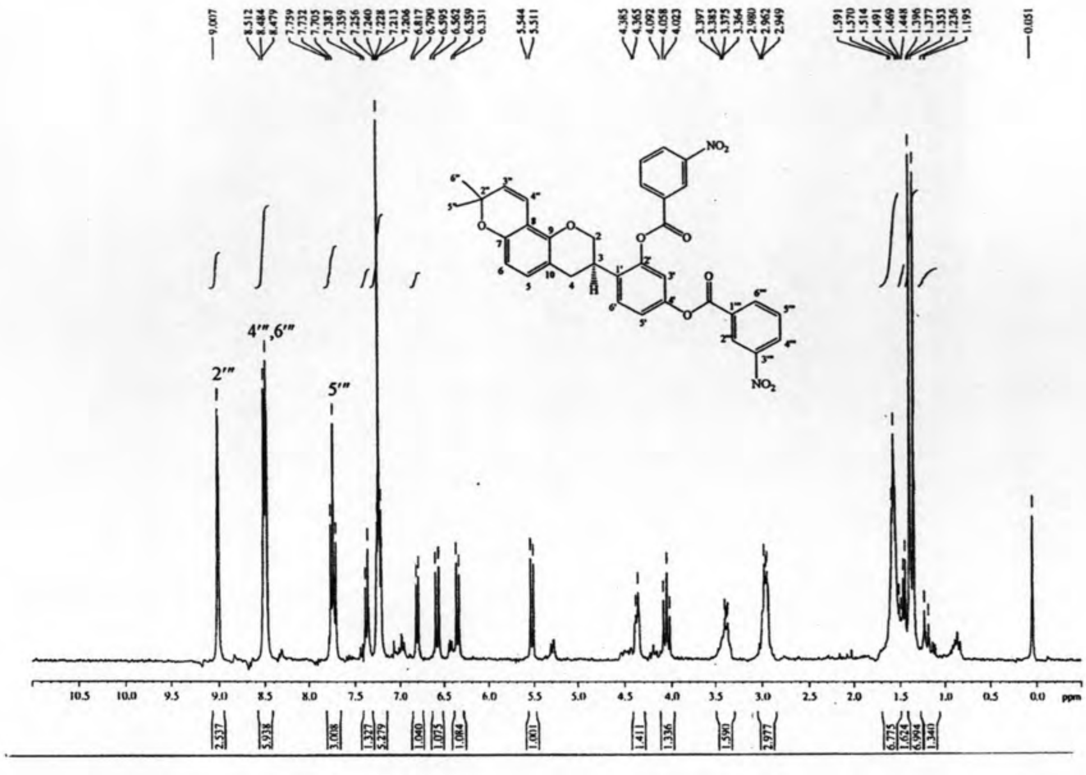

Figure 85. The 300 MHz ^{1}H-NMR spectrum of glabridin-2′,4′-O-di-3′′′-nitrobenzoate (**25**) in $CDCl_3$.

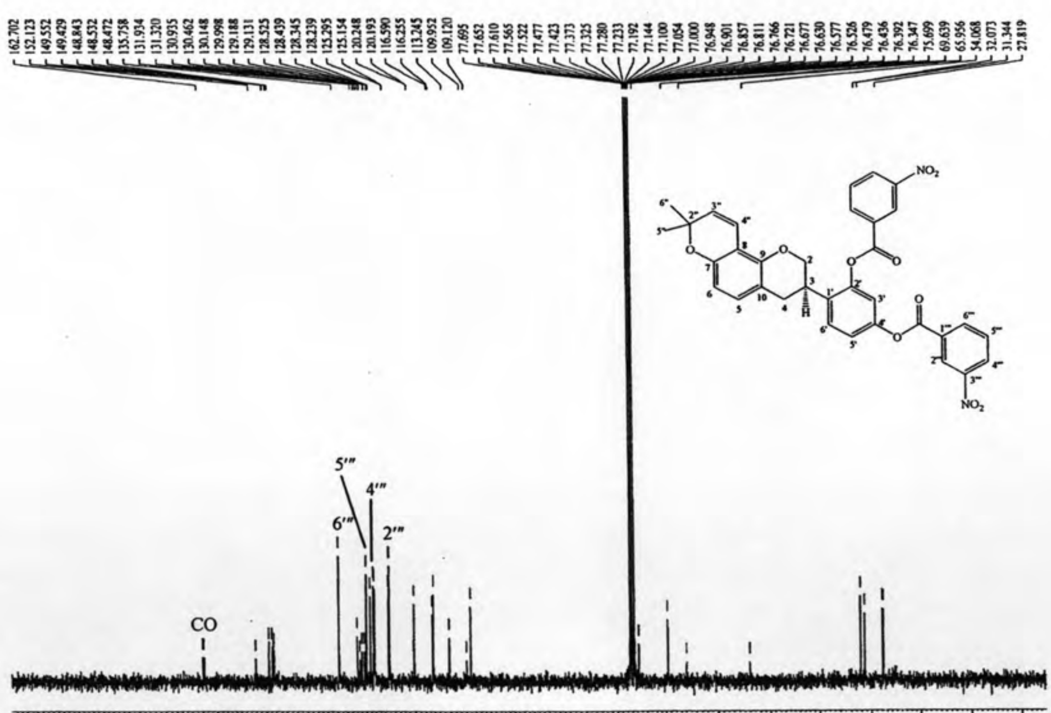

Figure 86. The 75 MHz ^{13}C-NMR spectrum of glabridin-2′,4′-O-di-3′′′-nitrobenzoate (**25**) in $CDCl_3$.

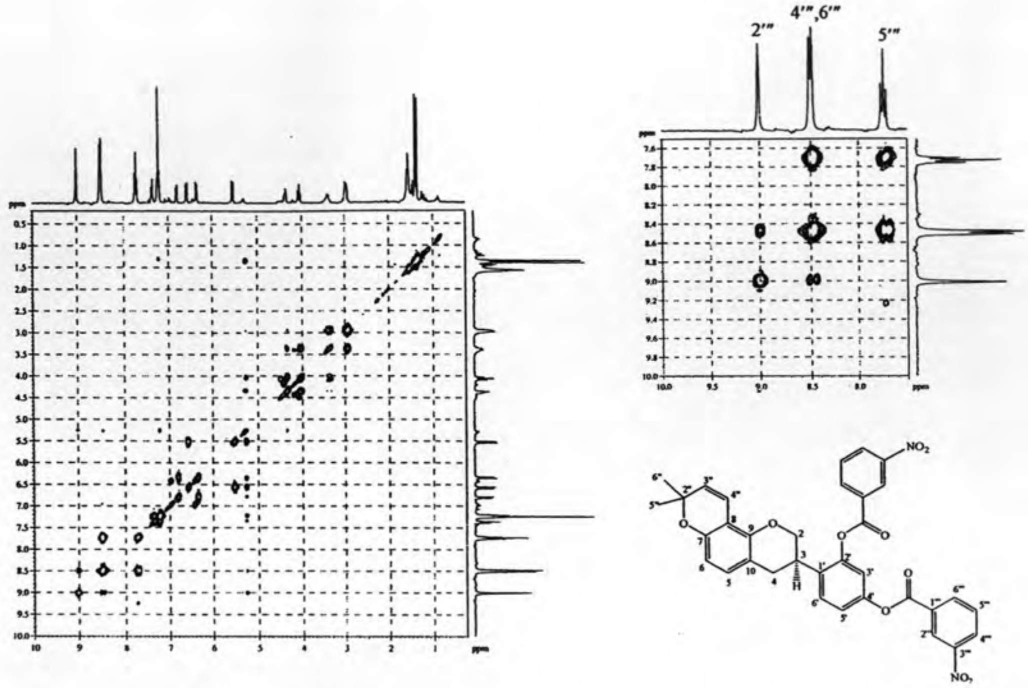

Figure 87. The ^{1}H-^{1}H COSY spectrum of glabridin-2′,4′-O-di-3′′′-nitrobenzoate (**25**) in $CDCl_3$.

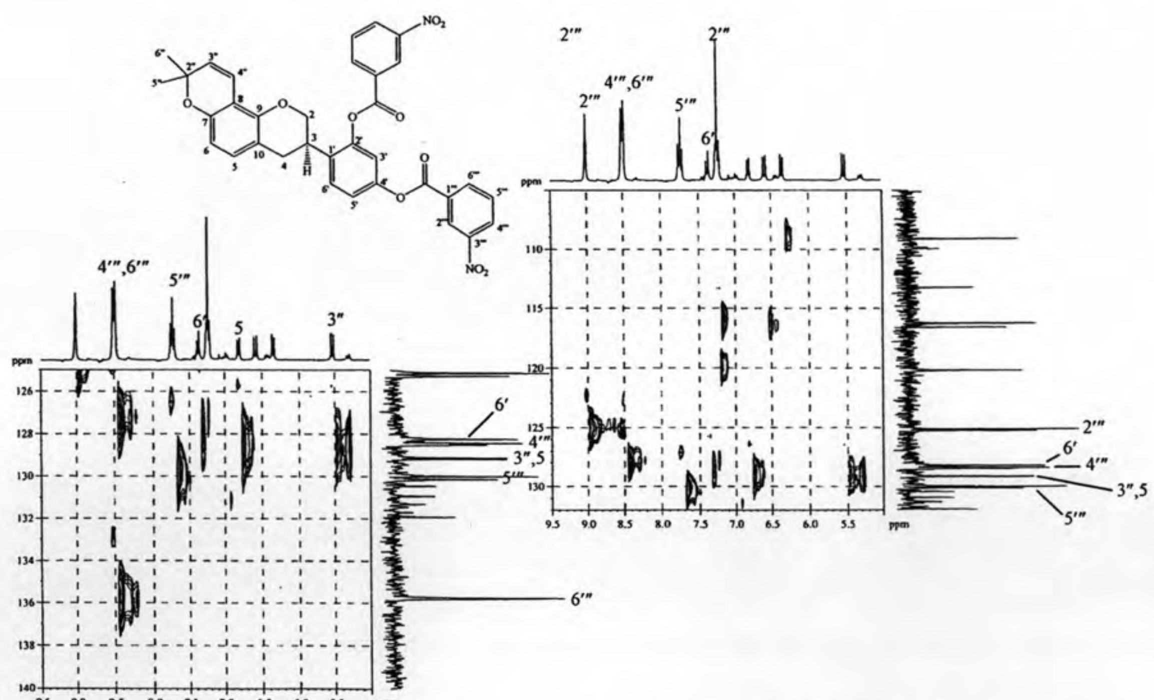

Figure 88. The HMQC spectrum of glabridin-2′,4′-O-di-3′′′-nitrobenzoate (**25**) in $CDCl_3$.

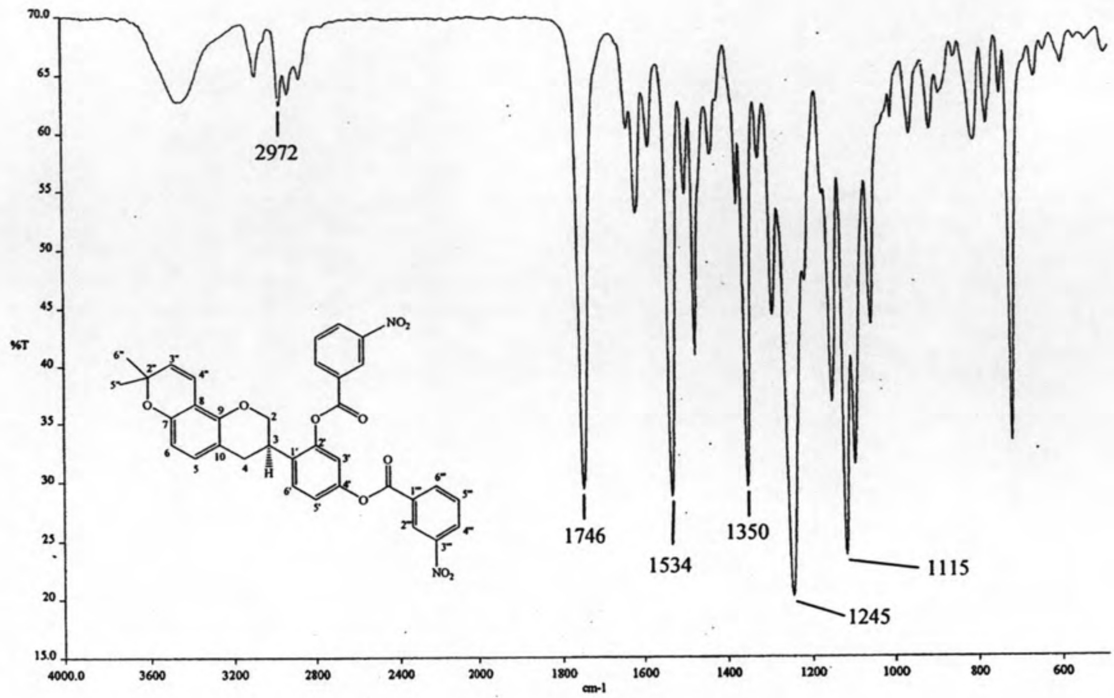

Figure 89. The infrared spectrum of glabridin-2′,4′-O-di-3‴-nitrobenzoate **(25)**.

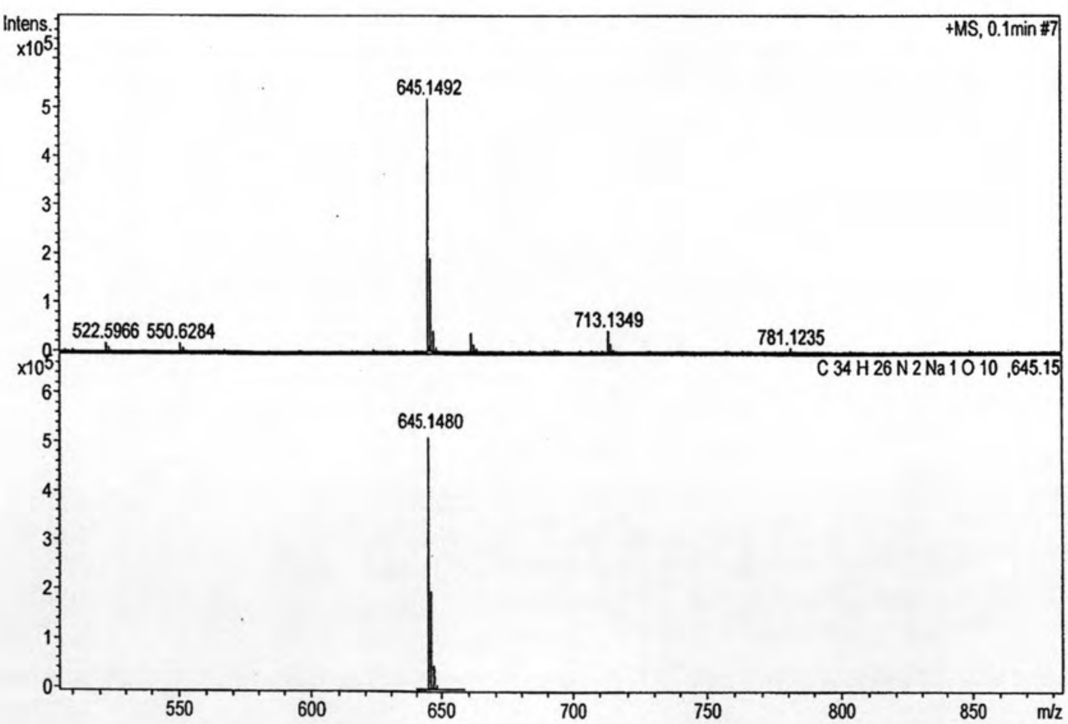

Figure 90 The TOF Mass spectrum of glabridin-2′,4′-O-di-3‴-nitrobenzoate **(25)**.

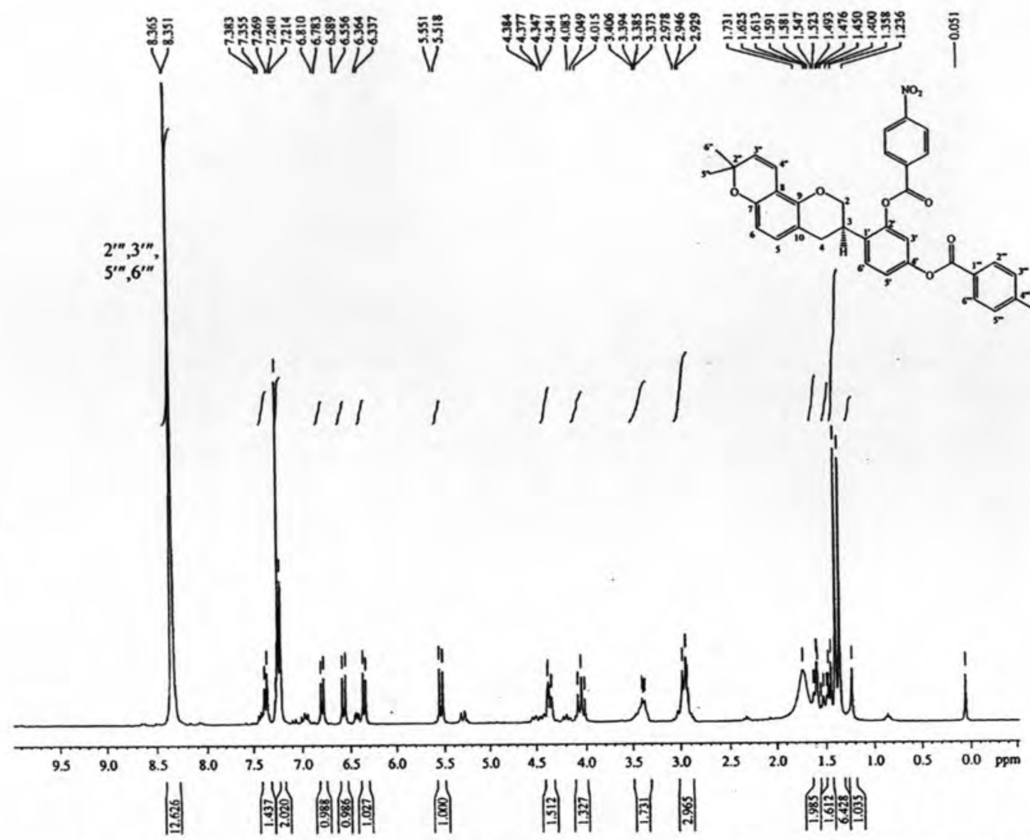

Figure 91. The 300 MHz ^{1}H-NMR spectrum of glabridin-2',4'-O-di-4'''-nitrobenzoate (**26**) in $CDCl_3$.

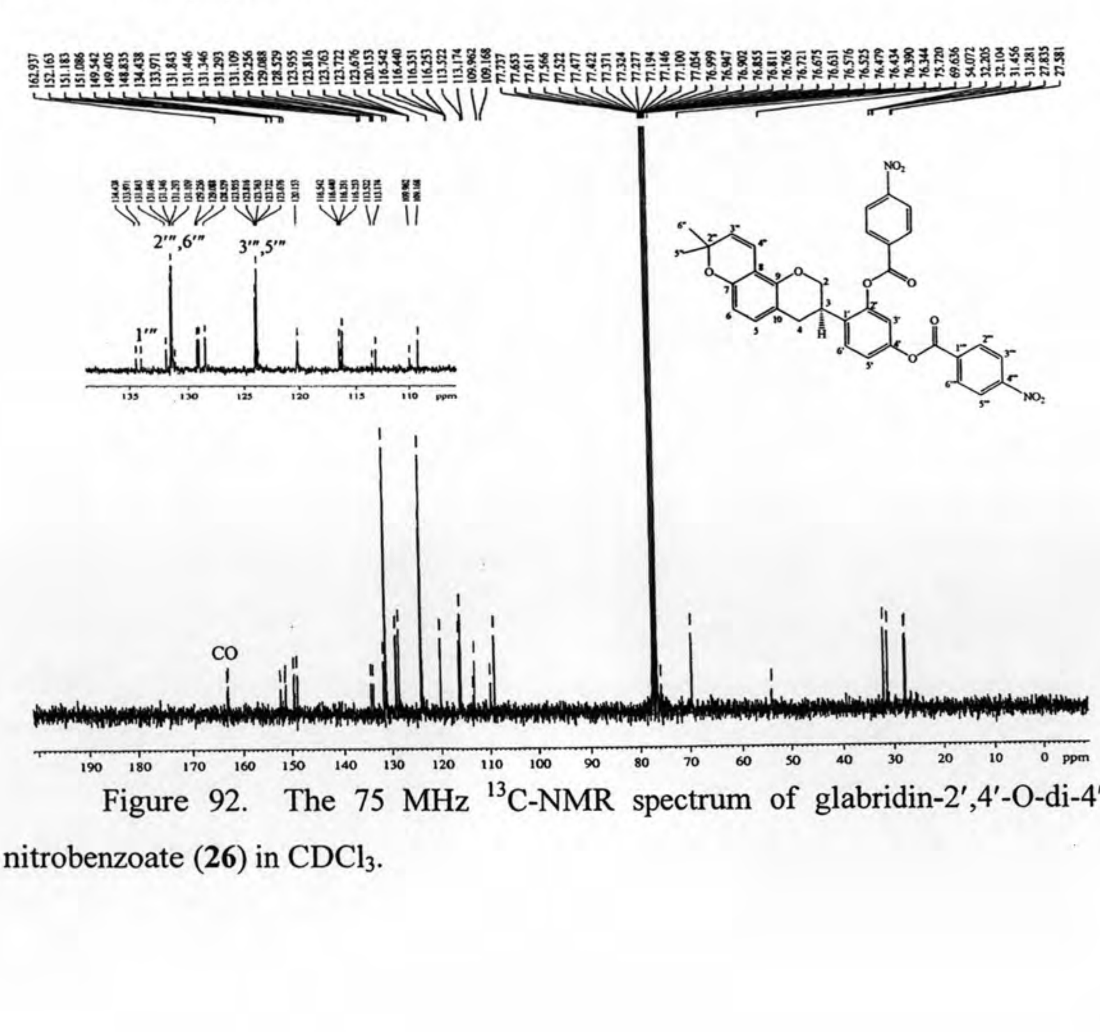

Figure 92. The 75 MHz ^{13}C-NMR spectrum of glabridin-2',4'-O-di-4'''-nitrobenzoate (**26**) in $CDCl_3$.

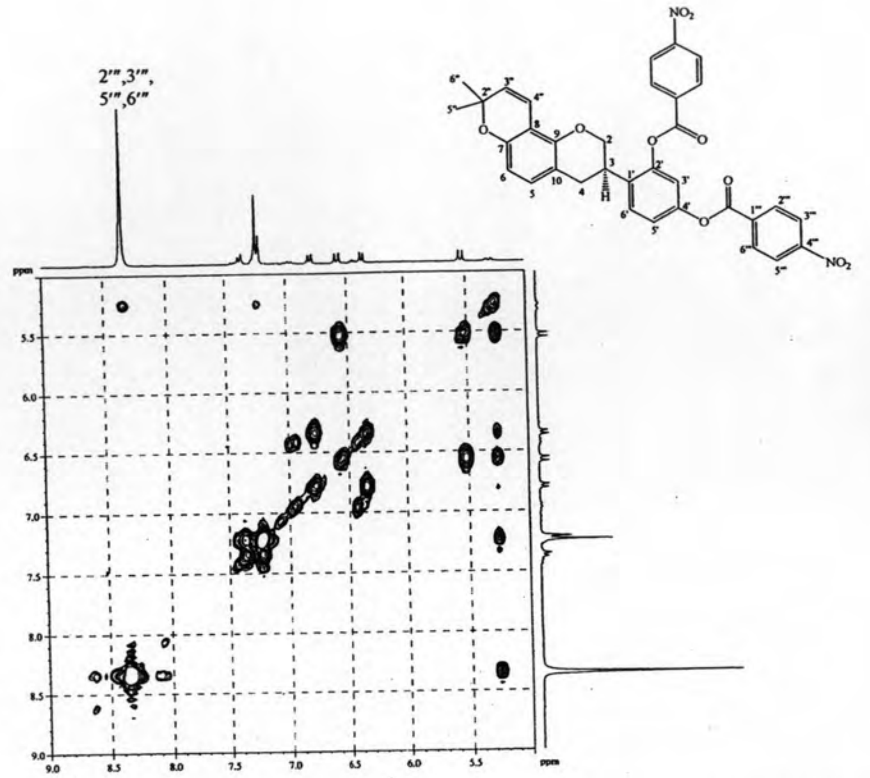

Figure 93. The ^{1}H-^{1}H COSY spectrum of glabridin-2′,4′-O-di-4‴-nitrobenzoate (**26**) in $CDCl_3$.

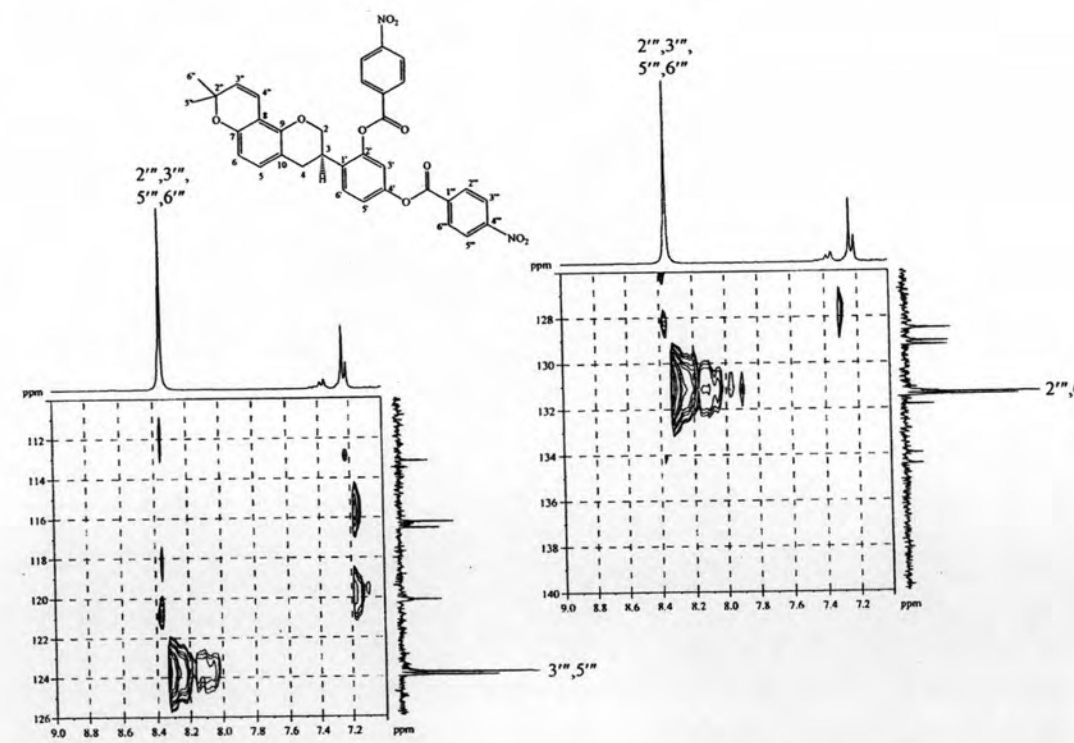

Figure 94. The HMQC spectrum of glabridin-2′,4′-O-di-4‴-nitrobenzoate (**26**) in $CDCl_3$.

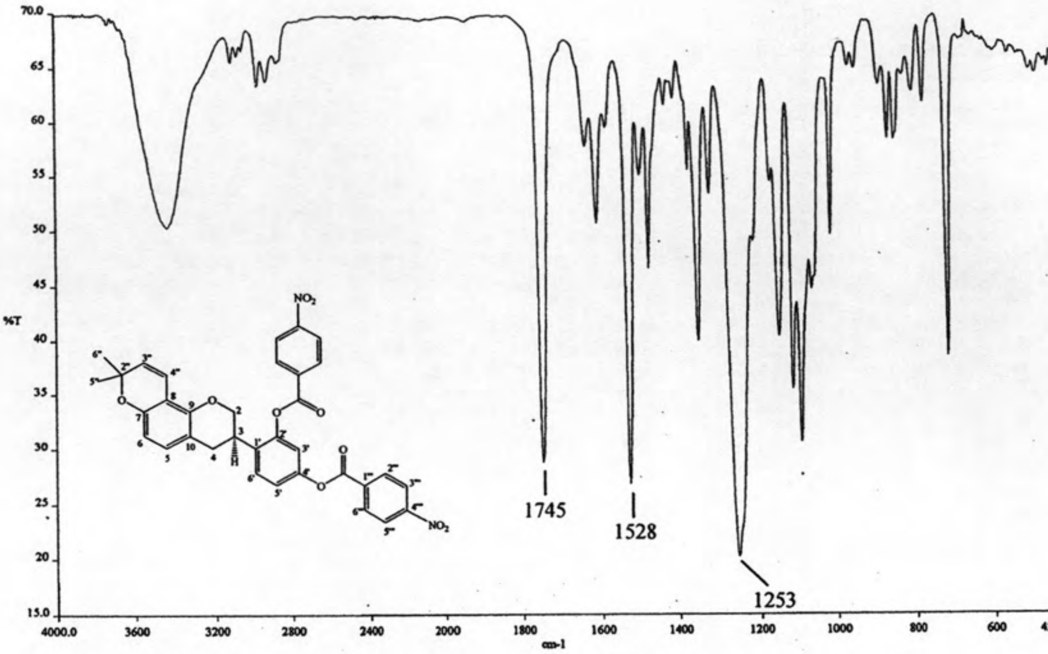

Figure 95. The infrared spectrum of glabridin-2′,4′-O-di-4‴-nitrobenzoate (**26**).

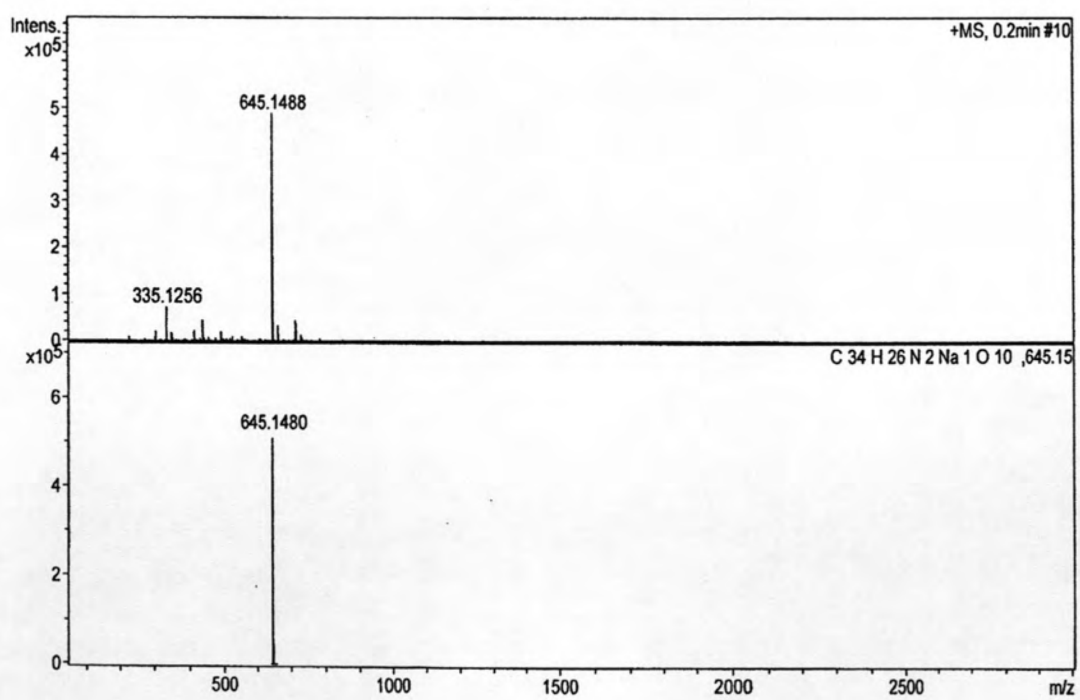

Figure 96. The TOF Mass spectrum of glabridin-2′,4′-O-di-4‴-nitrobenzoate (**26**).

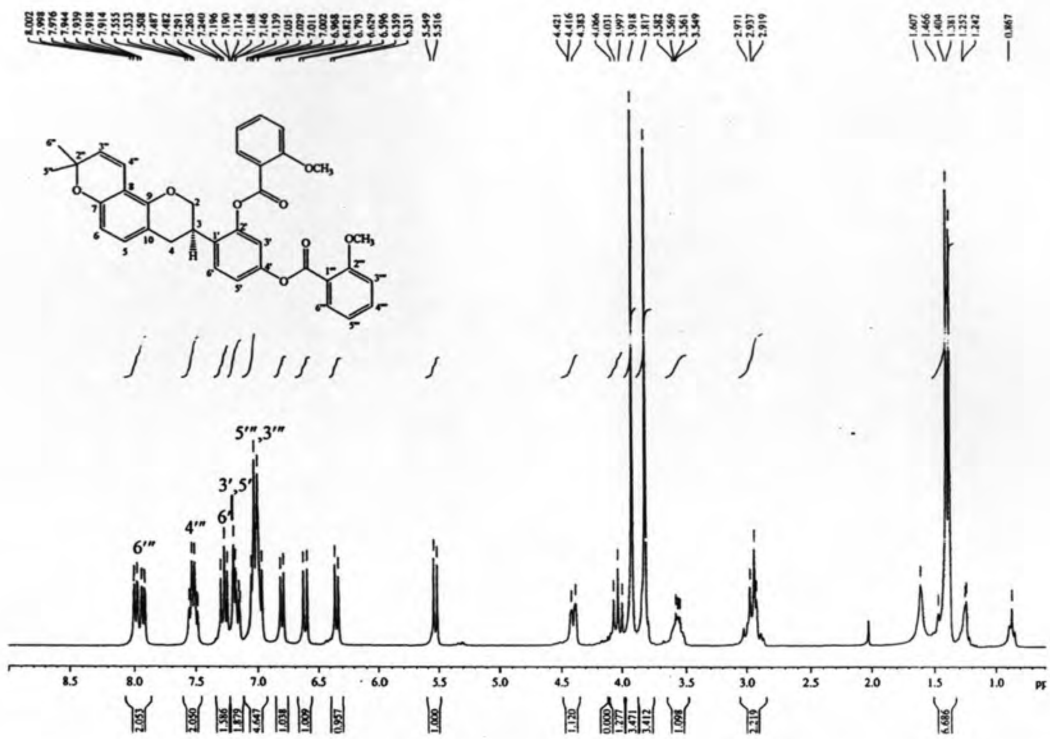

Figure 97. The 300 MHz ^{1}H-NMR spectrum of glabridin-2′,4′-O-di-2‴-methoxybenzoate (**27**) in $CDCl_3$.

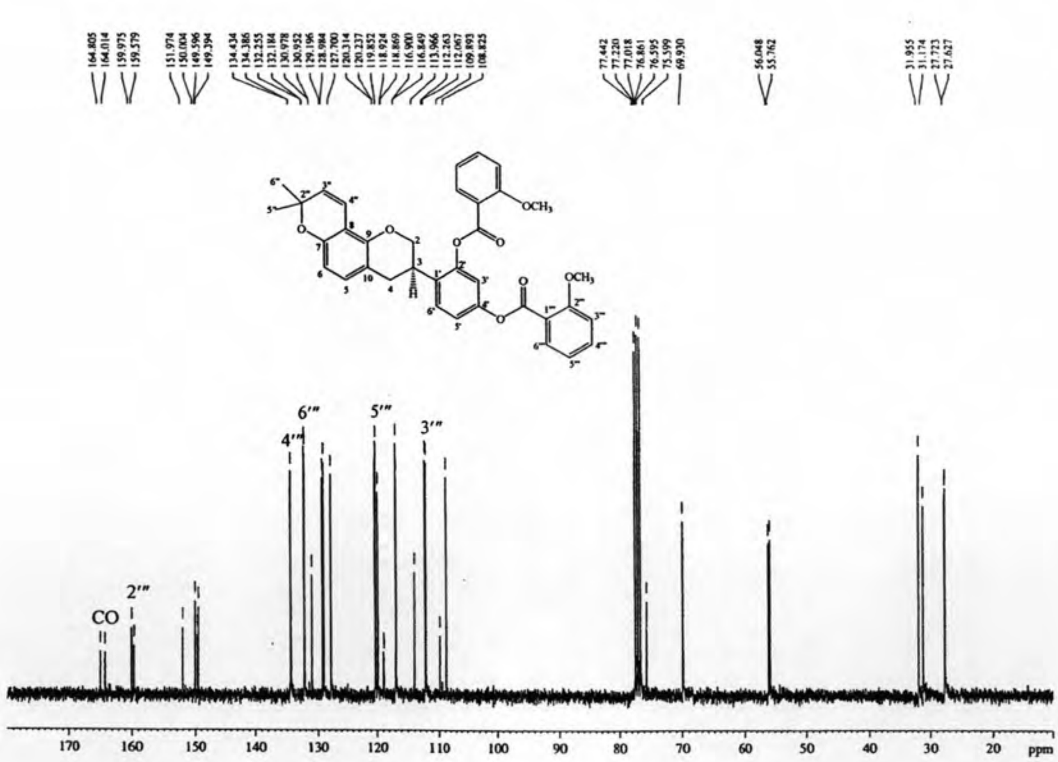

Figure 98. The 75 MHz ^{13}C-NMR spectrum of glabridin-2′,4′-O-di-2‴-methoxybenzoate (**27**) in $CDCl_3$.

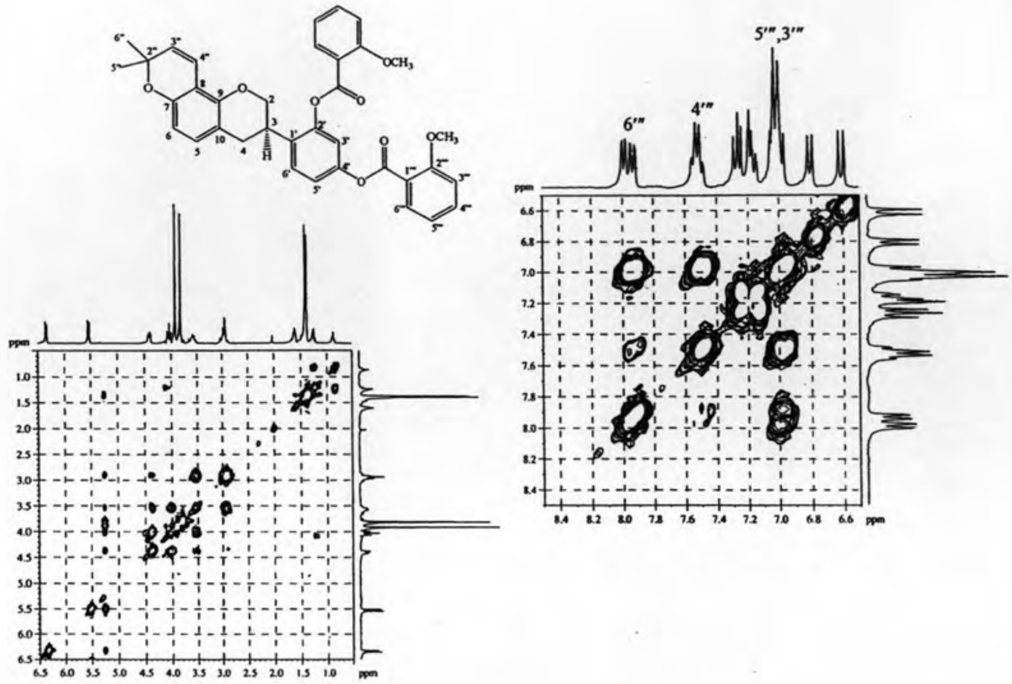

Figure 99. The ^{1}H-^{1}H COSY spectrum of glabridin-2',4'-O-di-2'''-methoxybenzoate (**27**) in $CDCl_3$.

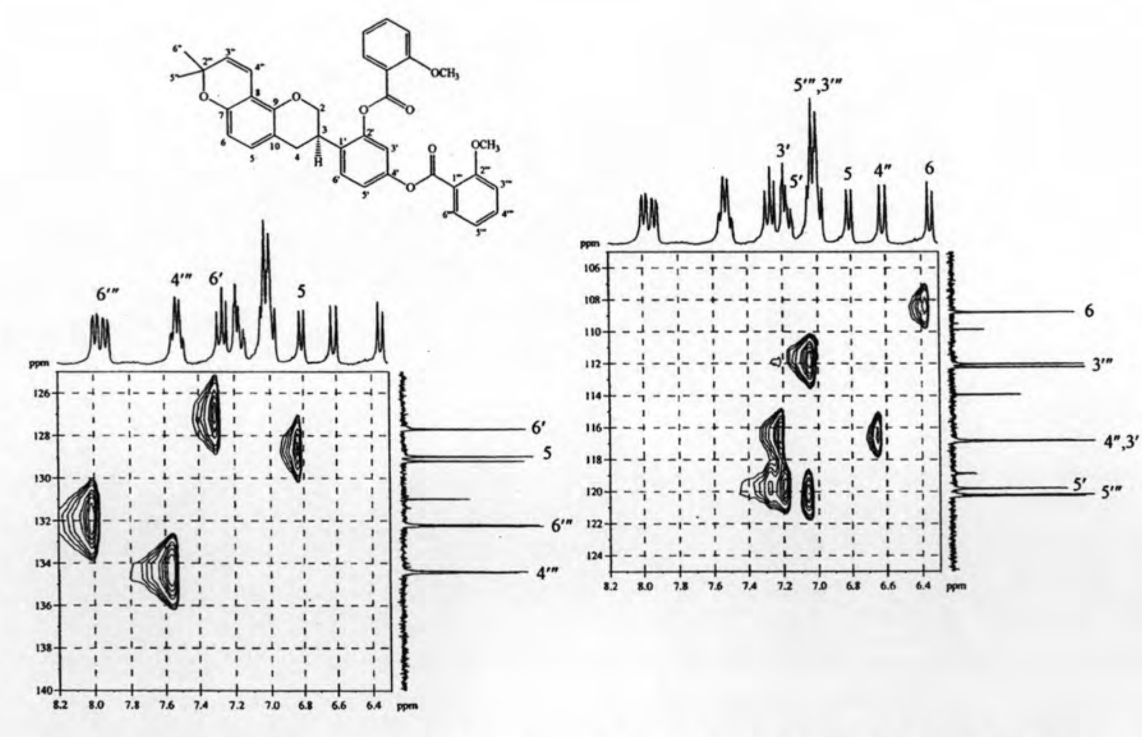

Figure 100. The HMQC spectrum of glabridin-2',4'-O-di-2'''-methoxybenzoate (**27**) in $CDCl_3$.

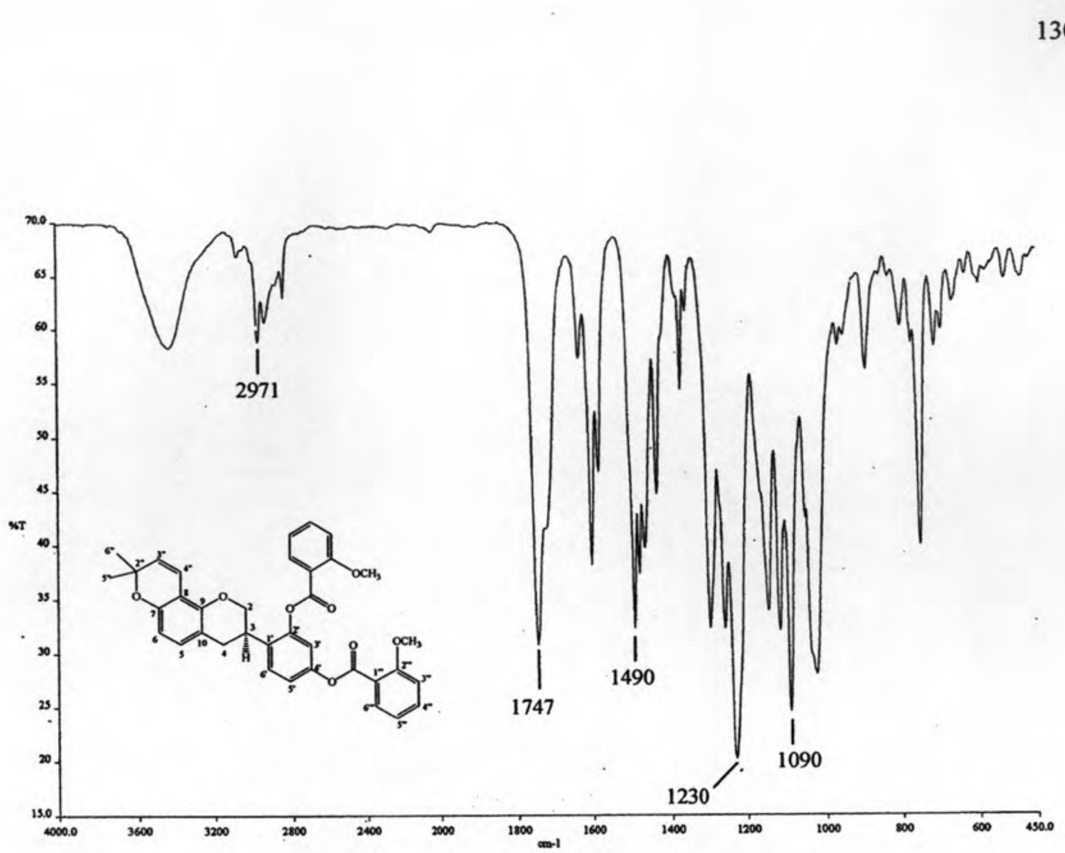

Figure 101. The infrared spectrum of glabridin-2′,4′-O-di-2‴-methoxybenzoate (**27**).

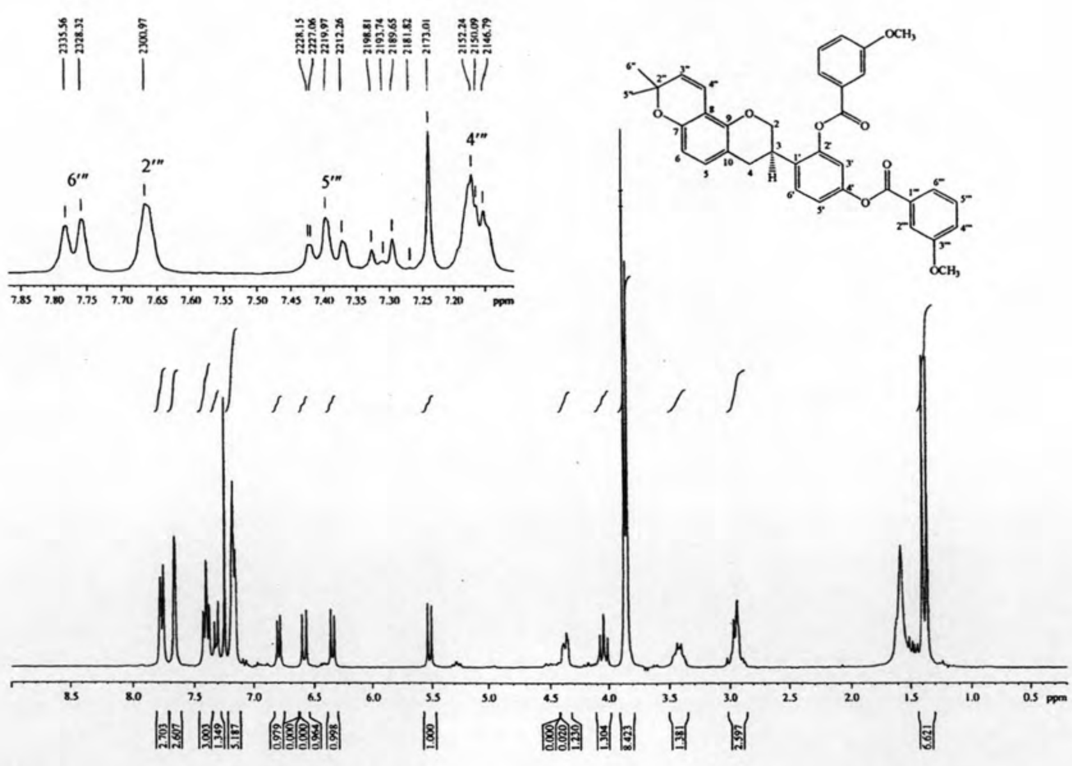

Figure 102. The 300 MHz ^{1}H-NMR spectrum of glabridin-2′,4′-O-di-3‴-methoxybenzoate (**28**) in $CDCl_3$.

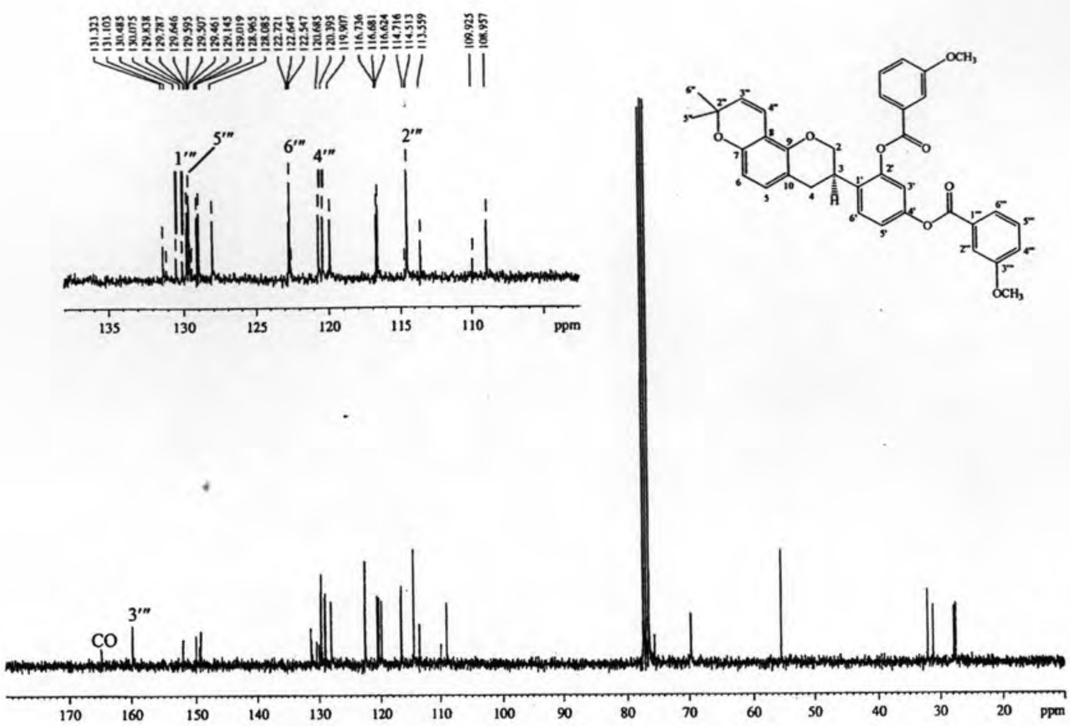

Figure 103. The 75 MHz ^{13}C-NMR spectrum of glabridin-2′,4′-O-di-3‴-methoxybenzoate (**28**) in $CDCl_3$.

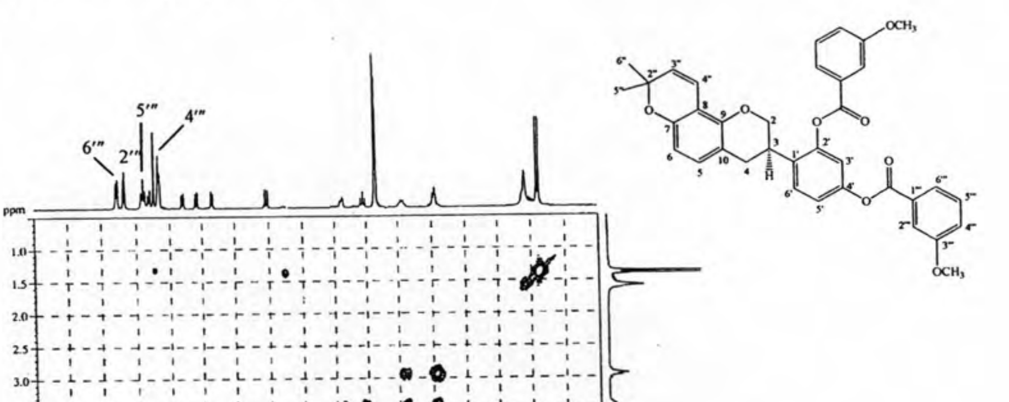

Figure 104. The ^{1}H-^{1}H COSY spectrum of glabridin-2′,4′-O-di-3‴-methoxybenzoate (**28**) in $CDCl_3$.

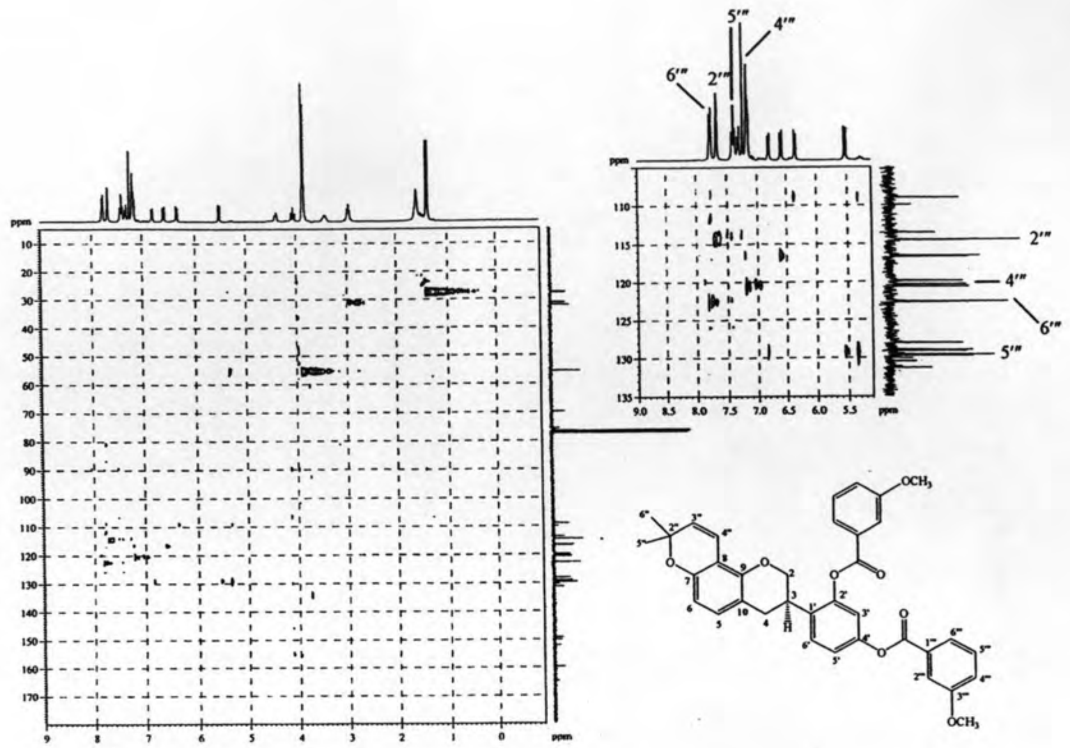

Figure 105. The HMQC spectrum of glabridin-2′,4′-O-di-3‴-methoxy-benzoate (**28**) in $CDCl_3$.

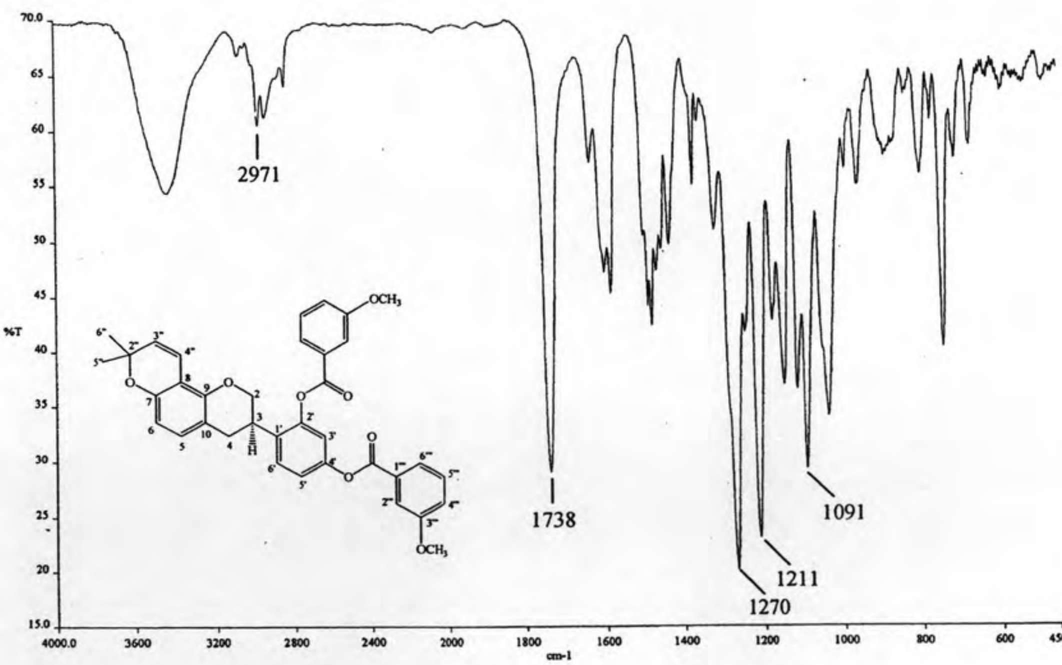

Figure 106. The infrared spectrum of glabridin-2′,4′-O-di-3‴-methoxy-benzoate (**28**).

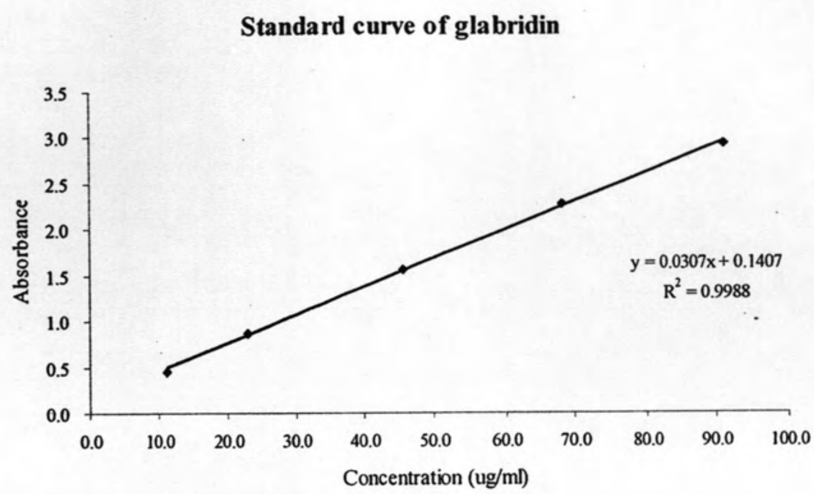

Figure 107. Calibration curve of glabridin (**4**) obtained from the UV absorption at 280 nm.

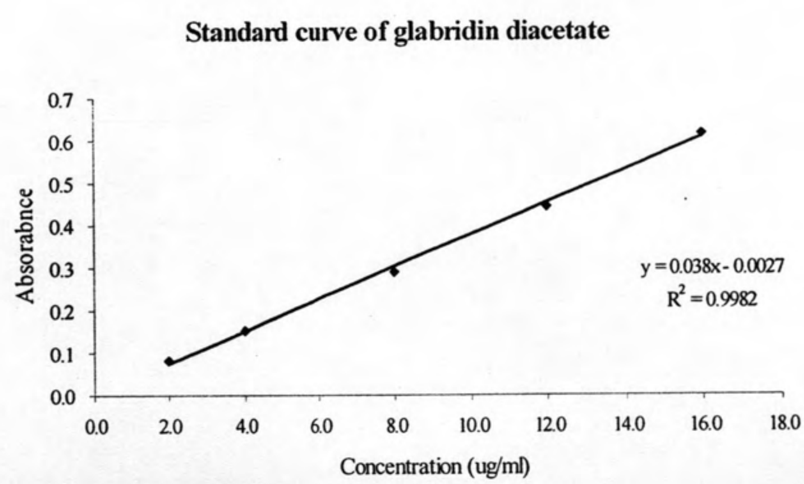

Figure 108. Calibration curve of glabridin diacetate (**16**) obtained from the UV absorption at 280 nm.

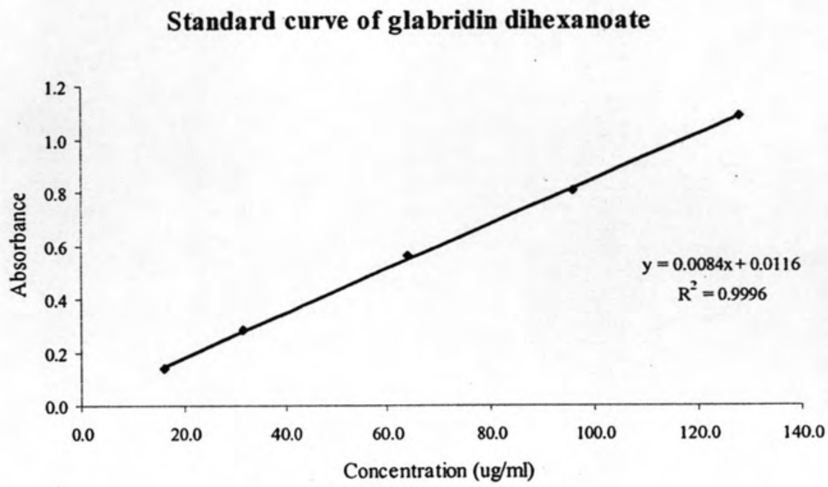

Figure 109. Calibration curve of glabridin dihexanoate (**17**) obtained from the UV absorption at 280 nm.

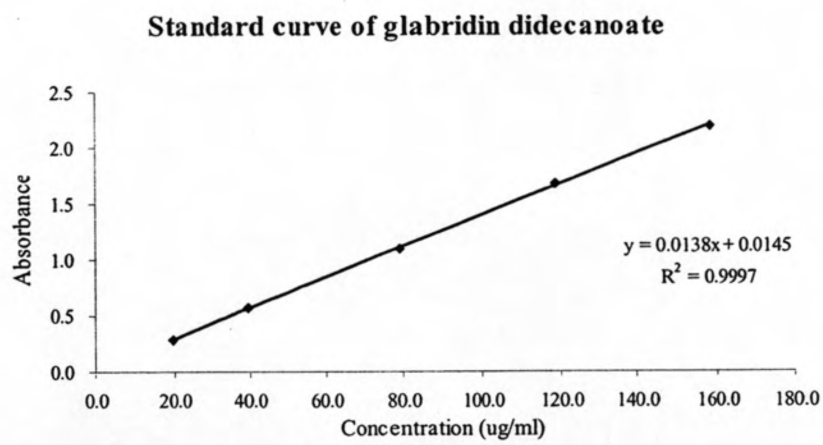

Figure 110. Calibration curve of glabridin didecanoate (**18**) obtained from the UV absorption at 280 nm.

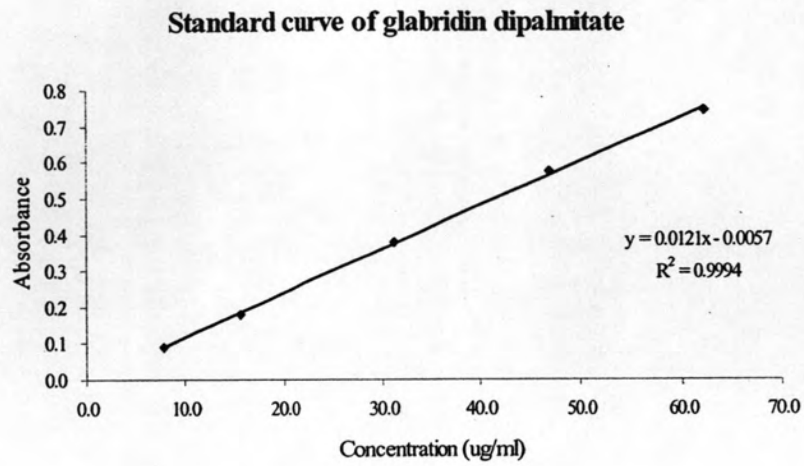

Figure 111. Calibration curve of glabridin dipalmitate (**19**) obtained from the UV absorption at 280 nm.

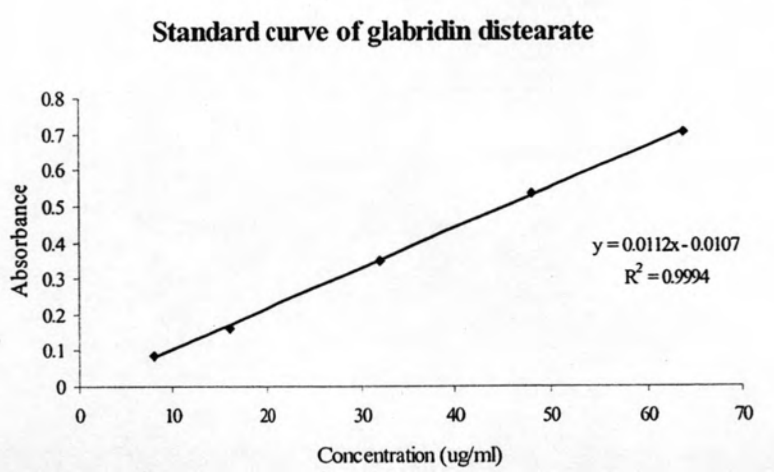

Figure 112. Calibration curve of glabridin distearate (**20**) obtained from the UV absorption at 280 nm.

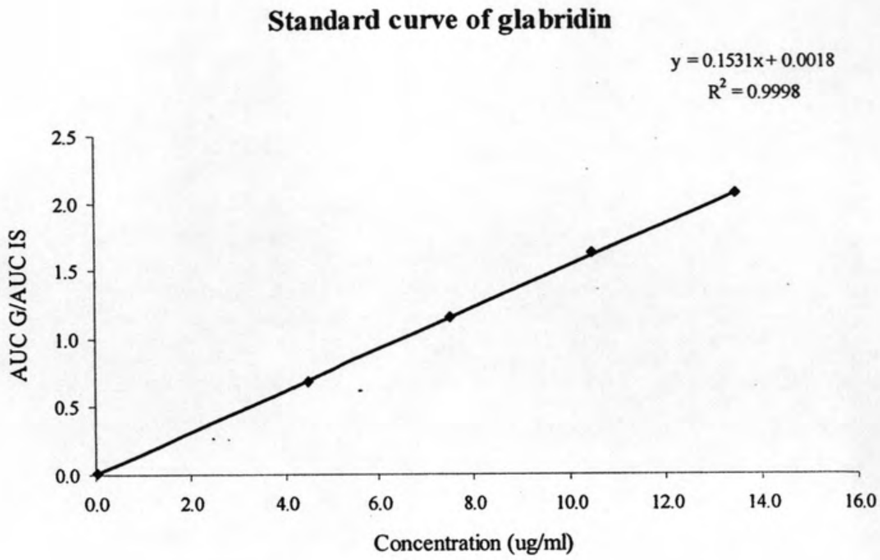

Figure 113. Calibration curve of glabridin (**4**) obtained from the AUC G / AUC IS ratio.

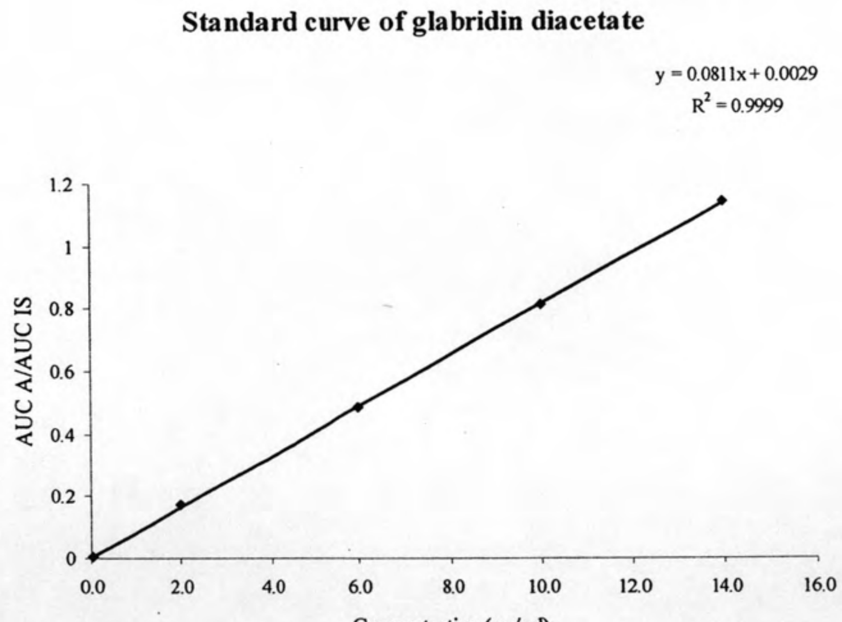

Figure 114. Calibration curve of glabridin diacetate (**16**) obtained from the AUC A / AUC IS ratio.

VITA

Miss. Warunee Jirawattanapong was born on August 28, 1963 in Songkhla, Thailand. She received her Bachelor of Science in Pharmacy with second class honor in 1987 from the Faculty of Pharmacy, Prince of Songkla University and Master of Science in Pharmacy in 1995 from the Faculty of Pharmaceutical Sciences, Chulalongkorn University, Thailand. At present, she is working for Medicinal Plant Research Institute, the Department of Medical Sciences, Ministry of Public Health.