

REFERENCES

1. Brandis, D. in Indian Trees, pp. 114-115. Bighen Singh Mahendra pal Singh, New Connaught Place, Dehra Dun, 1971.
2. Smitinand, Tem in Thai Plant Names (Botanical Names-Vernacular Names) Royal Forest Department, Bangkok, 1980.
3. Hansen, B. in Studies in the Flora of Thailand. Vol. 36 pp. 291-292, Dansk Botainsk Arkiv, Copenhagen, 1966.
4. Humbut, H. and T. Premer in Flore Générale. supplement ALA, Fasc.4, p. 36, Museum National D' Histaire Naturelle, Phanérogamie, Paris, 1945.
5. Hooker, J.D. in The Flora of British India. Vol. 1 pp. 502-506 M/S Bishen singh Mahendra pal singh, New connaught place, Dehra Dun, 1872.
6. Perry, L.M. and Metzger, J. in Medicinal Plants of East and Southeast Asia. pp. 363-364, The Mit Press, Cambridge, Massachusetts and London, 1980
7. Wu, T.S. and Furukawa, H., "Biological and Phytochemical investigation of *Clausena excavata*" J.of Natural Products 45(1982) : 718-720.
8. Quisumbing, E. in Medicinal Plants of the Philippines. Technical Bulletin, Bureau of Printing, Manila , 1951.

9. Wangboonskul, J. in Phytochemical Study of *Clausena harmandiana*
Root Bark. Graduate School, Department of Pharmaceutical
Chemistry, Chulalongkorn University, 1983
10. Okorie, D.A., "A New carbazole alkaloid and coumarins from roots
of *Clausena anisata*" Phytochemistry. 14(1975) : 2720.
11. Mester, I., "Constituents of *Clausena anisata* (Willd.)Oliv.
(Rutaceae), II Isolation and Structure of mupamine, a
new carbazole alkaloid" Ann.Chem. 10(1977) : 1725-1729.
12. Mester, I., Szendrei, K. and Reisch. J. "Constituents of
Clausena anisata (Willd.) Oliv. (Rutaceae) I. coumarins
from the root bark" Planta medica. 32(1977) : 81-85.
13. Gavindachari, T.R., Pai, B.R. and Subramanian, P.S. "Coumarins
of *Clausena dentata* (Willd.)R. and S." Tetrahedron .
24(1967) : 753-757.
14. Bose, P.K., Chakrarti, S. and Barua, A.K. J.Indian Chem.Soc.
50(1973) : 753.
15. Joshi, B.S. and Saksena, A.K. "Structures of Clausenin and
Clausenidin two new Pyranocoumarin from the roots of
Clausena heptaphylla Wt. & Arn. Tetrahedron. 23(1967)
: 4785-4789.
16. Bhattacharyya, P. and Chakraborty, D.P. "Murrayanine and dentatin
from *Clausena heptaphylla*" Phytochemistry. 12(1973) : 1831.

17. Joshi, B.S. and Govindachari, T.R. "Structure and Synthesis of Heptaphylline" Phytochemistry. 11(1972) : 2065-2071.
18. Joshi, B.S. and Gawad, D.H. "Isolation of Some Furanocoumarins from *Clausena indica* and Identity of Chalepensis with Xylotenin" Phytochemistry. 10(1971) : 480-481.
19. Joshi, B.S. and Kamat, V.N. "Structure of Clausindine, a new Coumarin from *Clausena indica* Oliv." Experientia.30(3), (1974) : 223.
20. Rakash, D. and Popli, S.D. "Coumarins from *Clausena indica*" Phytochemistry. 17(1978) : 1194-1195.
21. Joshi, B.S. and Kamat, V.N. "6-Methoxyheptaphylline, a new Carbazole Alkaloid from *Clausena indica* Oliv." Indian J. of Chem. 10(1972) : 1123-1124.
22. Joshi, B.S., and Gawad, D.H. "Isolation and Structure of Indizoline, a new carbazole alkaloid from *Clausena indica* Oliv." Indian J.Chem. 12(1974) : 437.
23. Kong, Y.C. "Dehydroindicolactone, a new coumarin from *Clausena lansium*" Fitoterapia. 54(1), (1983) : 47-48.
24. Prakash, D. "Chemical Constituents of *Clausena lansium* : Part I Structure of Lansamide-I and Lansine" Indian J.Chem. sect. B, 19B (12), (1980) : 1075-1076.
25. Anwer, F. and Popli, S.P. "Clauserin a novel coumarin from *Clausena pentaphylla* (Roxb.) DC." Experientia. 33(4), (1977), : 412-413.

26. Shoeb, A. and Popli, S.P. "Clausemarins A and B : Two Novel Spasmolytic Terpenoid Coumarins from *Clausena pentaphylla* (Roxb.) DC." J.C.S. Chem.Comm. 7(1978) : 281-282.
27. Rao, S. and Kumar, V.P.S. "Chemical Examination of *Clausena willdenowii* W. & A.: Isolation of 3-(1,1-Dimethylallyl) Xanthyletin from the Root & Bark" Indian J.Chem. 20B, (1981) : 88-89.
28. Krishnaswanry, N.R. in Recent Trends in Coumarin Chemistry, Advancing Fronters in the Chemistry of Natural Product, pp. 124-137, Hindustan Publishing Corporation, India, 1965.
29. Steck, W. and Mazurek, M. "Identification of Natural Coumarins by NMR Spectroscopy." Lloydia, 35(4), (1972) : 418-439.
30. Seshadri, T.R. and Vishwapaul "Recent Advances in Naturally Occurring Coumarins" J.Scient.Ind.Res. 32(1973) : 227-255.
31. Tandon, S. and Rastogi, R.P. "Recent Advances in Naturally Occurring Coumarins" J.Scient.Ind.Res. 38(1979) : 428-441.
32. Gibbs, R.D. in Chemotaxonomy of Flowering Plants. Vol. 1 pp. 440-459, McGill-Queen's, University Press, Montreal and London, 1974.
33. Gray, A.Z. and Waterman, P.G. "Review coumarins in the Rutaceae" Phytochemistry, 17(1978) : 845-864.

34. Dean., F.M. in Naturally Occurring Oxygen Ring Compounds pp. 176-219, Butterworth Scientific Publishers, London, 1963.
35. Manitto, P. in Biosynthesis of Natural Products. p. 375
John Wiley & Sons, New York, 1981.
36. Brown, S.A. "Biosynthesis Studies on Coumarins." Planta Medica.
36(1979) : 299-310.
37. Floss, H.G. in Biosynthesis of Furanocoumarins. Recent Advances in
Phytochemistry, (Runeckles, V.C. and Watkin, J.E. eds.)
Vol. 4. pp. 143-164, Appleton-Century-Crofts, Educational
Division Meredith Corporation, New York, 1972.
38. Vernin, G. in Chemistry of heterocyclic compounds in Flavous and
Aromas. p. 243, John Willey & Sons, New York, 1982.
39. Nakanishi, K. and Nozoe, S. in Natural Products Chemistry. Vol. 2
pp. 203-207, Kodanaha LTD., Academic Press, Inc., New York,
1975.
40. Kapil, R.S. in The Alkaloids Chemistry and Physiology. (Edited by
Manske, R.H.F.) Vol. XIII. pp. 253-302, Academic Press,
New York, 1971.
41. Kureel, S.P. and Popli, S.P. "New Alkaloids from *Murraya koenigii*
Spreng." Experientia. 25(1969) : 790.
42. Chakraborty, D.P. in Progress in the Chemistry of Organic Natural
Products (W. Herz editor) Vol. 34, pp. 299-371, Wien,
Springer-Verlag, New York, 1977.

43. Cordell, G.A. in Introduction to Alkaloids. A Biosynthetic Approach. pp.616-618 , John Willey & Sons, New York, 1981
44. Bhattacharry, P. and Chakraborty, D.P. "Murrayanine and Dentatin from *Clausena heptaphylla* Wt. and Arn." Phytochemistry, 12(1973) : 1831.
45. Chakraborty, D.P. and Bose, P.K. "On the Constitution of Murrayanine, a carbazole Derivative Isolated from *Murraya koenigii* Spreng." Tetrahedron, 21(1965) : 681.
46. Chakraborty, D.P. and Das, B.P. "Glycozolidine, a New Carbazole Derivative from *Glycosmis pentaphylla*(Retz.)DC." Science and Cult. (India) 32(1966) : 181.
47. Chakraborty, D.P. "Glycozoline, a Carbazole Derivative from *Glycosmis pentaphylla* (Retz.) DC." Tetrahedron Letters. (1966) : 661
48. Chakraborty, D.P. "Glycozoline, a Carbazole Derivative from *Glycosmis pentaphylla*." Phytochemistry, 8(1969) : 769.
49. Chowdhury, B.K. and Chakraborty D.P., "Mukoeic Acid, the first Carbozole Carboxylic Acid From Plant Source." Chem. and Ind. (1969) . : 549
50. Roy, S.P. and Chakraborty, D.P. "3-Methyl Carbazole from *Clausena heptaphylla*." Phytochemistry. 13(1974) : 1017.
51. Chakraborty, D.P. and Islam, A. "Heptazoline, a New Carbazole Alkaloid from *Clausena heptaphylla* Wt. and Arn." J.Indian Chem.Soc. 47(1970) : 1197.

52. Dutta, N.L. and Quassim, C. "Constituents of *Murraya koenigii* Structure of Girinimbine." Indian J.Chem. 7(1969) : 307.
53. Narasimhan, N.S. and Chitguppi, V.P. "Structures of Mahanimbin and Koenimbin." Tetrahedron Letters. 53(1968) : 5501-5504.
54. Chakraborty, D.P. and Roy, S. "Heptazolidine, a Carbazole Alkaloid from *Clausena heptaphylla* Wt. and Arn." Chem.and Ind. (1974) : 303.
55. Joshi, B.S. and Gawad, D.H. "On the Structure of Girinimbine, Mahanimbine, Isomahanimbine, Koenimbidine and Murrayacine." Tetrahedron. 26(1970) : 1475.
56. Chakraborty, D.P. and Das, K.C. "Structure of Murrayacine" Chem. Commun. (1968) : 967
57. Roy, S. and Chakraborty, D.P. "Murrayacine from *Clausena heptaphylla*." Phytochemistry. 15(1976) : 356.
58. Narasimhan, N.S. and Kelkar, S.L. "Alkaloids of *Murraya koenigii* Structure of Mahanine, Koenine, Koenigine and Koenidine." Indian J.Chem. 8(1970) : 473.
59. Chakraborty, D.P. and Bose, P.K. "Structure of Mahanimbine, a Pyranocarbazole Derivative from *Murraya koenigii* Spreng." Science and Cult.(India) 32(1966) : 83.
60. Roy, S. and Chakraborty, D.P. "Mahanimbine from *Murraya koenigii* Spreng." Phytochemistry. 13(1974) : 2893

61. Narasimhan, N.S. and Kelkar, S.L. "Alkaloids of *Murraya koenigii* : Structure of Mahanimbine, koenimbine, Mahanine, Koeniginine, Koenins and (I) Isomahanimbine." Indian J. Chem. 13(1975) : 993.
62. Kureel, S.P. and Popli, S.P. "Terpenoid Alkaloids and Synthesis of Mahanimbine." Experientia. 26(1970) : 1055.
63. Chakraborty, D.P. and Roy, S. "Structure of Murrayacinine, a New Carbazole Alkaloid from *Murraya koenigii* Spreng." Chem. and Ind. (1974) : 165.
64. Chakraborty, D.P. J.Indian Chem.Soc. 46(1969) : 177.
65. Chakraborty, D.P. and Das, K.C. Chem.Commum. (1968) : 967.
66. Kureel, S.P. and Popli, S.P. Experientia. 25(1969) : 790.
67. Kureel, S.P. and Popli, S.P. "The Synthesis of (I) Mahanimbine and Bicyclomahanimbine." Chem.Commun. (1969) : 1120.
68. Chakraborty, D.P., Das, K.C., Das, D.C. and Chowdhury, B.K. "On the Antibiotic Properties of some Carbazole Alkaloids." Trans.Bose Res.Inst. 38(1975) : 1.
69. Das, K.C., Chakraborty, D.P. and Bose, P.K. "Antifungal Activity of Some Constituents of *Murraya koenigii* Spreng." Experientia. 21(1965) : 340.
70. Ahond, A. and Poupat, C. "E'tude par RM ¹³C D'alcaloides A'squelette acridinone 9(10H) et pyrido (4, 3b) carbazole (6H)" Tetrahedron. 34(1978) : 2385-2388.

71. Binst, G.V., Danheux, C. and Martin, R.H. "Solvent effect in IR and NMR spectroscopy of methoxy derivatives of 1,2,3,4-tetrahydrocarbazole" Bull.Soc.Chim.Belges. 75(1966) : 181-190.
72. Binst, G.V. and Danheux, C. "Etude par resonance magnetique nucleaire (RMN) de derives methoxyles du tetrahydrocarbazole." Tetrahedron letters. 17(1964) : 973-981.
73. Stahl, E. Thin-Layer Chromatography, A Laboratory Handbook. Springer-Verlag, New York, 1969.



APPENDIX

System 9

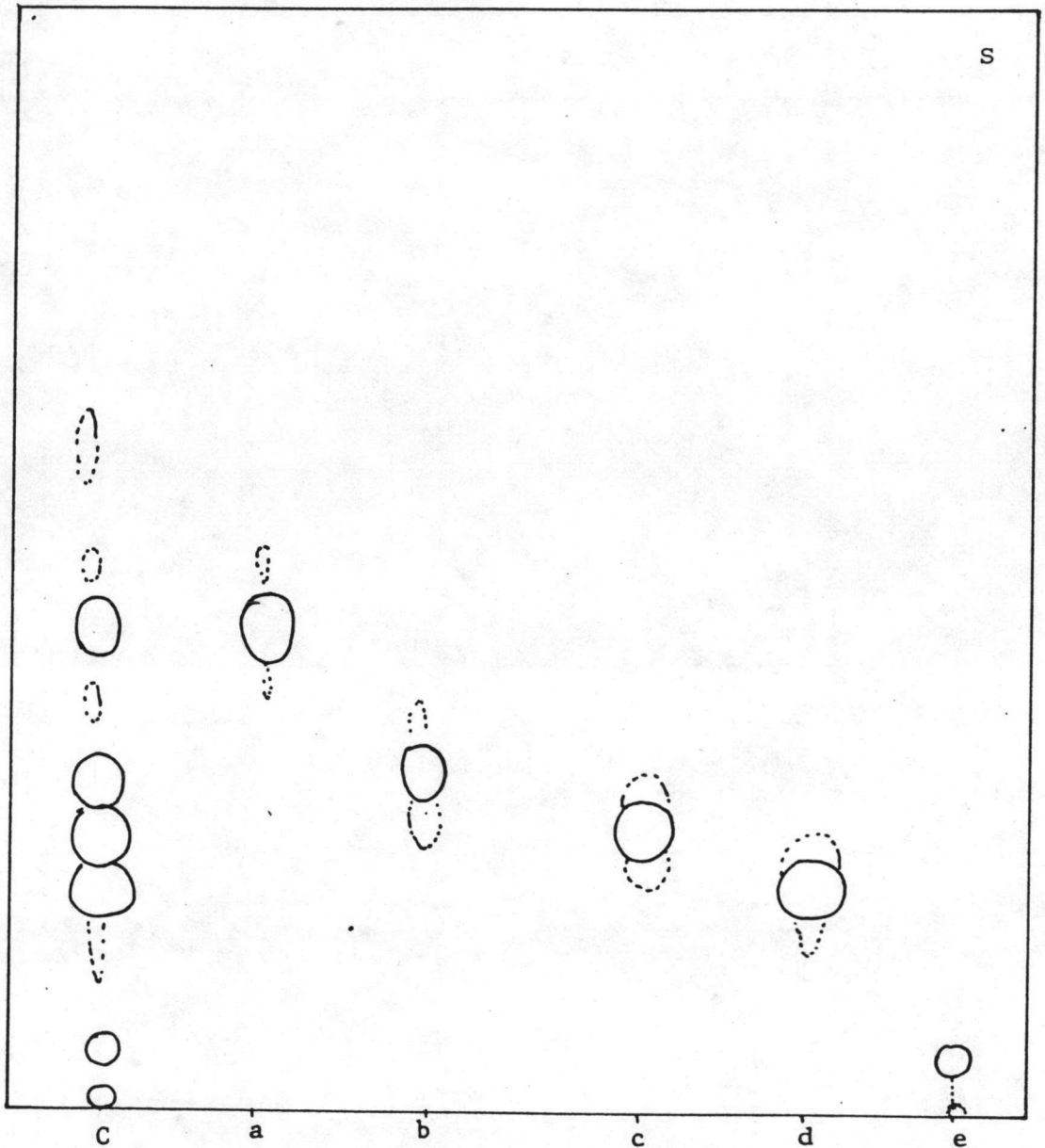


Fig. 14 Thin layer chromatogram of crude hexane extract (C),
 fractions 16-18(a), fractions 30-38(b), fractions 40-47(c),
 fractions 67-73(d), fractions 81-82(e)

S = Silica gel 60 G as the adsorbent

System 10

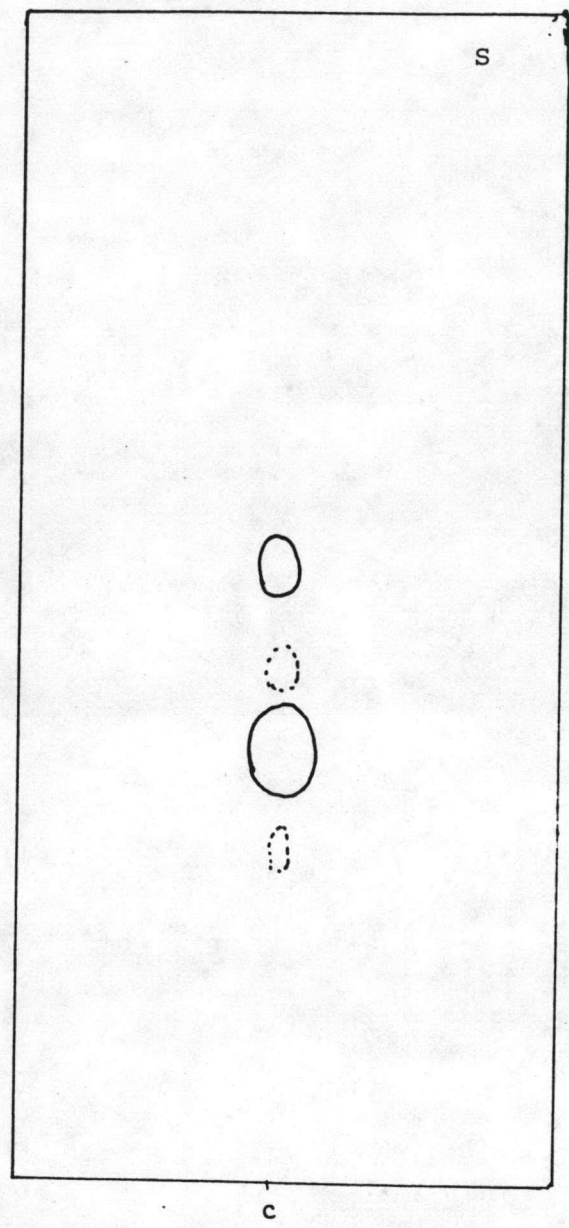


Fig. 15 Thin layer chromatogram of fraction c

System 1

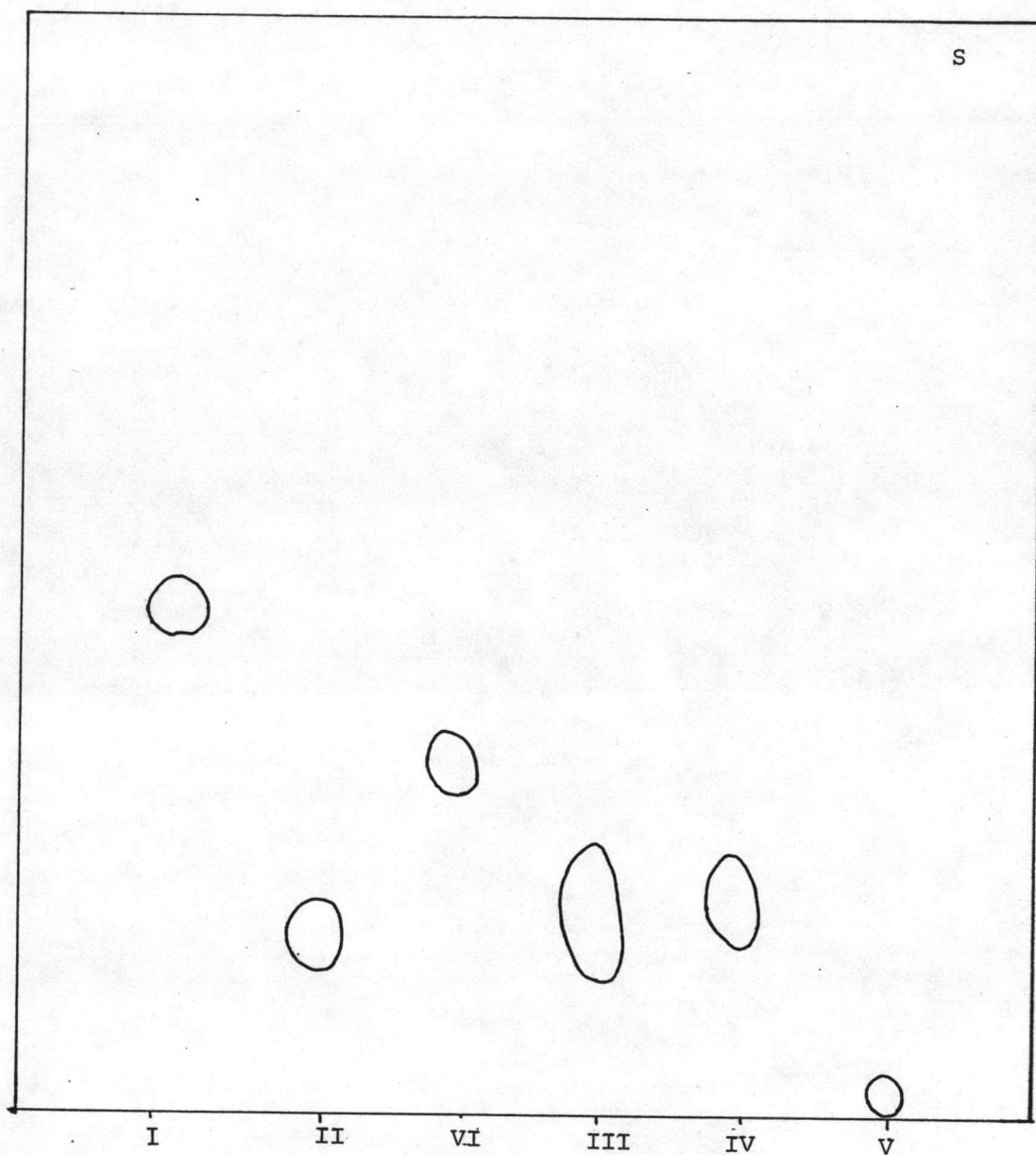


Fig. 16 Thin layer chromatogram of compound I -VI

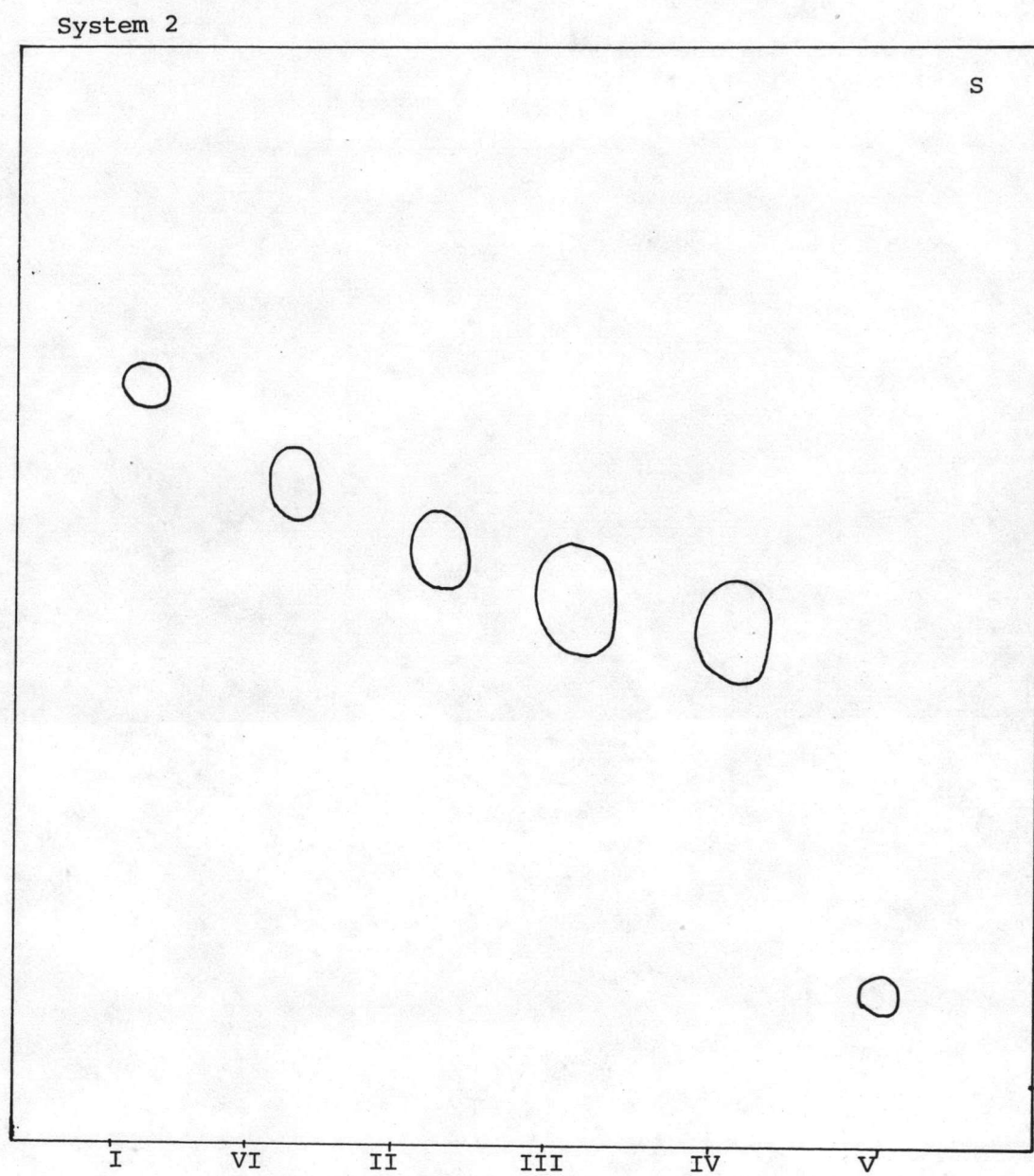


Fig. 17 Thin layer chromatogram of compound I-VI

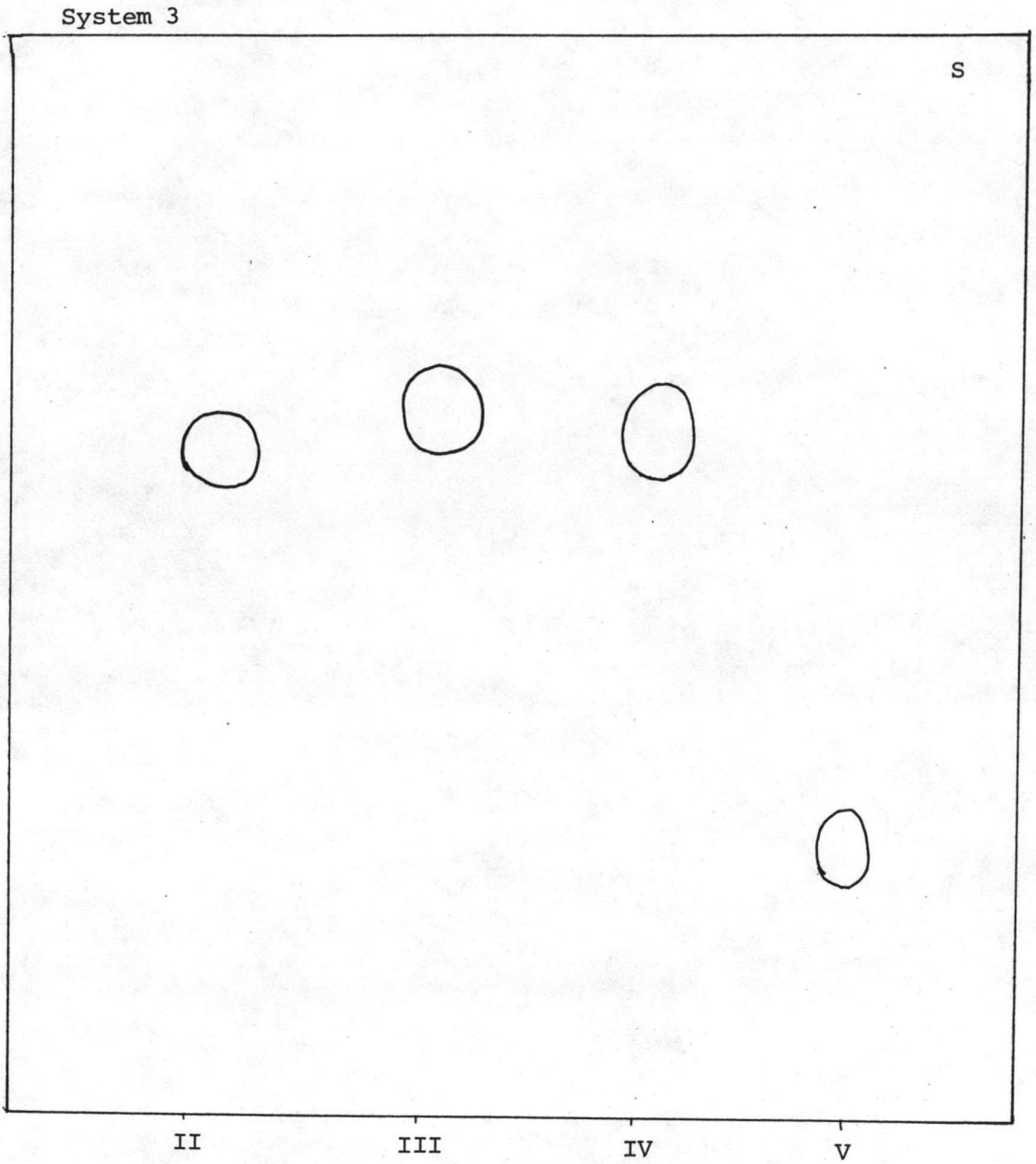


Fig. 18 Thin layer chromatogram of compound II-V

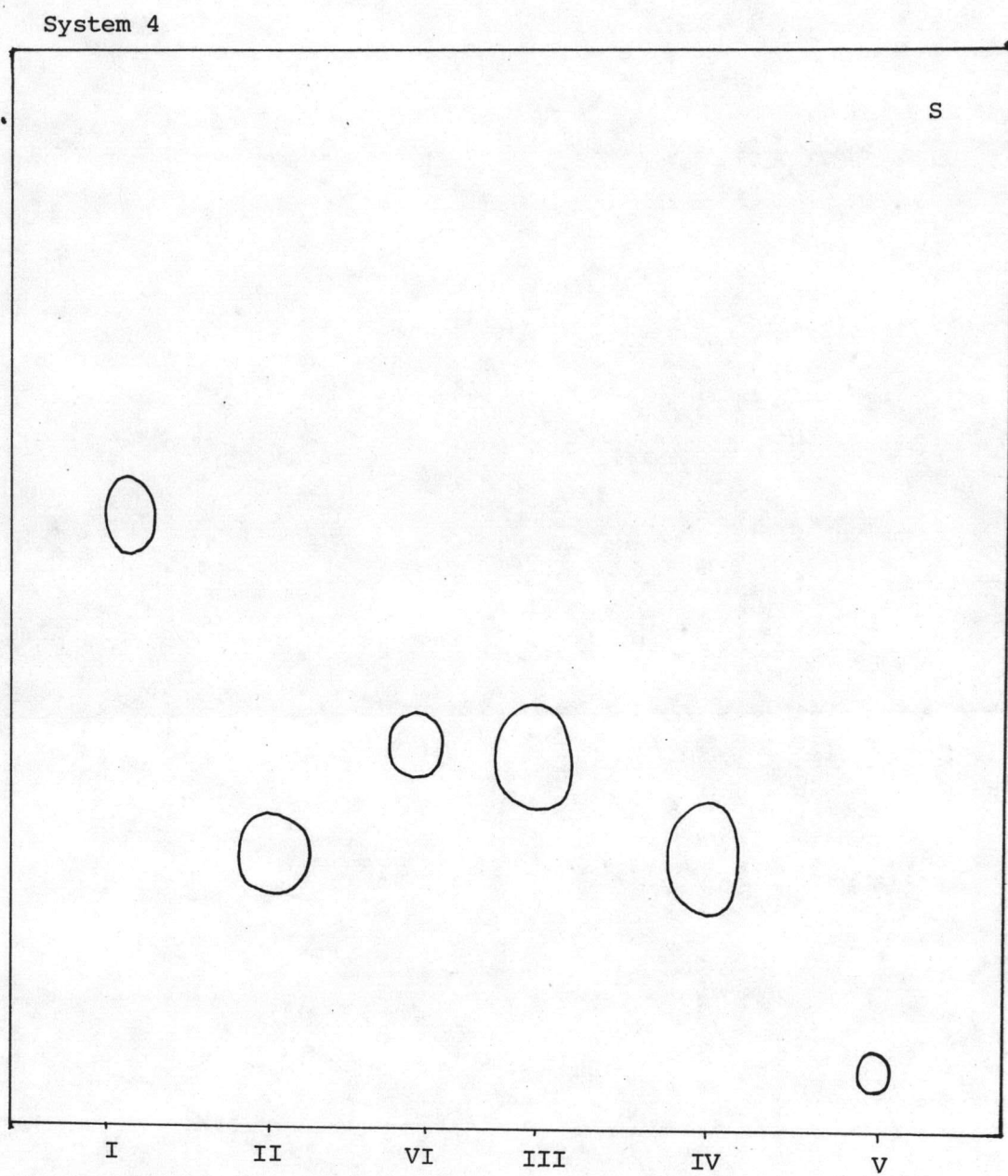


Fig.19 Thin layer chromatogram of compound I-VI

System 5

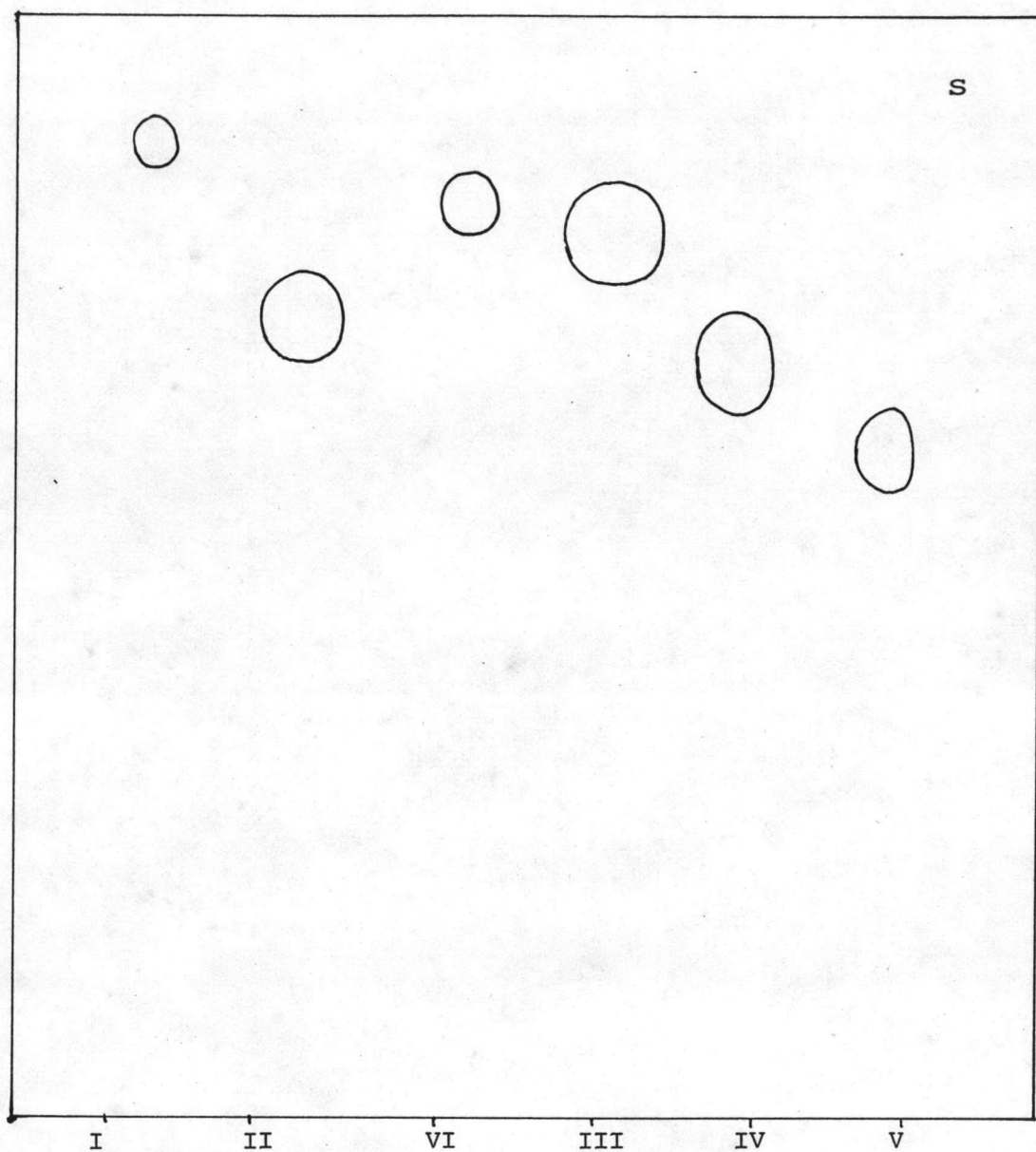


Fig.20 Thin layer chromatogram of compound I-VI

System 6

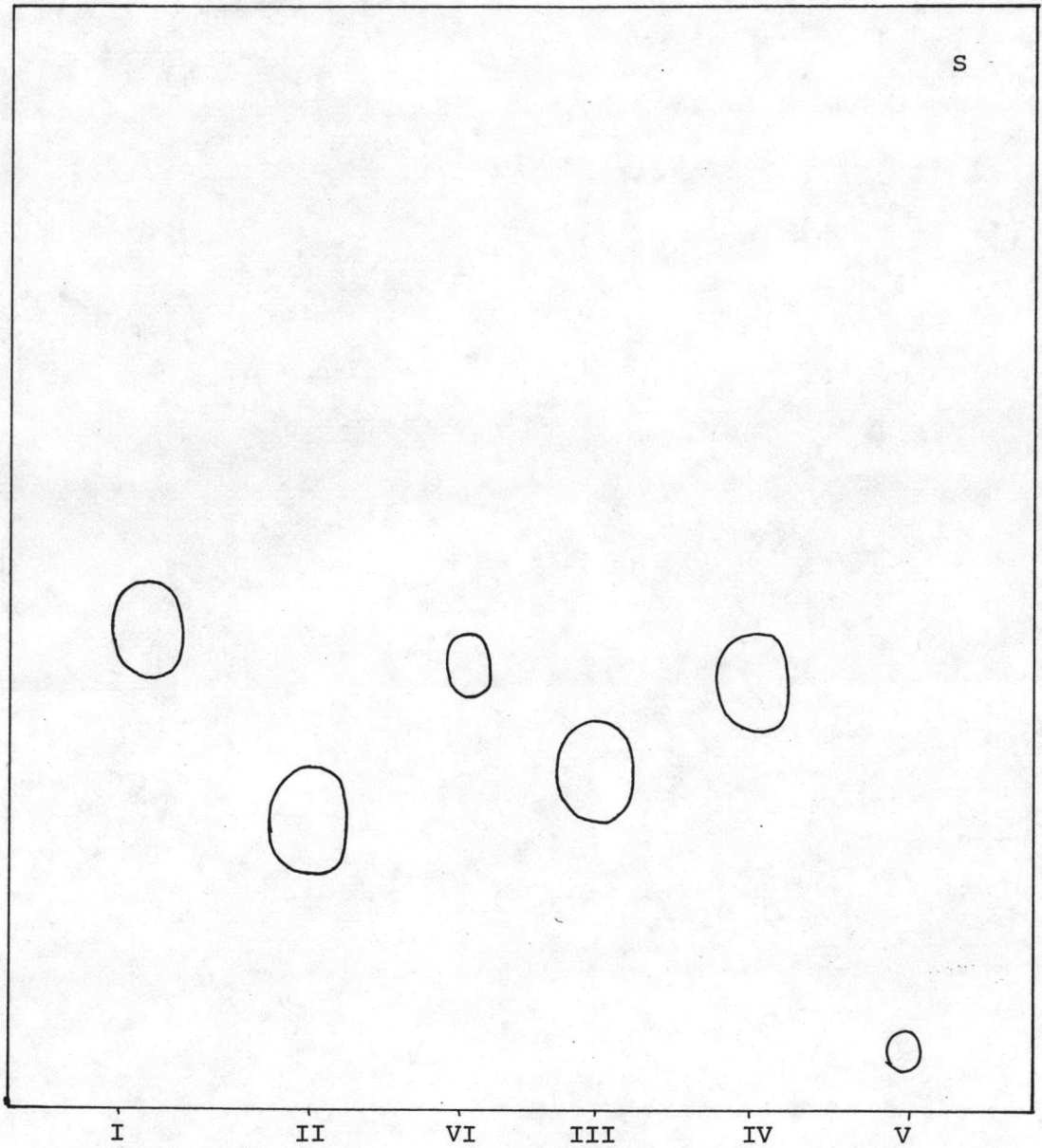


Fig.21 Thin layer chromatogram of compound I-VI

System 7

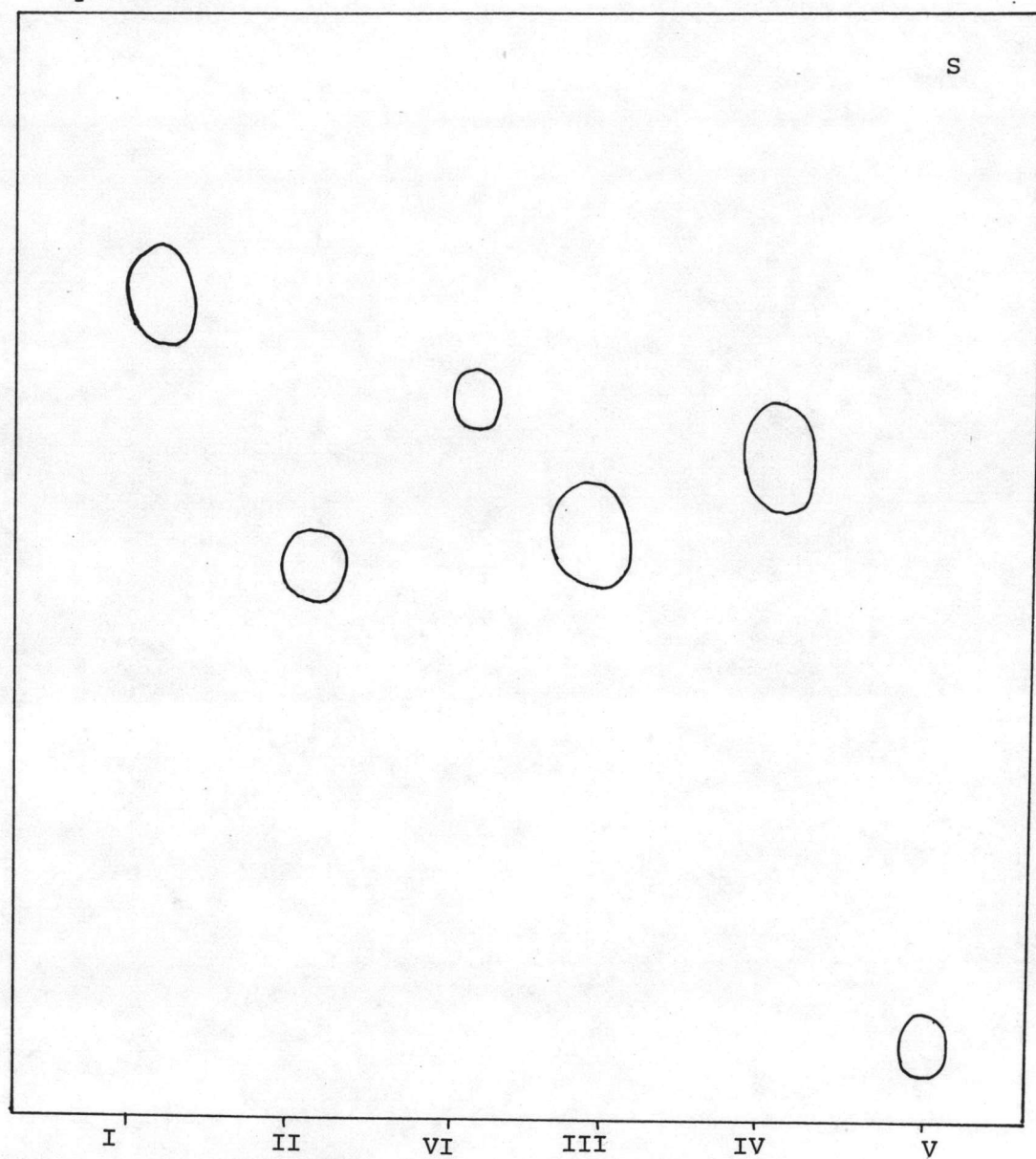


Fig.22 Thin layer chromatogram of compound I-VI

System 8

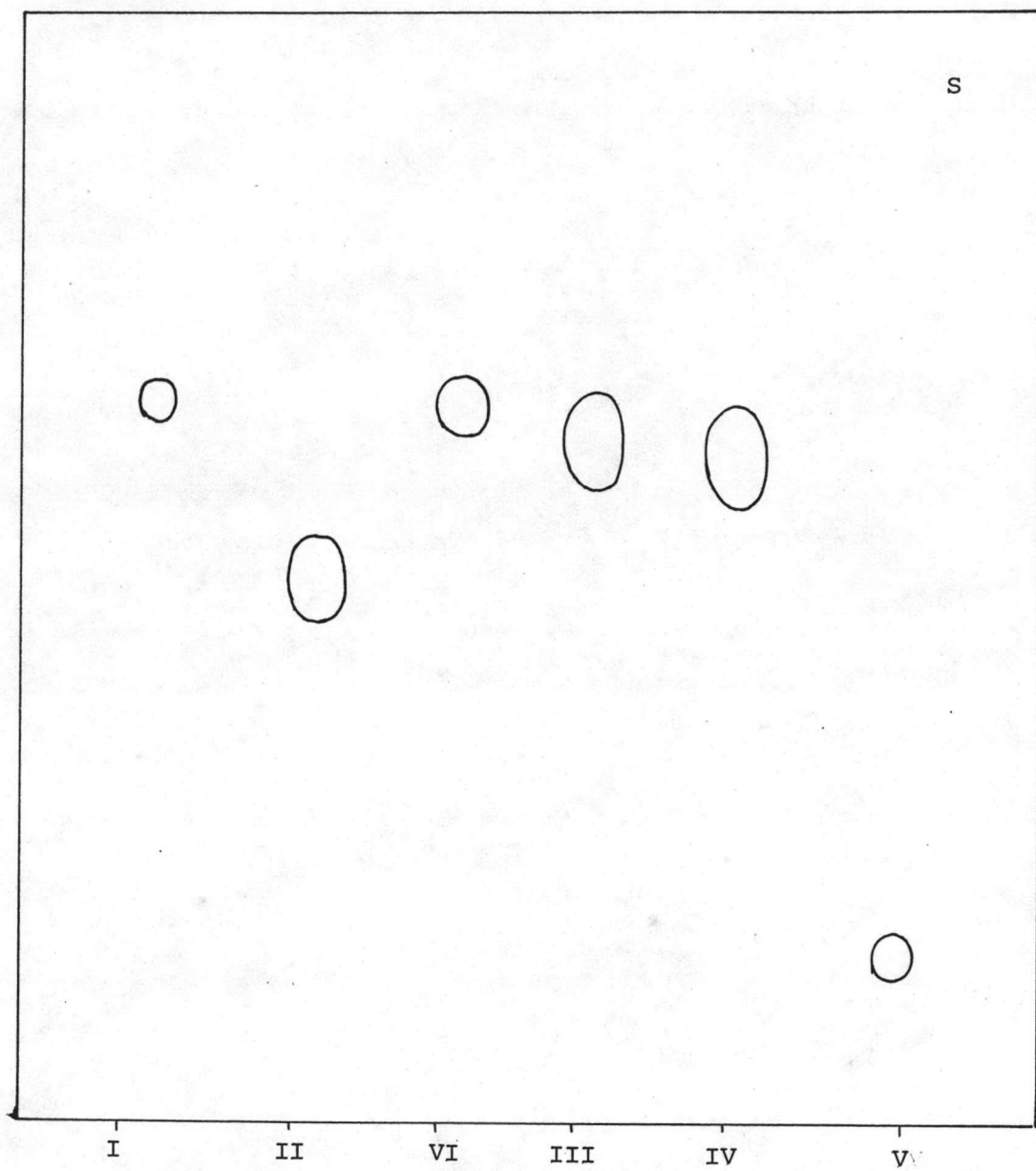


Fig.23 Thin layer chromatogram of compound I-VI

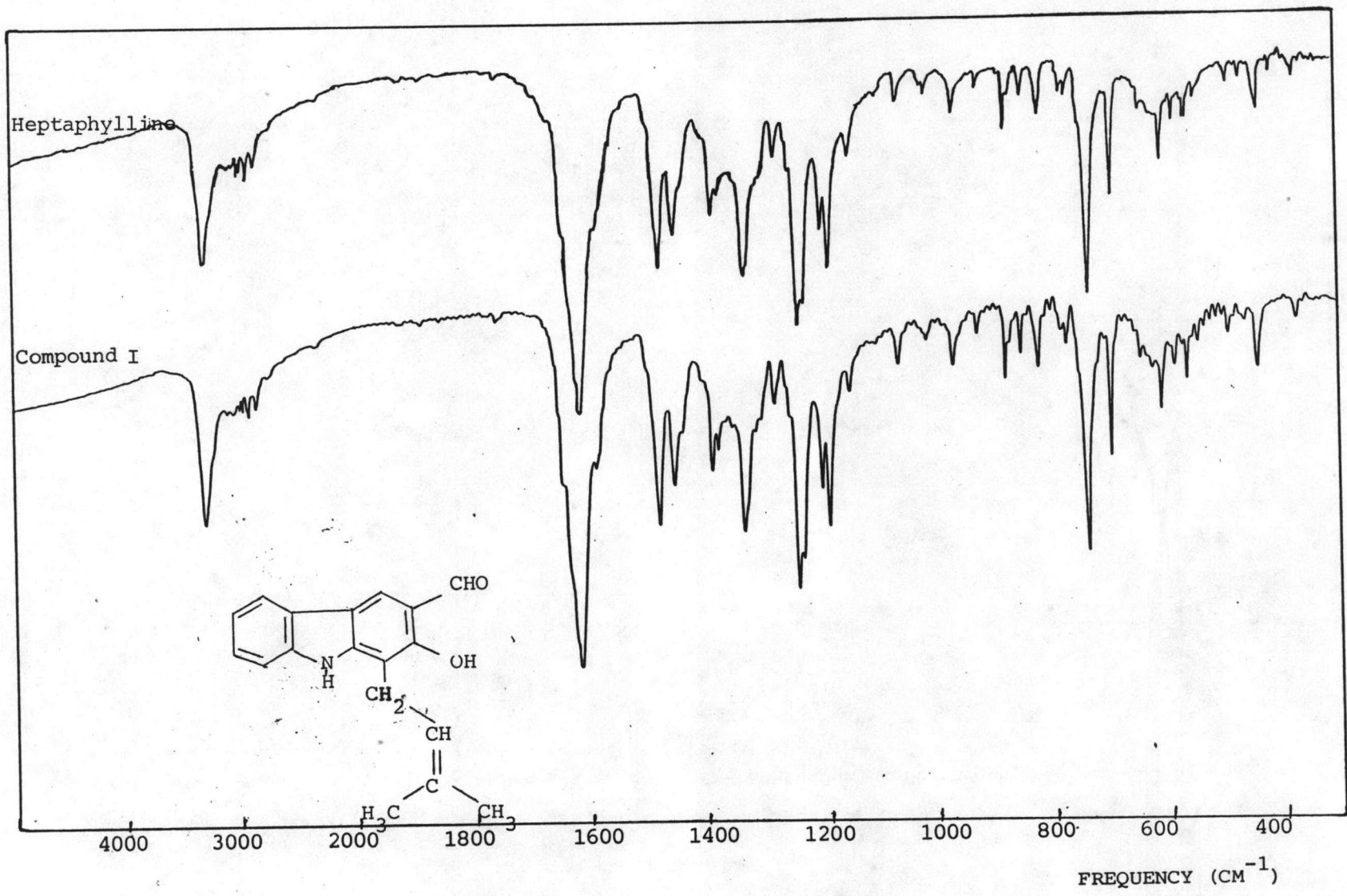


Fig.24 Infrared absorption spectrum of Heptaphylline and compound I in KBr disc

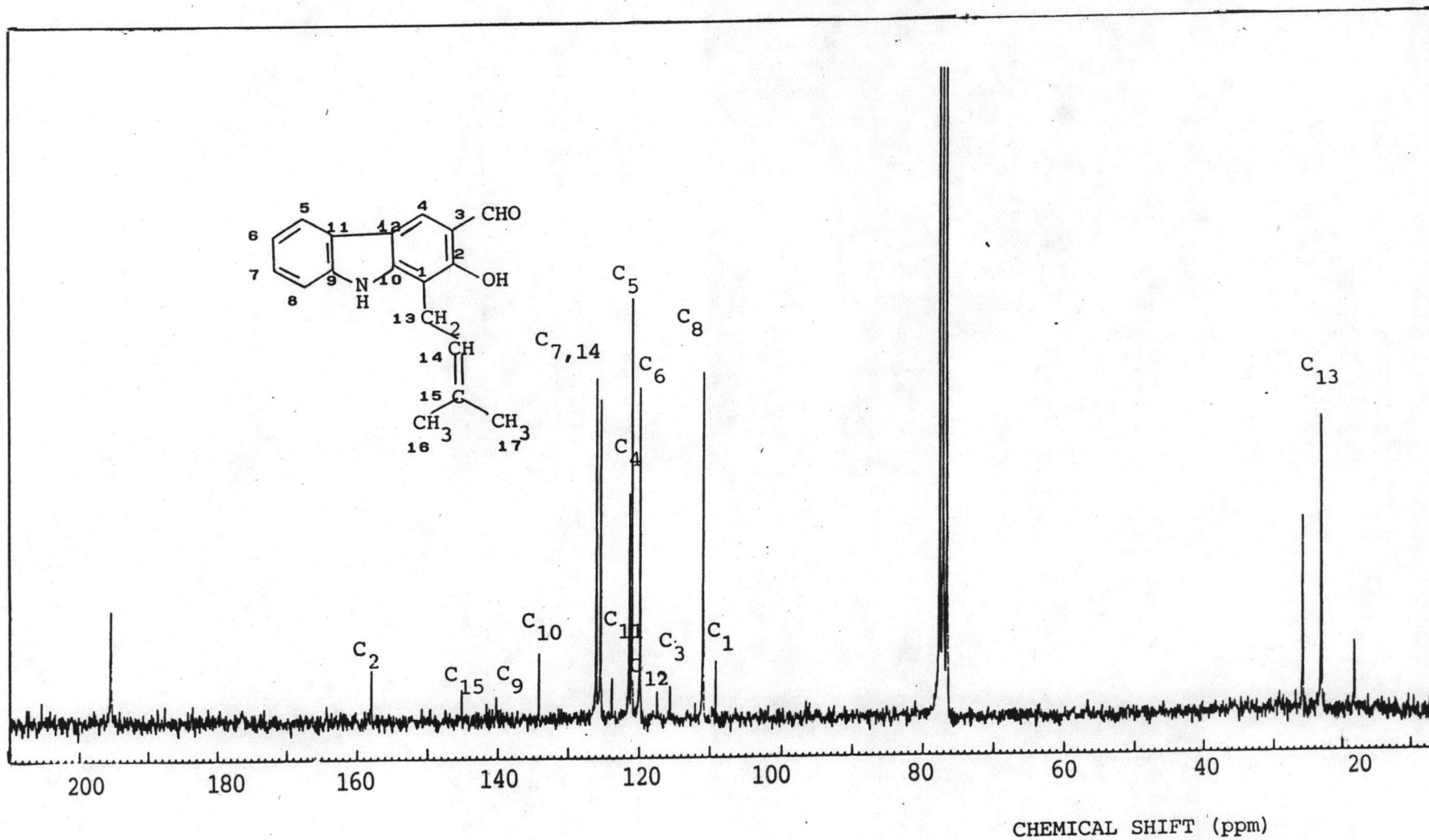


Fig.25 ¹³C NMR Spectrum (62.89 MHz) (Proton noise decoupling) of compound I in CDCl₃

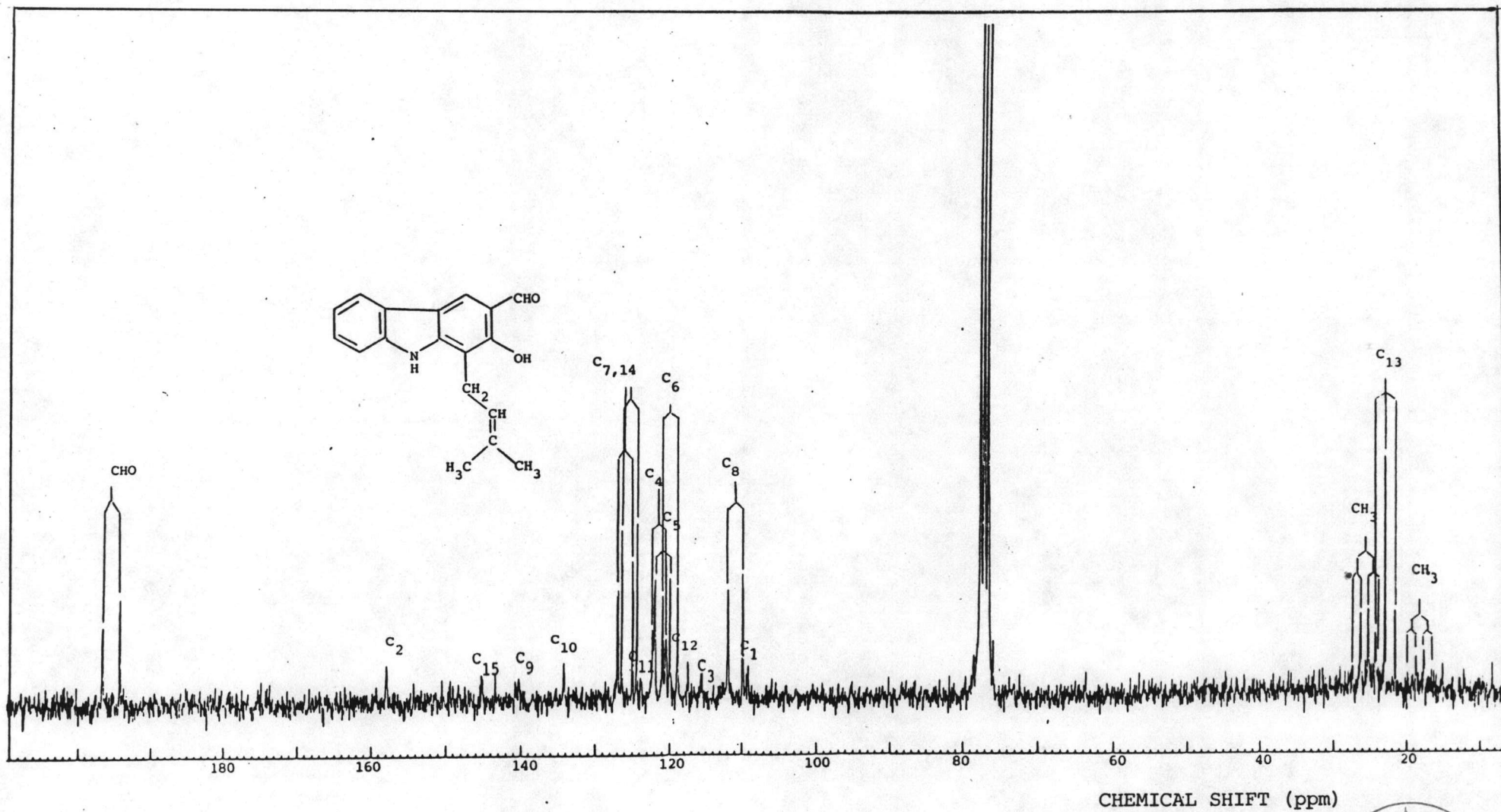


Fig.26 ¹³C NMR Spectrum (62.89 MHz) (off resonance) of compound I in CDCl₃



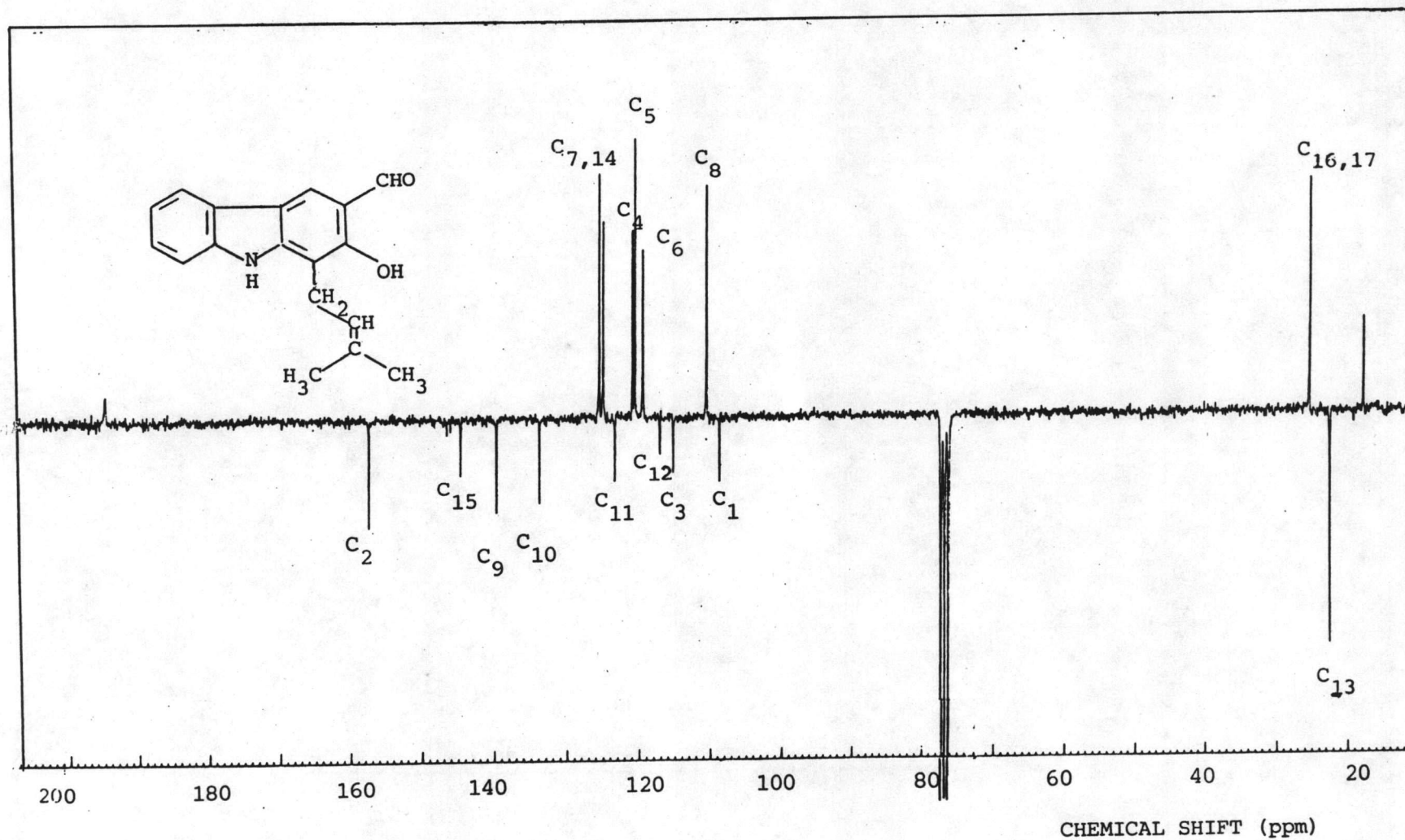


Fig.27 ¹³C NMR Spectrum (62.89 MHz) (APT Technique) of Compound I in CDCl₃

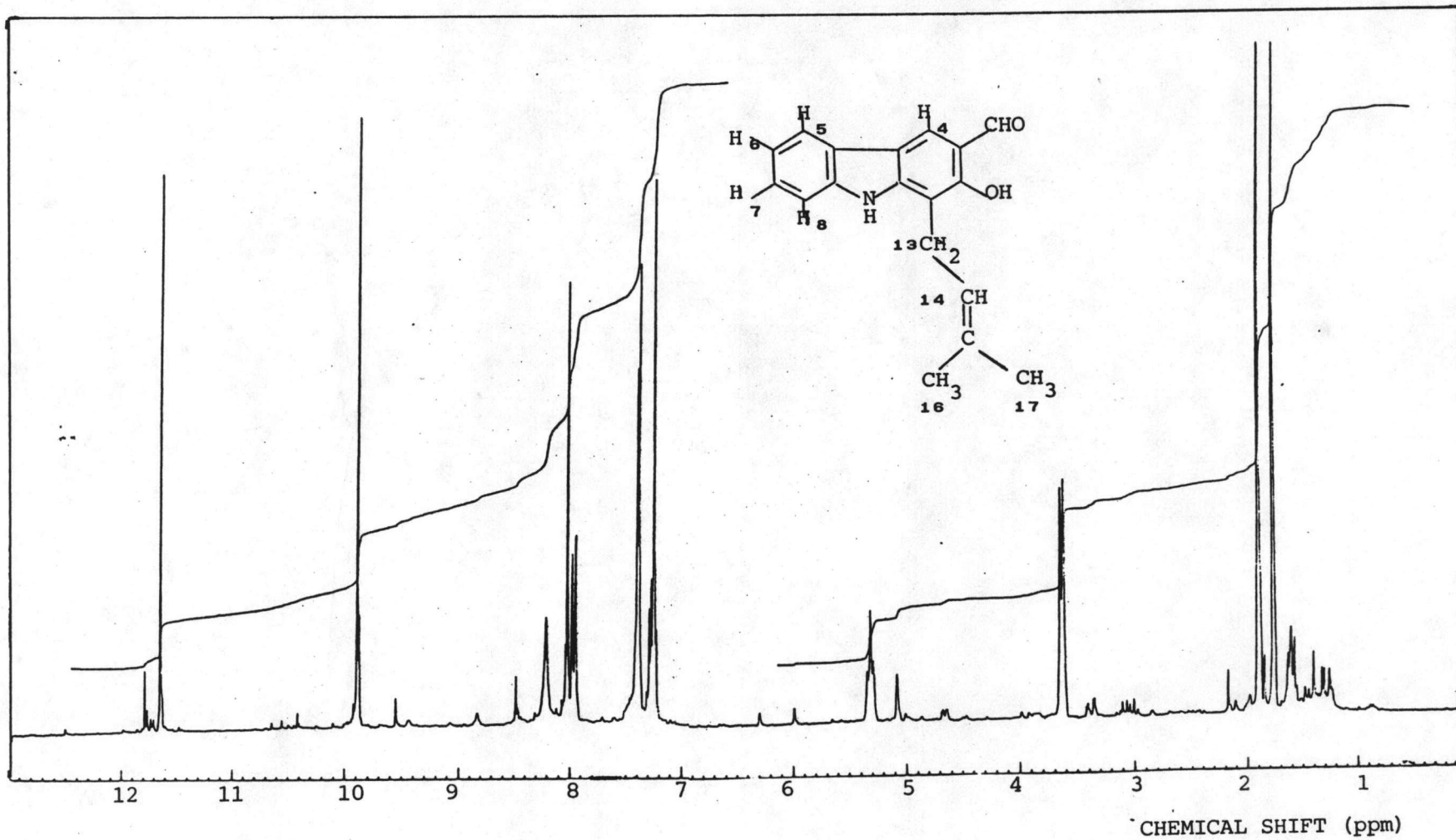


Fig.28 ¹H NMR Spectrum (250 MHz) of Compound I in CDCl₃

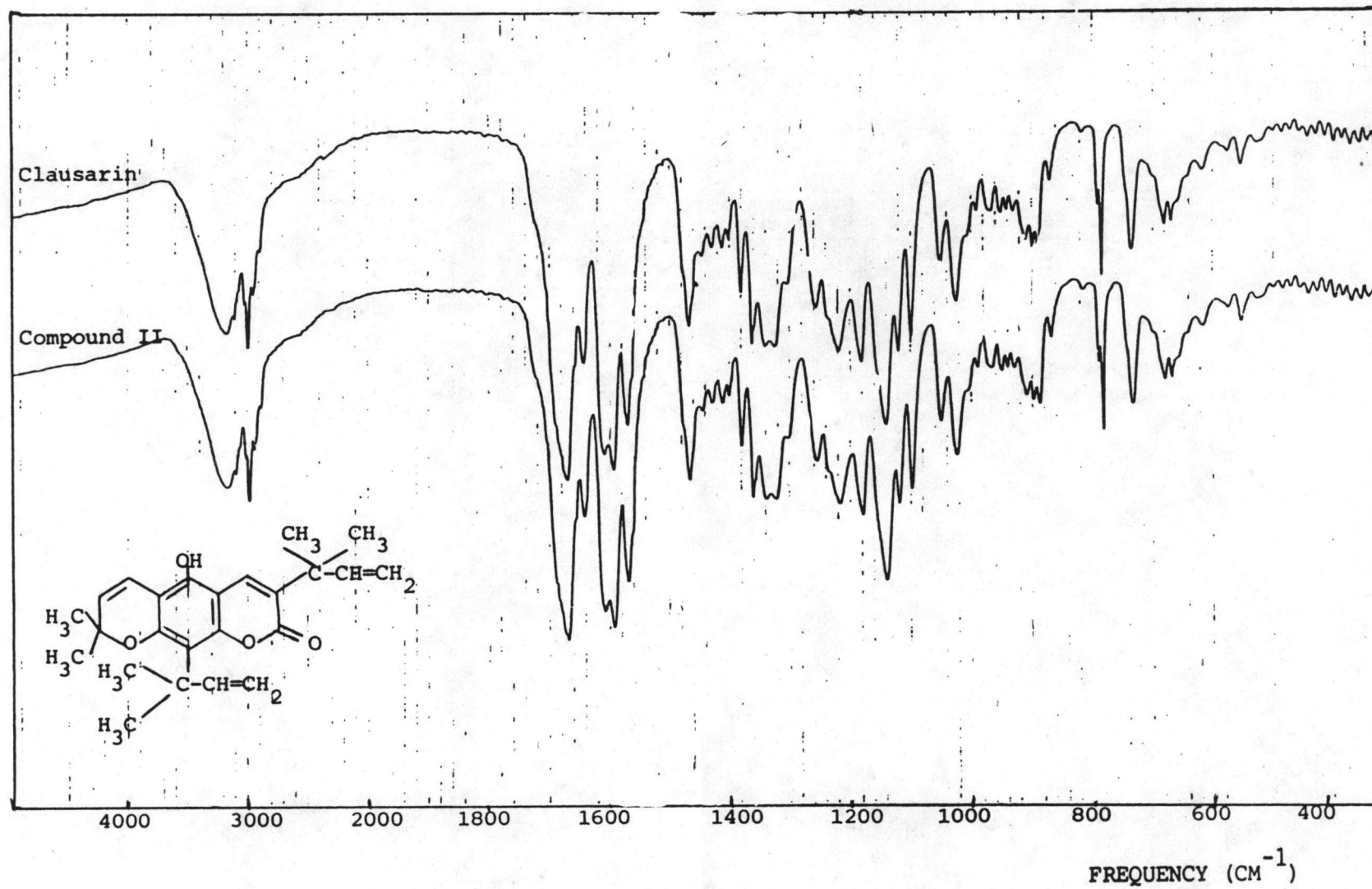


Fig.29 Infrared absorption spectrum of Clausarin and compound II in KBr disc

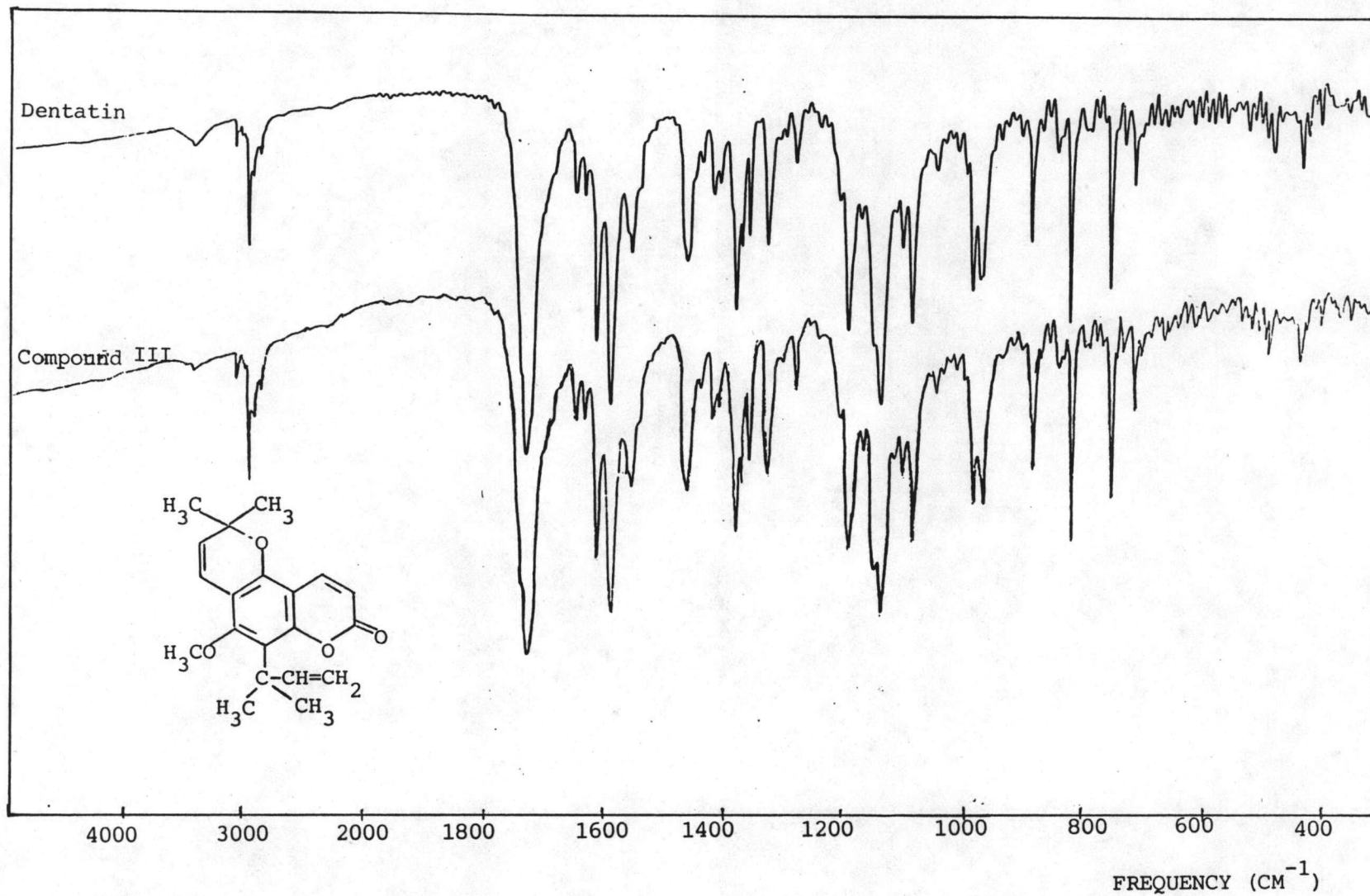


Fig.30 Infrared absorption spectrum of Dentatin and compound III in KBr disc

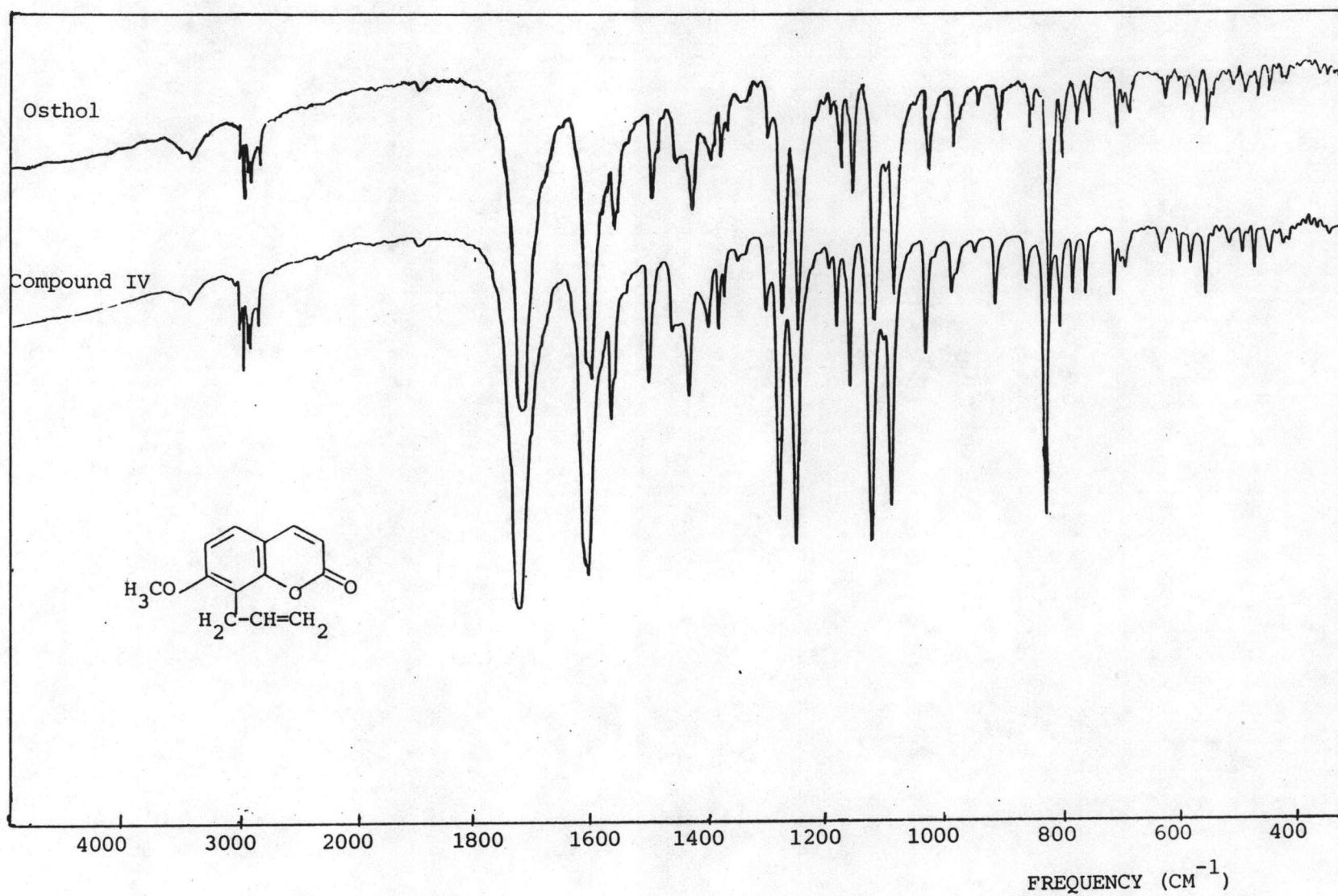


Fig.31 Infrared absorption spectrum of Osthol and compound IV in KBr disc

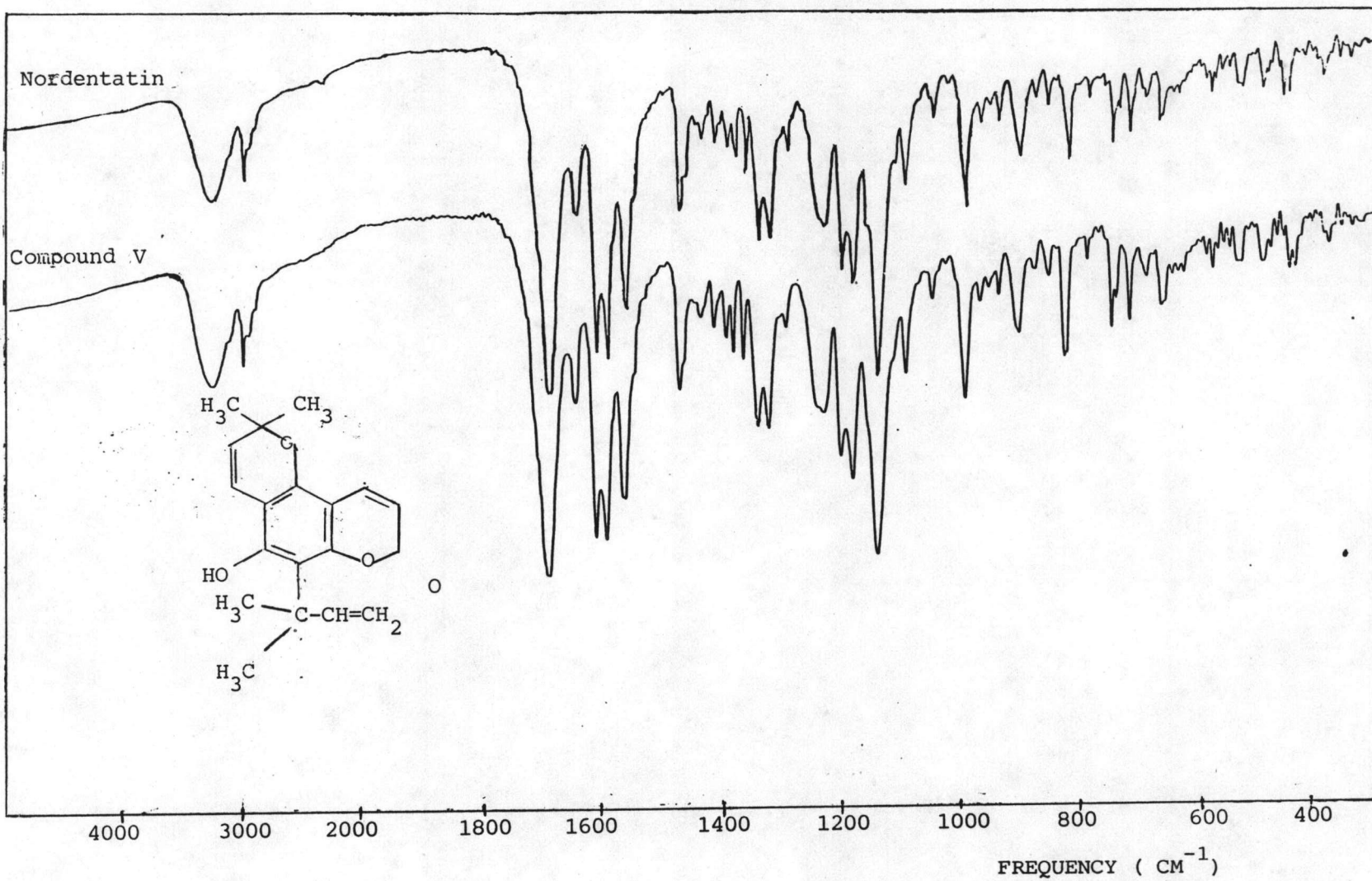


Fig.32 Infrared absorption spectrum of Nordentatin and compound V in KBr disc.

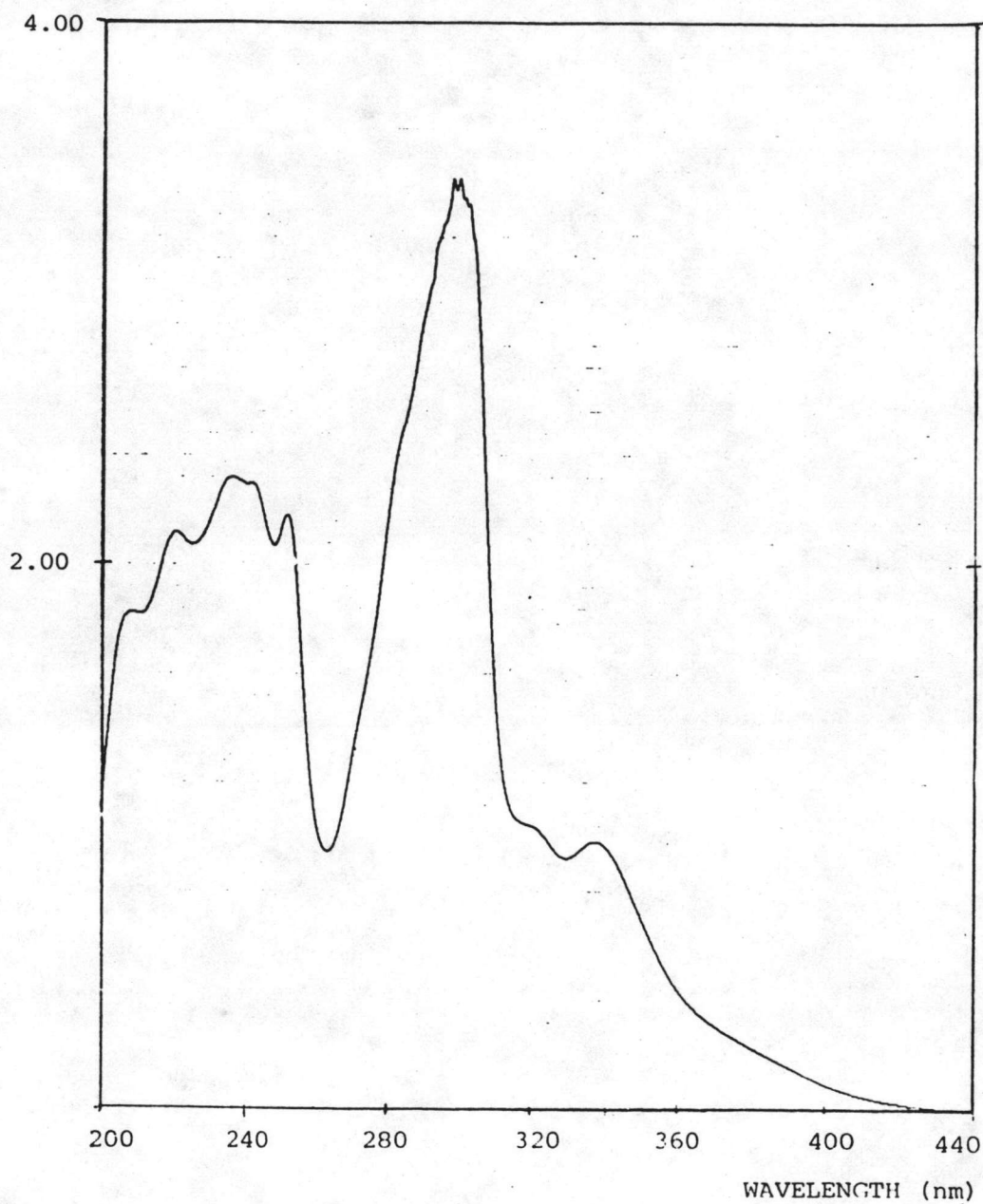


Fig.33 Ultraviolet absorption spectrum of compound VI in methanol

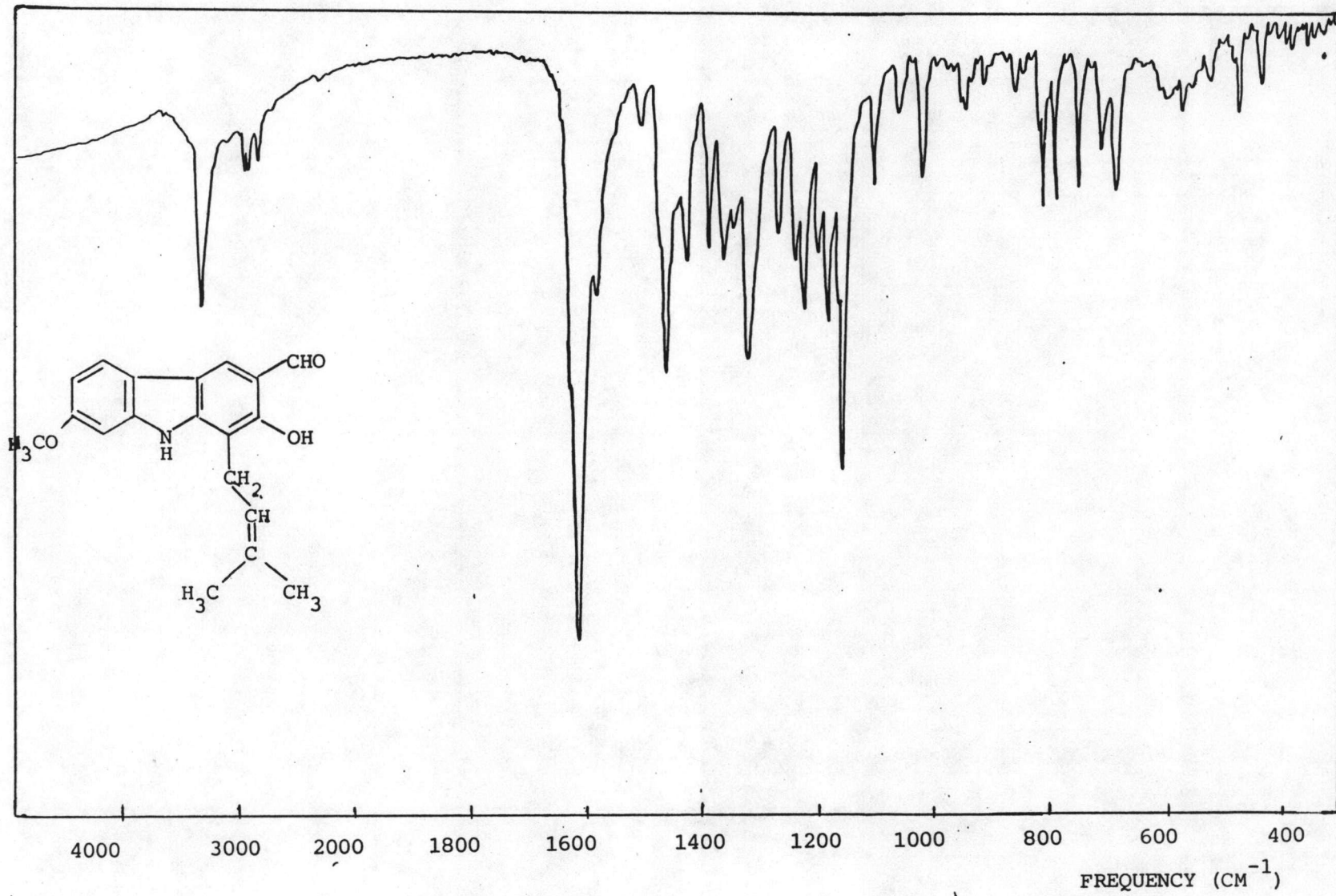


Fig.34 Infrared absorption spectrum of Compound VI in KBr disc

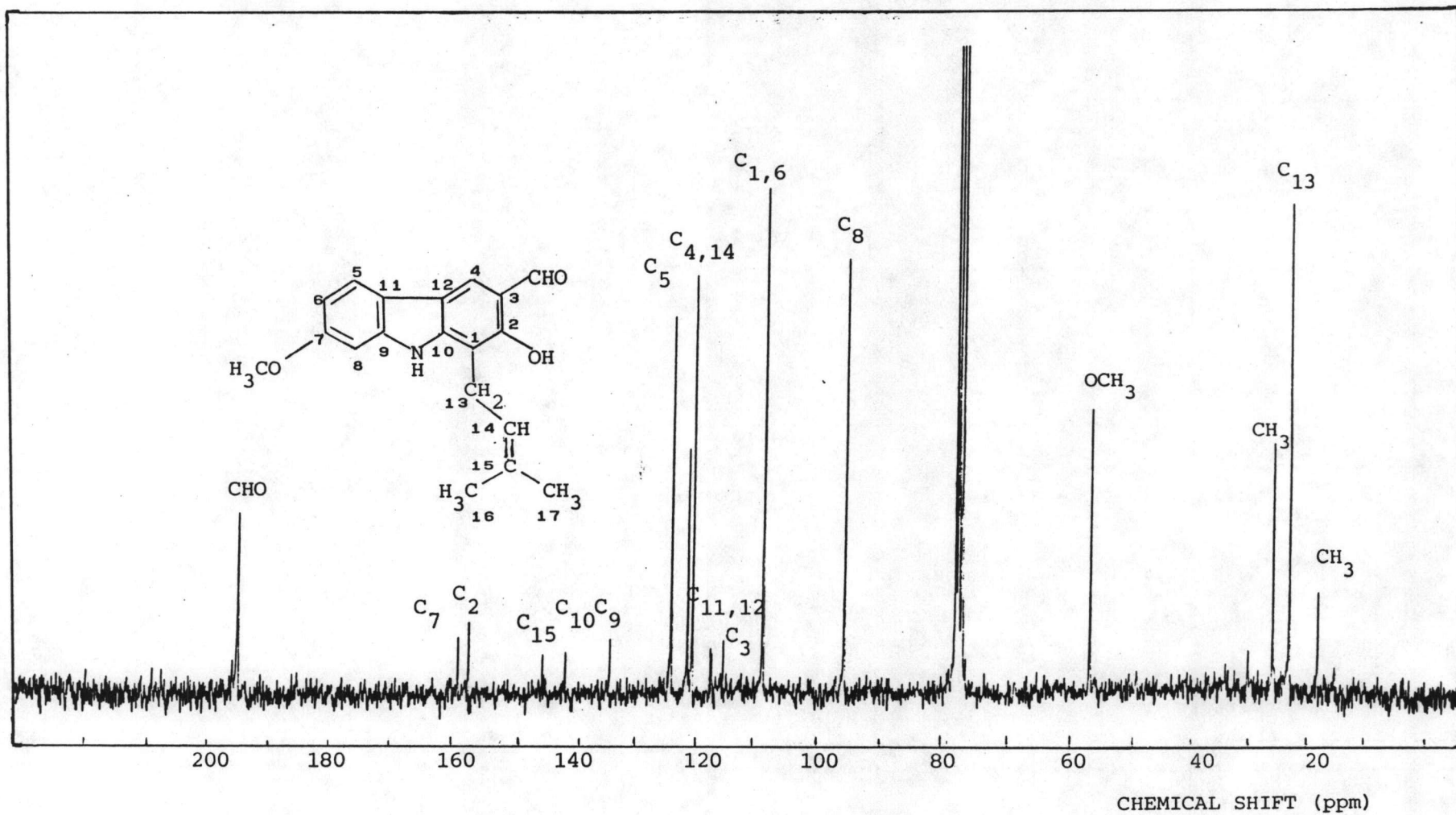


Fig.35 ^{13}C NMR Spectrum (62.89 MHz) (Proton noise decoupling) of compound VI in CDCl_3

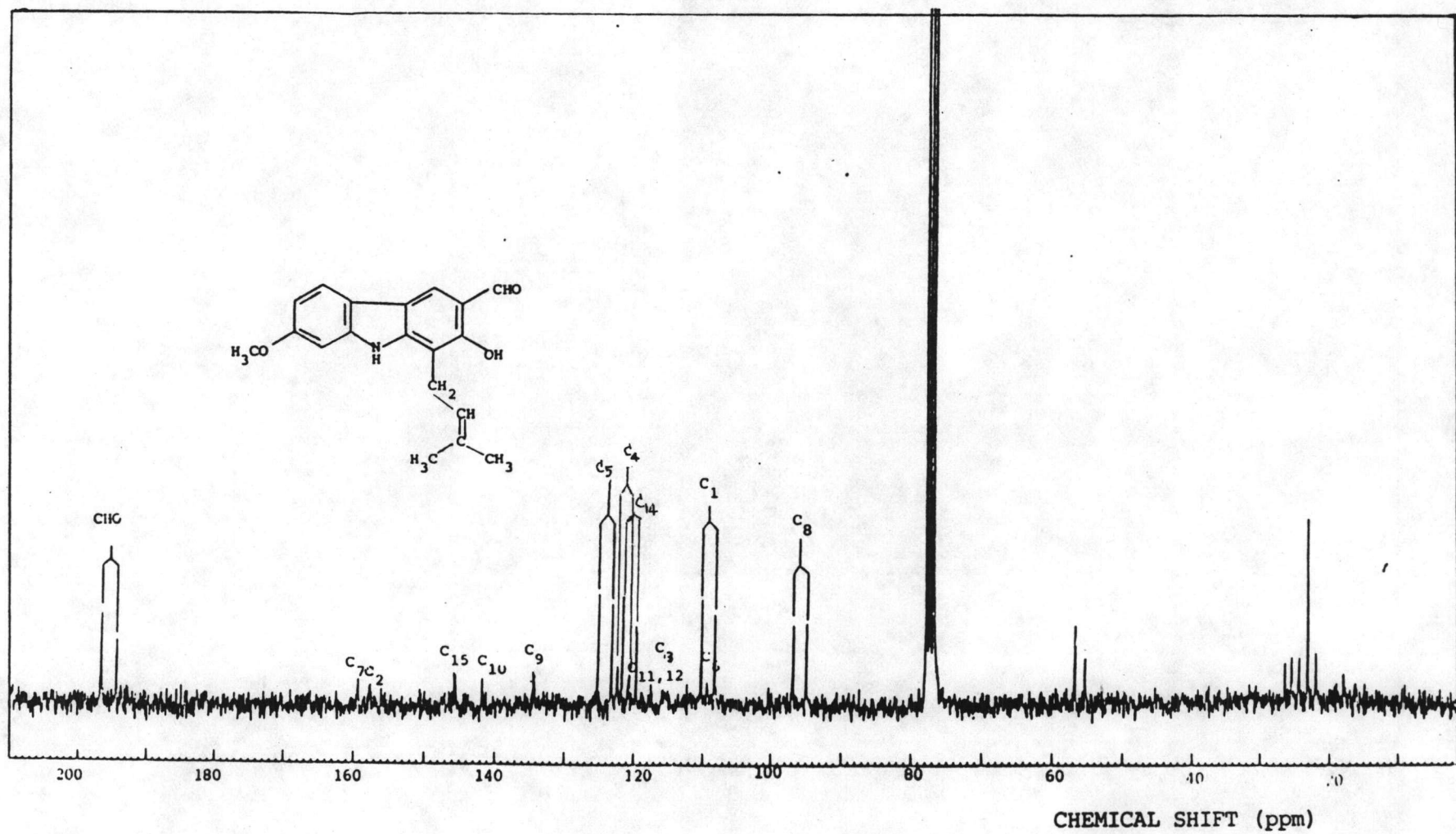


Fig.36 ^{13}C NMR Spectrum (62.89 MHz) (off resonance) of compound VI in CDCl_3

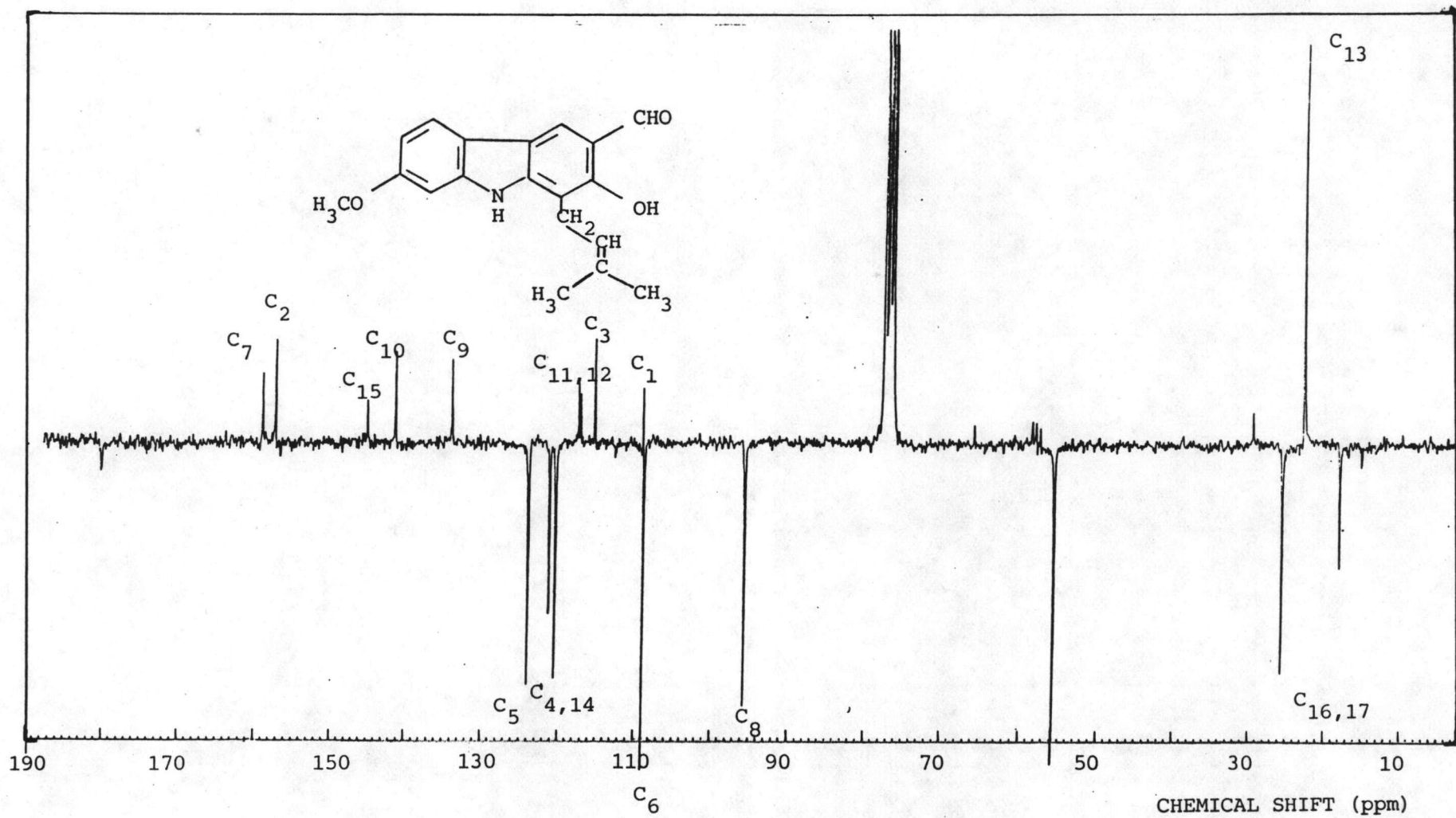


Fig. 37 ^{13}C NMR Spectrum (62.89 MHz) (APT Technique) of Compound VI in CDCl_3

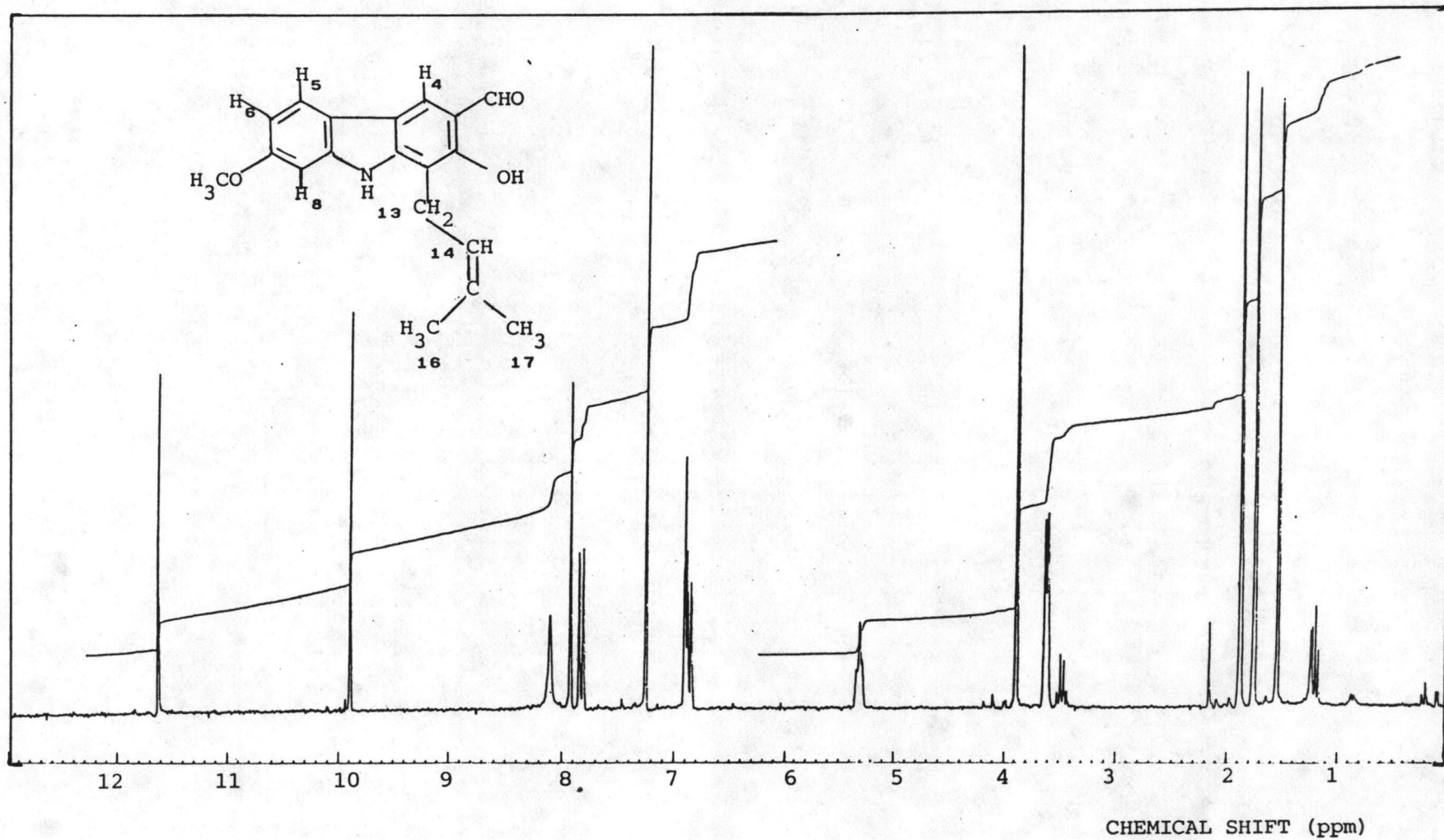


Fig.38 ¹H NMR Spectrum (250 MHz) of Compound VI in CDCl₃

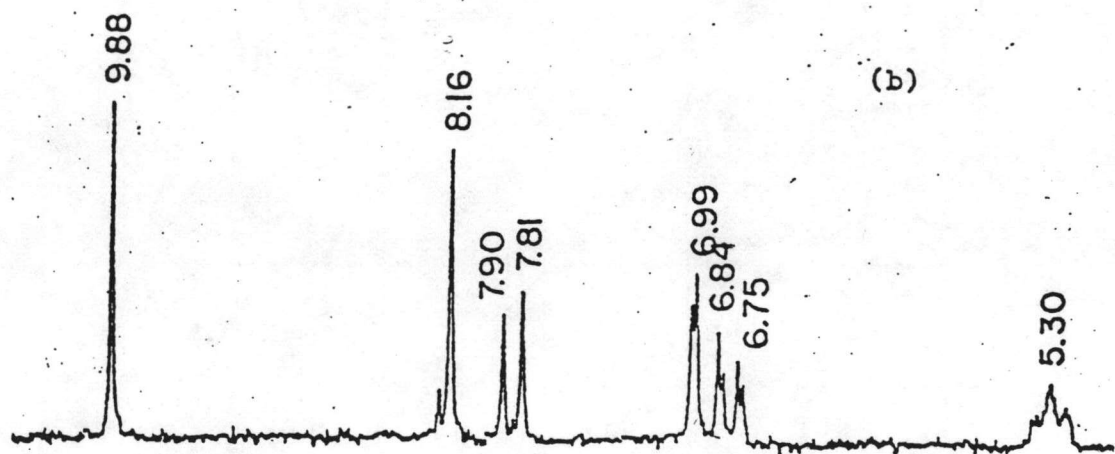
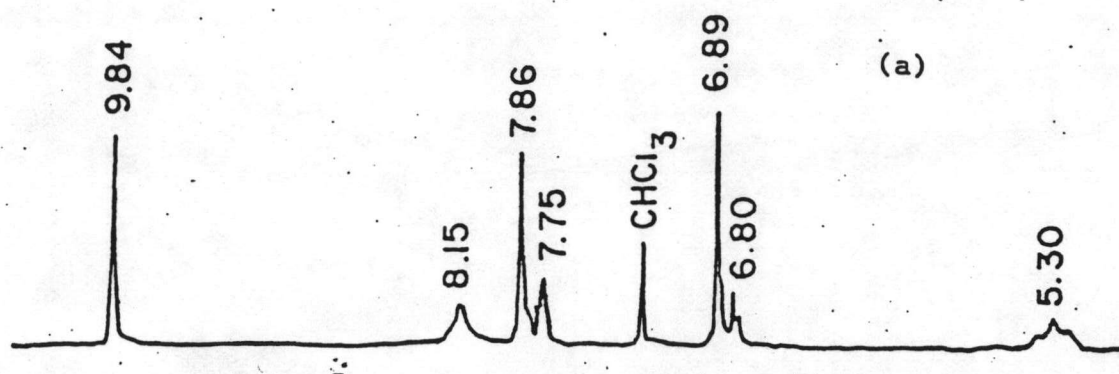


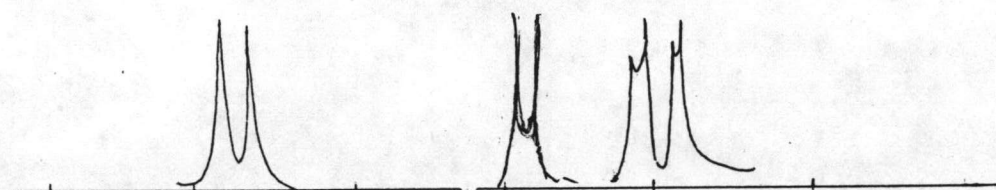
Fig.39 ^1H NMR Spectrum (90 M Hz) of Compound VI (7-Methoxyheptaphylline)

(a) in CDCl_3

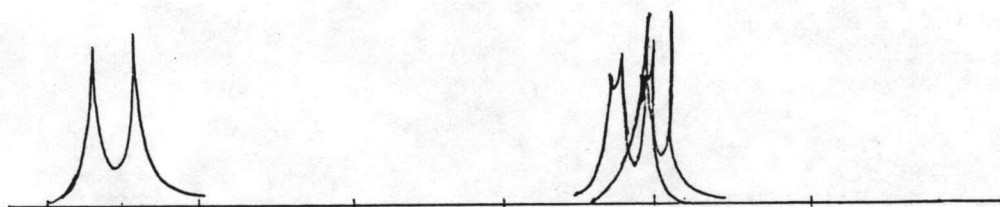
(b) in DMSO-d_6



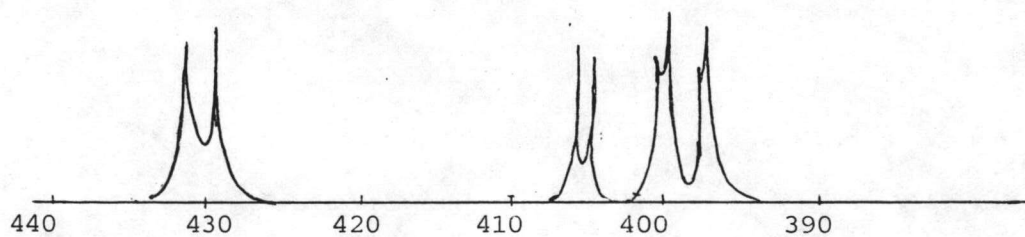
(a) 1,2,3,4-Tetrahydro-6 methoxycarbazole in CDCl_3



(b) 1,2,3,4-Tetrahydro-6 methoxycarbazole in DMSO-d_6



(c) 1,2,3,4-Tetrahydro-7 methoxycarbazole in CDCl_3



(d) 1,2,3,4-Tetrahydro-7 methoxycarbazole in DMSO-d_6

Fig. 40 ^1H NMR spectra of 1,2,3,4-Tetrahydro-6,7 methoxycarbazole
in CDCl_3 and DMSO-d_6

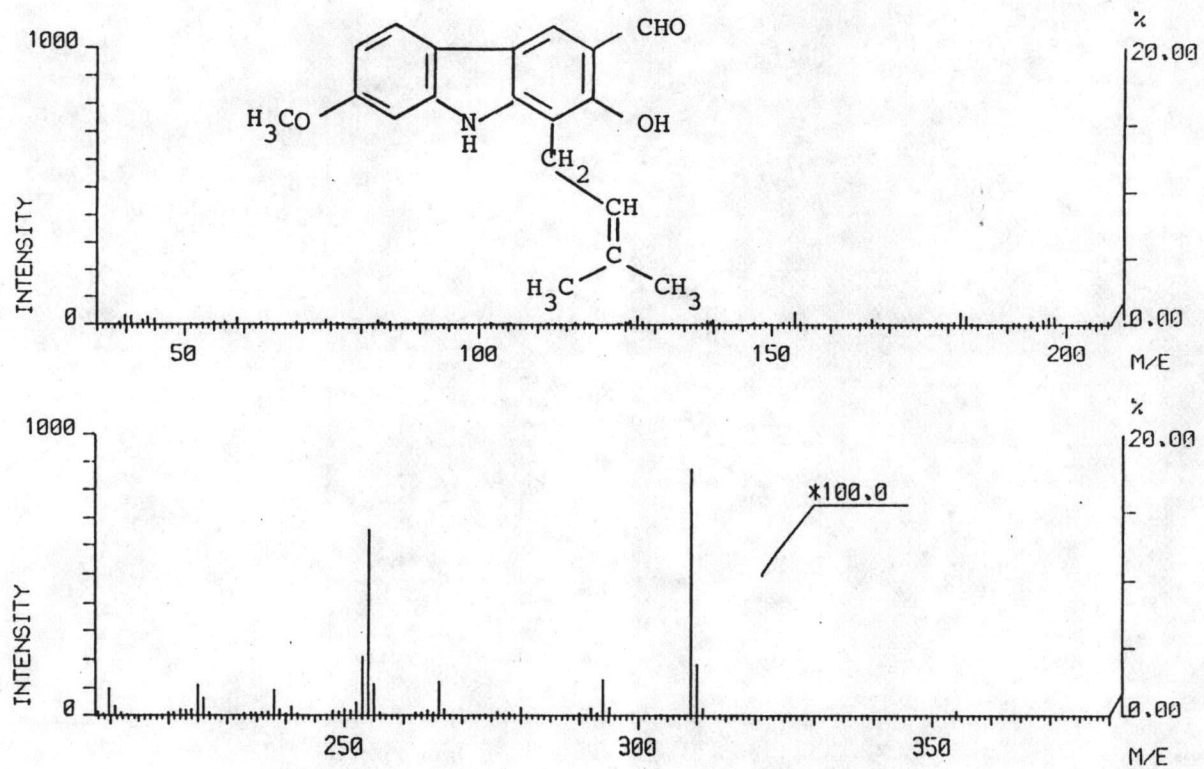


Fig. 41 Mass Spectrum of Compound VI

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