

## REFERENCES

1. Matthew S., G. A. *Pest Management*, New York: Longwan Group Limited, **1990**.
2. Pimsaman, S. *Insecticides*, Faculty of Agriculture, Khonkaen University, **1994**.
3. Audus, L. J. *Herbicides: physiology, biochemistry, ecology*, 2<sup>nd</sup> ed., Vol.1, London: Academic Press, **1976**, 5.
4. Arteca, R. N. *Plant Growth Substances: Principles and Applications*, New York: Chapman and Hall, **1995**, 277.
5. Salisbury, F. B. and Ross, C. W. *Plant Physiology*, California: Wadsworth Publishing Company, **1992**, 357.
6. Oda, K.; Ishii, T. and et al. "Isoxazoline derivatives and plant growth regulators". U. S. 4,889,551 Dec. 26, 1989.
7. Leopold, A. C. *Auxin and Plant Growth*, 2<sup>nd</sup> ed., Los Angeles: University of California Press Berkeley, **1960**, 51.
8. Went, F. W. "Auxin, the plant-growth hormone", *Bol. Rev.*, **1935**, *1*, 162. Through *C. A.* **1935**, *29*, 5478<sup>9</sup>.
9. Kogl, F. "The growth substances of the auxin and bios groups", *Ber.*, **1935**, *68A*, 16. Through *C.A.* **1935**, *29*, 2563.
10. Pokorny, R. "Some chlorophenoxyacetic acids", *J. Am. Chem. Soc.*, **1941**, *63*, 1768.
11. Zimmerman, P. W. and Hitcock, A. E. "Substituted phenoxy and benzoic acid growth substances and the relation of structure to physiological activity", *Contrib. Boyce Thompson Inst.*, **1942**, *12*, 321. Through *C. A.* **1942**, *36*, 6199<sup>7</sup>.
12. Templeman, W. G. "The uses of plant growth substances", *Ann. Appl. Biol.*, **1955**, *42*, 162. Through *C. A.* **1955**, *49*, 12611i.
13. Zimmerman, P. W. and Hitcock, A. E. "Root-inducing activity of phenoxy compounds in relation to their structure", *Contrib. Boyce Thompson Inst.*, **1942**, *12*, 497.
14. Hamner, C. L. and Tukey, H. B. "The herbicidal action of 2,4-dichlorophenoxy acetic acid and 2,4,5-trichlorophenoxyacetic acid on bindweed", *Science*, **1944**, *100*, 154.

15. Zimmerman, P. W. and Synerholm, M. E. "The preparation of some substituted phenoxy alkyl carboxylic acids and their properties as growth substances", *Contrib. Boyce Thompson Inst.*, **1945**, *14*, 91.
16. Buchel, K. H. *Chemistry of Pesticides*, 2<sup>nd</sup> ed., New York: John Wiley & Sons, Inc., **1983**.
17. Stevenson, H. A. and Brookes, R. F. " $\alpha$ -Phenoxyalkanoic acids." *Brit.* 822,199 Oct. 21, 1959. Through *C. A.* **1961**, *55*, 2575i.
18. a) Weintraub, R. L.; Brown, J. W. and Throne, J. A. "Relation between molecular structure and physiological activity of plant growth regulators II. Formative activity of phenoxyacetic acids" *J. Agr. Food Chem.*, **1954**, *2(19)*, 996. b) Shizuoka, T. Y.; Takematsu, T. and Konnai, M. "Phenoxyacetic acid derivatives and plant growth regulating agents containing them as active ingredients": U. S. 5,235,092 Aug. 10, 1993.
19. Kuramochi, H.; Yoshimura, T.; Miyazawa, T.; Konnai, M.; Takematsu, T. and Yoneyama, K. "Structural requirements of phenoxyalkanoic acids and related compounds for promotion of flowering in *Sagittaria pygmaea* Miq.", *J. Agr. Food Chem.*, **1996**, *44(7)*, 111.
20. Wood, J. W. and Fontaine, T. D. "Synthetic plant-growth regulators. III. 2,4-Dichlorophenoxyacetyl derivatives of amino acids", *J. Org. Chem.*, **1952**, *17*, 891.
21. Krewson, C. F. and Wood, J. W. "Biologically active 2,4-dichlorophenoxy-acetylated amino acids", *J. Org. Chem.*, **1960**, *25*, 143.
22. a) Feung, C. S.; Hamilton, R. H. and Mumma, R. O. "Metabolism of 2,4-dichlorophenoxyacetic acid. IV. Mass spectra and chromatographic properties of amino acid conjugates", *J. Agr. Food Chem.*, **1973**, *21(4)*, 632. b) Feung, C. S.; Hamilton, R. H. and Mumma, R. O. "Metabolism of 2,4-dichlorophenoxyacetic acid. V. Identification of metabolites in soybean callus tissue cultures", *J. Agr. Food Chem.*, **1973**, *21(4)*, 637. c) Feung, C. S., Hamilton, R. H. and Mumma, R. O. "Metabolism of 2,4-dichlorophenoxyacetic acid by soybean cotyledon callus tissue cultures", *J. Agr. Food Chem.*, **1971**, *19*, 475. d) Feung, C. S.; Hamilton, R. H.; Witham, F. H. and Mumma, R. O. *Plant Physiol.*, **1972**, *50*, 80.

23. Feung, C. S.; Hamilton, R. H. and Mumma, R. O. "Metabolism of 2,4-dichlorophenoxyacetic acid. VI. Biological properties of amino acid conjugates", *J. Agr. Food Chem.*, **1974**, 22(2), 307.
24. Chinnawong, S. *Principle of Practical for Control Weeds*, Bangkok: Department of Agronomy, Faculty of Agriculture, Kasetsart University, **1996**.
25. Harada, J.; Shibayama, H. and Morita, H. *Weeds in the Tropics*, Tokyo: Sanbi Printing. Co., Ltd. **1997**, 19.
26. Kittipong, P. *Giant Mimosa and Control*, Bangkok: Funny Publishing, **1987**, 7.
27. Khamdee, Y. *Mai Dok & Mai Pradub Chalerm Prakiat*, 1<sup>st</sup> ed., Bangkok: Dansutha Printing Co.,Ltd., **1993**, 232.
28. Smitinand, T. *Thai Plant Names (Botanical Names-Vernacular Names)*, 2<sup>nd</sup> ed., New Jersey: Roehrs Company-Publishers, **1980**, 90.
29. Graf, A. B. *Tropica-Color Cyclopedia of Exotic Plants and Trees*, 2<sup>nd</sup> ed., New Jersey: Roehrs Company-Publishers, **1981**, 978.
30. Weesommai, A.; Siripanish, S.; Meenakanit, A. and Pichakam *Paru Mai Nai Ngarn Phum Sathapattayakarm*, Bangkok: Green Thum Co., Ltd., **1997**, 259.
31. Furniss, B. S.; Hannaford, A. J.; Rogers, V.; Smith, P. W. G. and Tatchell, A. R. *Vogel's Textbook of Practical Organic Chemistry*, 5<sup>th</sup> ed., New York: John Wiley & Sons, **1989**, 754, 1249.
32. Hayes, N. V. and Branch, G. E. K. "The acidic dissociations of phenoxyacetic acid and its derivatives", *J. Am. Chem. Soc.*, **1943**, 65, 1555.
33. *The Merck Index: an encyclopedia of chemicals, drugs and biological*. 12<sup>th</sup> ed., New Jersey: Merck & Co., Inc., **1996**.
34. Finger, G. C.; Gortatowski, M. J.; Shiley, R. H. and White, R. H. "Aromatic fluorine compounds. VIII. Plant growth regulators and intermediates" *J. Am. Chem. Soc.*, **1959**, 81, 94.
35. Phillips, J. N. "The influence of ionization on the ultraviolet spectra of chlorinated phenoxyacetic acids and related phosphorus analogues", *Aus. J. Chem.*, **1959**, 12, 199.
36. Fawcett, C. H.; Wain, R. L. and Wightman, F. "Studies on plant growth-regulating substances. VIII. The growth-promoting activity of certain aryloxy- and arylthio-alkanecarboxylic acids", *Ann. Appl. Biol.*, **1955**, 43(3), 342.

37. Weast, R. C. *Handbook of Chemistry and Physics*, 1<sup>st</sup> ed., Florida: CRC Press, Inc., **1988**, C-416, C-417.
38. Toohill, J. W. R. L. and Wightman, F. "Studies on plant growth-regulating substances. X. The activity of some 2:6- and 3:5-substituted phenoxyalkane-carboxylic acids", *Ann. Appl. Biol.*, **1956**, 44(4), 547.
39. Elvidge, J. A. and Foster, R. G. "Monomethyl-indoles, -benzofurans and -benzothiophenes, their long-range and other proton-proton couplings and the non-equivalence of methylene protons in some intermediate diethyl acetals", *J. Chem. Soc.*; **1964**, 981.
40. Baker, B. R.; Lee, W. W.; Skinner, A. P.; Martinez, A. P. and Tong, E. "Potential anticancer agents-L. Non-classical antimetabolites-II. Some factors in the design of exo-alkylating enzyme inhibitors, particularly of lactic dehydrogenase", *J. Med. Pharm. Chem.*, **1960**, 2(6), 633.
41. Honma, S. and Kambekawa, A. "Isolation and characterization of metabolites derived from 1-*tert*-butylamino-3-(2,3-dimethylphenoxy)-2-propanol (D-32), a new  $\beta$ -blocker", *Chem. Pharm. Bull.*, **1975**, 23, 1045.
42. Abraham, D. J.; Kennedy, P. E.; Mehanna, A. S.; Patwa, D. C. and Williams, F. L. "Design, synthesis and testing of potential antisickling agents. 4. Structure-activity relationships of benzyloxy and phenoxy acids" *J. Med. Chem.*, **1984**, 27(8), 967. Through *C. A.*, **1984**, 101, 48174r.
43. Albright, A. R. "A hydrate of 1,3,5-xylenoxyacetic acid", *J. Am. Chem. Soc.*, **1933**, 55, 1736.
44. Minton, T. H. and Stephen, H. "Preparation of *o*-, *m*- and *p*-nitrophenoxyacetic acids and various nitrotolxyloxyacetic acids and their derivatives", *J. Chem. Soc.*, **1922**, 121, 1591.
45. Papa, D.; Schwenk, E. and Ginsberg, H. F. "Reductions with nickel-aluminum alloy and aqueous alkali. Part VII. Hydrogenolysis of sulfur compounds", *J. Org. Chem.*, **1949**, 14, 723.
46. Chatterjea, J. N. and Mehrotra, V. N. "Synthesis of furano compounds. XXIII. succinoylation of  $\beta$ -brazan", *J. Indian Chem. Soc.*, **1963**, 40, 203. Through *C. A.*, **1963**, 59, 9943f.
47. Schuikin, N. I.; Erivanskaya, L. A. and An., V. V. "Contact catalytic transformation of phenetole, *n*-propyl and isopropyl phenyl ethers in the

- presence of aluminum oxide", *Vestn. Mosk. Univ.*, **1957**, *12(5)*, 125. Through *C. A.*, **1959**, 1213c.
48. Bowman, R. S.; Stevens, D. R. and Baldwin, W. E. "Steric and resonance effects in the *tert*-butyl and isobutylphenols", *J. Am. Chem. Soc.*, **1957**, *79*, 87.
49. Abdurasuleva, A. R.; Akhmedov, K. N. and Tadzhimukhamedov, Kh. S. "Benzylation of phenol and anisole", *Uzb. Khim. Zh.*, **1972**, *16(2)*, 54. Through *C. A.*, **1972**, *77*, 74942v.
50. Knut, L.; Rolf, S. and Sverker, V. U. "Stereochemical assignment of the threo and erythro forms of 2-(2,6-dimethoxyphenoxy)-1-(3,4-dimethoxyphenyl)-1,3-propanediol forms X-ray analyses of the synthetic intermediates (z)-2-(2,6-dimethoxyphenoxy)-3-(3,4-dimethoxyphenyl)-2-propenoic acid and threo-2-(2,6-dimethoxyphenoxy)-3-(3,4-dimethoxyphenyl)-3-hydroxypropanoic acid", *Acta Chem. Scand; Ser. B*, **1987**, *B41(7)*, 499. Through *C. A.* **1988**, *109*, 109,957n.
51. Purohit, D. M. and Shah, V. H., *Indian J. Chem. Sect. B.*, **1999**, *38(5)*, 618.
52. Shapiro, S. L.; Soloway, H.; Shapiro, H. and Freedman, L. "Hypocholesteremic agents I. *p*-(Acetamidophenoxy)acetic acid derivatives", *J. Pharm. Sci.*, **1961**, *50*, 973.
53. Munch-Petersen, J. and Hauser, C. R. "Acylation of certain  $\alpha$ -alkoxy and  $\alpha$ -aryloxy ketones and esters", *J. Am. Chem. Soc.*, **1949**, *71*, 770.
54. Tietze, L. F.; Eicher, T. and et al. *Reactions and Syntheses in the Organic Chemistry Laboratory*, California: University Science Books, **1989**, 119.
55. Newman, M. S.; Fones, W. and Renoll, M. "New compounds as plant growth regulators", *J. Am. Chem. Soc.*, **1947**, *69*, 718.
56. Eckstein, Z. "Some problems of obtaining weed killers. III. The action of active chlorine on phenoxyacetic acids", *Roczniki Chem.*, **1956**, *30*, 627. Through *C. A.*, **1957**, 657h.
57. Hill, C. M.; Towns, M. B. and Senter, G. "Preparation and reactions of several chlorine substituted phenoxyacetyl chlorides", *J. Am. Chem. Soc.*, **1949**, *71*, 257.
58. Haskelberg, L. "The halogenation of aryloxyacetic acids and their homologs", *J. Org. Chem.*, **1947**, *12*, 426.



59. Fraukenthal, P. P. and Wachenheim, K. E. "5-(*N*-3,4,5,6-Tetrahydrophthalimide) cinnamic acid derivatives": U. S. 5,009,701 Apr. 23, 1991.
60. Bolhofer, W. A.; Baldwin, J. J.; Merck and Co., Inc. "(Succinimidoaryloxy) alkanolic acids, esters and amides": U. S. 3,465,002 Sep. 2, 1969. Through *C. A.*, **1970**, *72*, 78730u.
61. Vamecq, J.; Lambert, D.; Poupaert, J. H.; Masereel, B. and Stables, J. P. "Anticonvulsant activity and interactions with neuronal voltage-dependent chlorine substituted phenoxyacetyl chlorides", *J. Am. Chem. Soc.*, **1949**, *71*, 257.
62. Borders, C. L., Jr; Blech, D. M. and McElvany, K. D. "L-Amino acid ethyl ester hydrochlorides", *J. Chem. Ed.*, **1984**, *61*(9), 814.
63. Young, P. E. and Campbell, A. "The synthesis of a dipeptide from its component amino acids", *J. Chem. Ed.*, **1982**, *59*(8), 701.
64. Shizuo, A.; Toshiyuki, H.; Teizo, Y. and Yataro, I "Novel amide compound and herbicide comprising it": E. P. 194,403 Sep. 17, 1986.
65. Stevenson, D. and Young, G. T. "Amino-acids and peptides. Part XXXI. *N*-(piperidino-oxycarbonyl)-amino-acids and their use in peptide synthesis", *J. Chem. Soc. (London)*, **1969**, 2389.
66. Harada, J.; Yano, M. *Proceedings of the Ninth Asian-Pacific Weed Science Society Conference*, The Nation Science and Technology Authority and Phillippine Tobacco Research and Training Center, **1983**, 71.
67. Mitchell, J. W. and Livingston, G. *Methods of Studying Plant Hormones and Growth-Regulating Substances*, Washington, D. C.: U. S. Government Printing Office, **1968**, 79.

## APPENDICES

## APPENDICES A

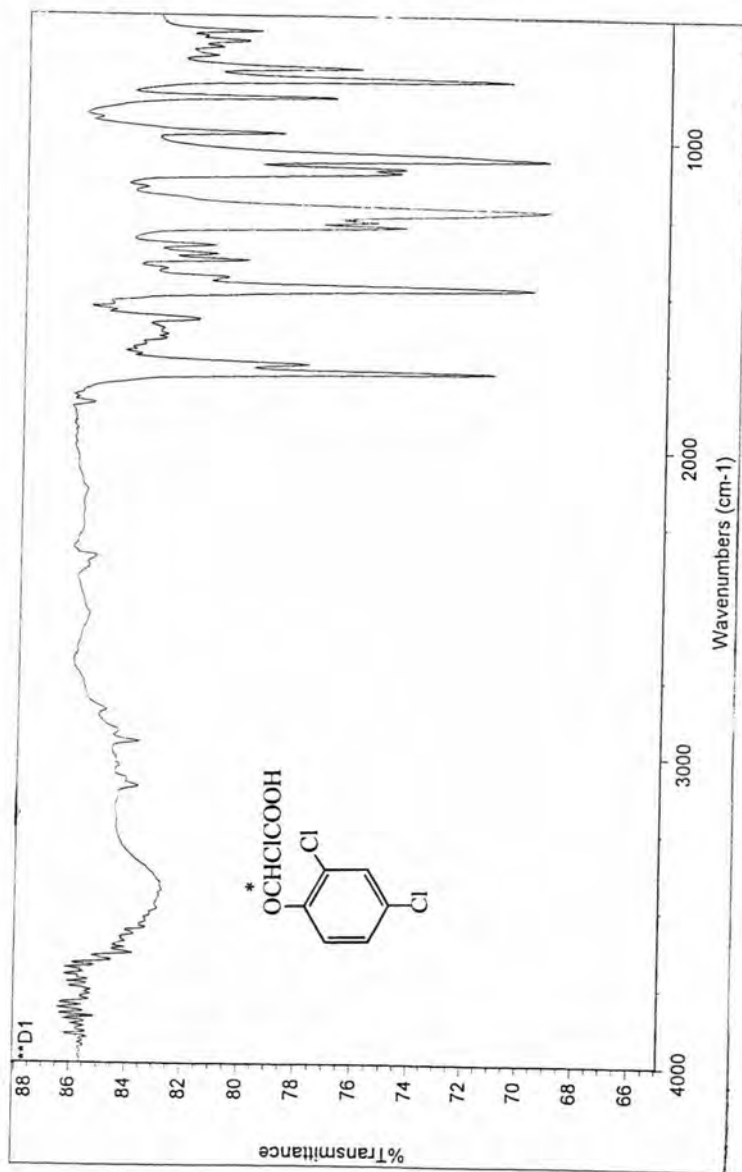


Figure A.1 The FT-IR spectrum of 41



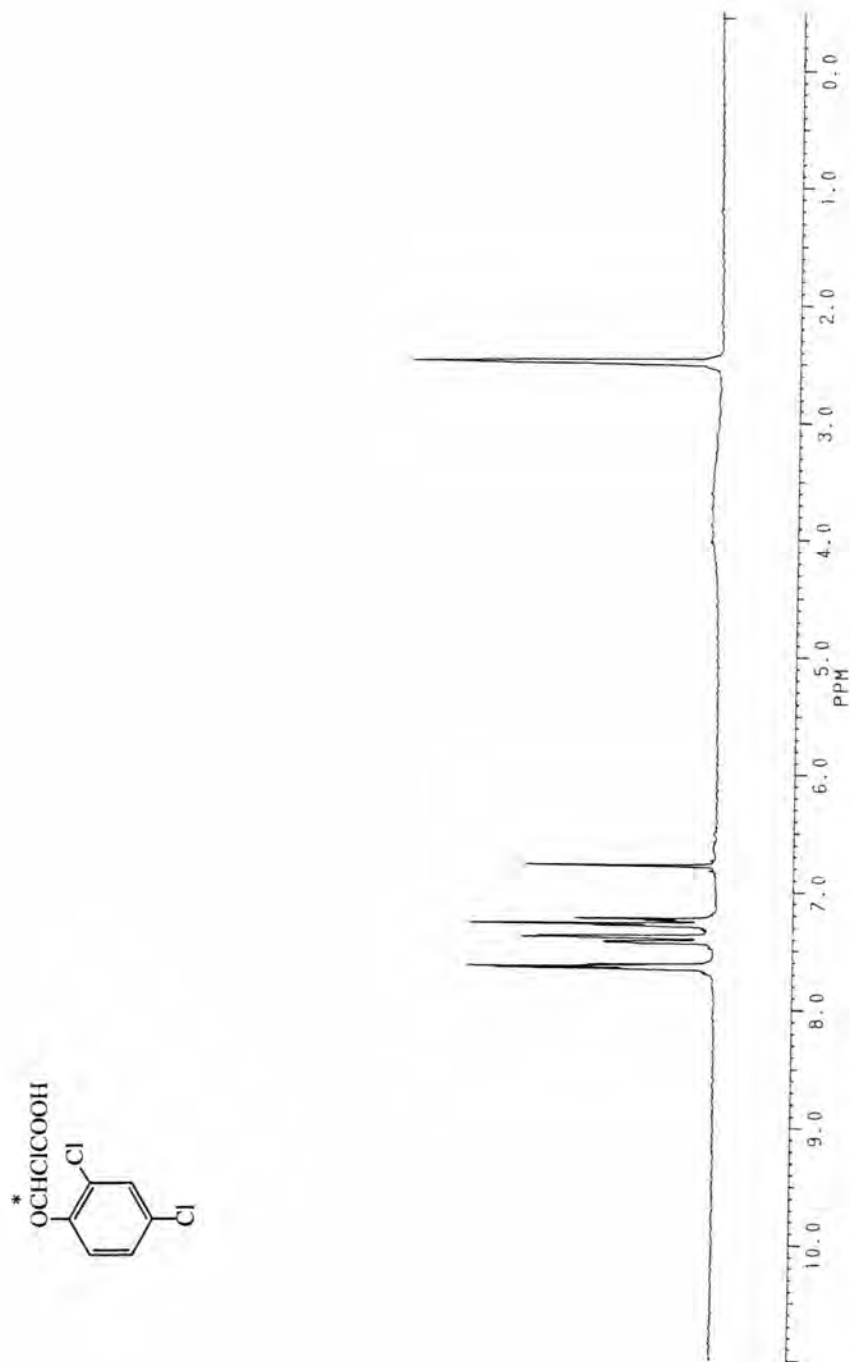


Figure A.2 The <sup>1</sup>H-NMR spectrum of **41**

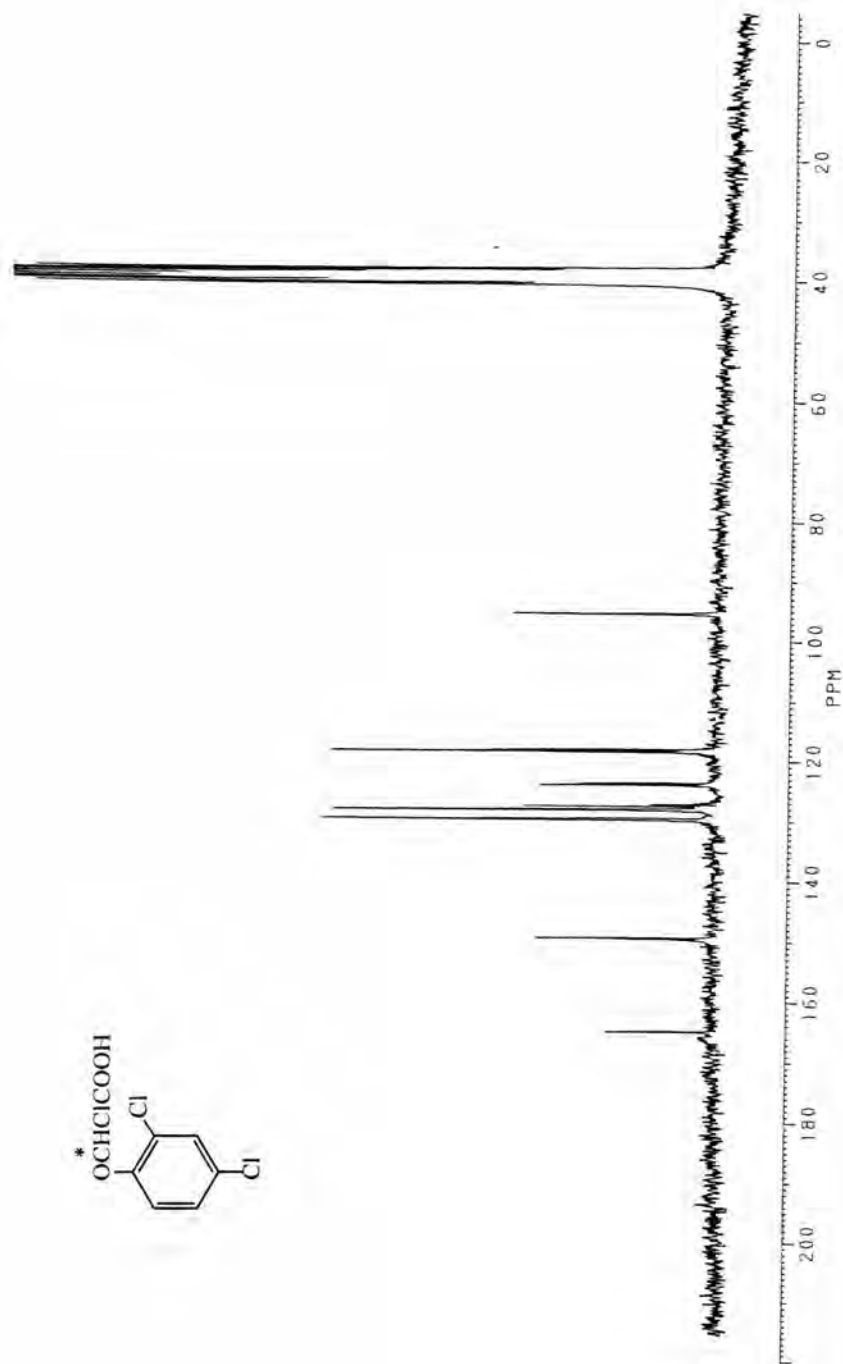
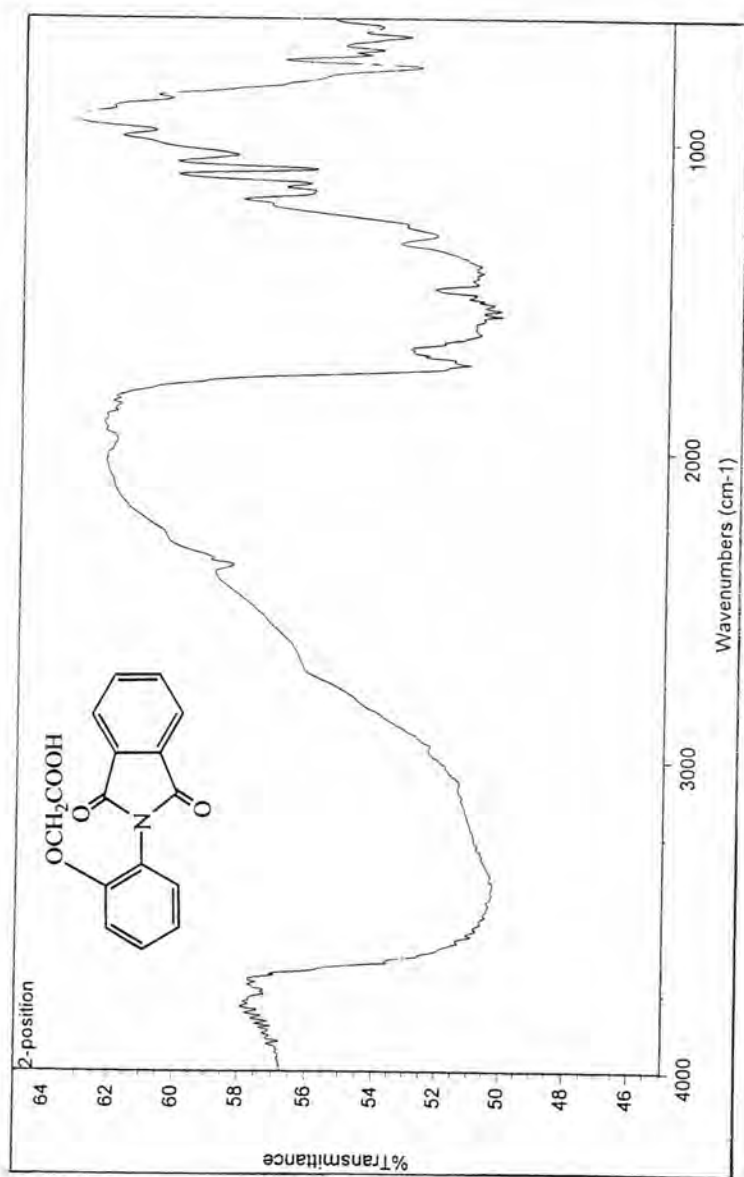


Figure A.3 The  $^{13}\text{C}$ -NMR spectrum of 41



**Figure A.4** The FT-IR spectrum of **50**

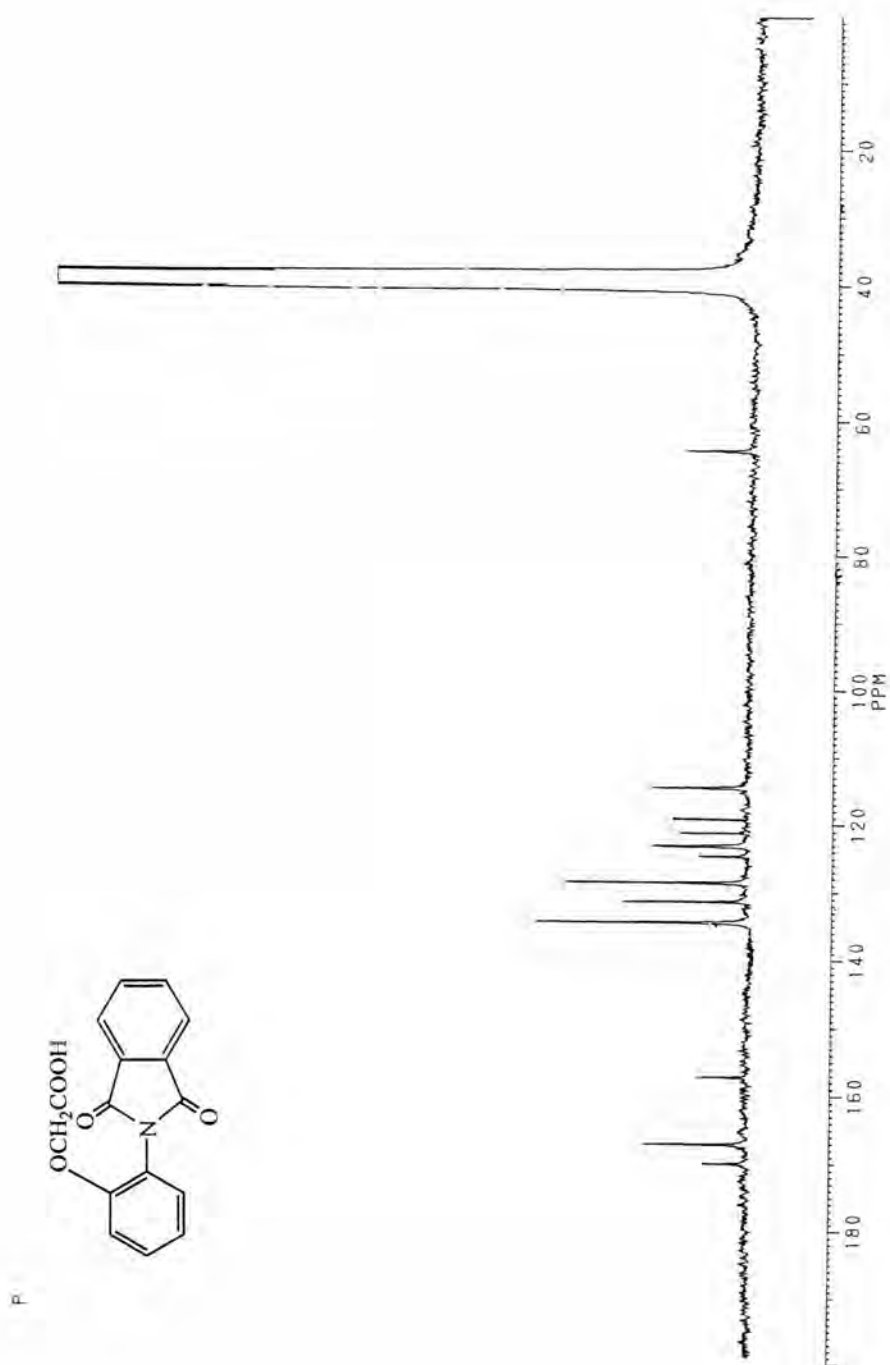
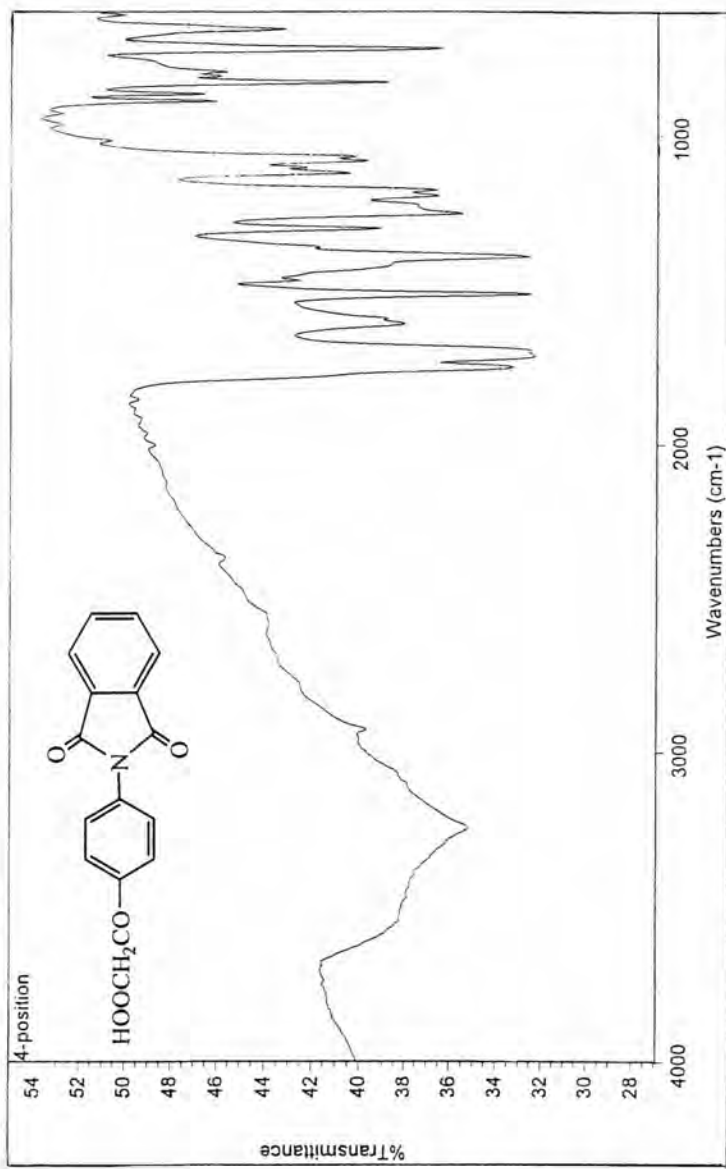


Figure A.5 The  $^{13}\text{C}$ -NMR spectrum of 50



**Figure A.6** The FT-IR spectrum of **51**

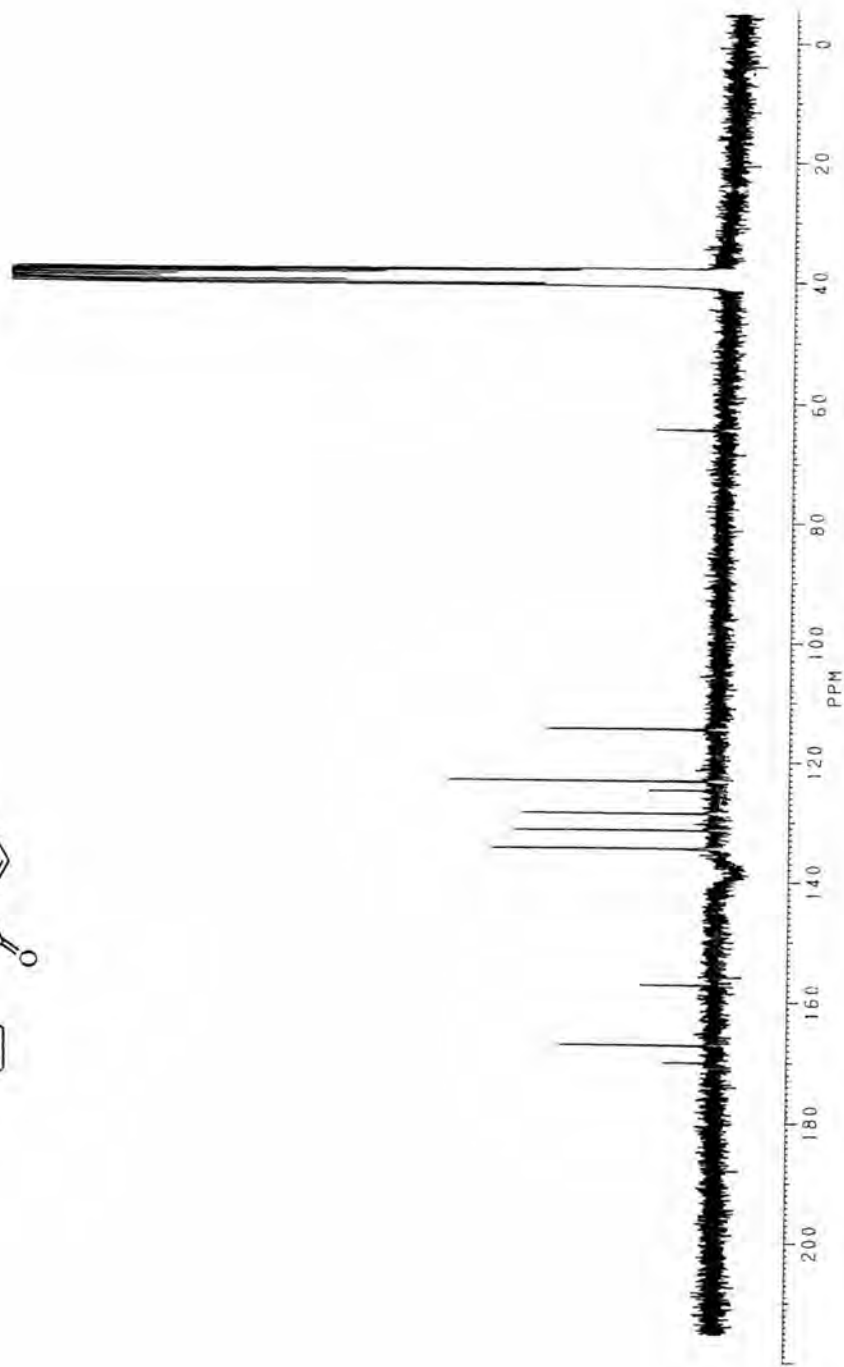
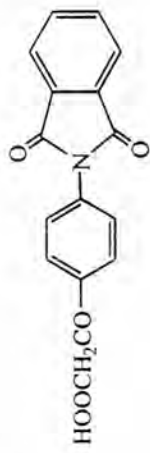


Figure A.7 The  $^{13}\text{C}$ -NMR spectrum of 51



## APPENDICES B

**Table A** Percent growth inhibition at concentrations of 1, 10, 100 and 1000 ppm of some substituted phenoxyacetic acids against *M. pigra* Linn.

Compound	% Growth Inhibition at (ppm)							
	Root				Shoot			
	1	10	100	1000	1	10	100	1000
1	-37.14	3.19	-46.28	82.25	-27.33	-21.27	-28.85	63.62
2	4.21	-8.56	55.30	95.74	53.31	37.31	65.32	100.00
3	49.98	70.96	77.41	87.09	-7.62	6.78	51.49	71.20
4	-108.60	-19.20	51.04	80.84	-14.64	-41.09	47.09	94.12
5	-174.58	-29.84	74.46	89.36	26.64	22.64	66.65	96.00
6	37.86	90.76	93.73	99.67	3.00	-70.49	14.76	58.85
7	-14.94	68.07	76.59	76.59	6.63	46.65	61.32	79.99
8	43.24	73.93	86.80	94.09	-14.64	20.63	38.27	58.85
9	6.42	80.46	82.25	85.48	18.14	53.09	57.56	75.75
10	37.75	37.75	33.97	100.00	-135.19	-87.96	51.85	100.00
11	12.55	48.85	81.85	94.39	5.30	13.30	58.65	75.99
12	-114.94	53.17	74.46	76.59	-5.38	35.97	63.99	81.33
13	33.97	24.54	52.84	49.07	-125.00	-126.85	-13.89	67.59
14	29.79	50.53	73.41	100.00	7.11	-1.82	5.32	100.00
15	14.90	40.96	21.28	89.36	16.04	23.19	1.75	55.34
16	39.36	15.96	64.90	95.21	10.68	-1.82	-1.82	64.27
17	-82.97	-40.95	47.61	61.70	-12.54	8.90	26.76	51.77
18	-76.05	4.26	39.90	95.74	1.75	10.68	28.55	67.85
19	-142.01	-135.09	-60.63	87.30	5.32	7.11	5.32	42.84
20	-89.35	-86.69	-68.08	70.21	17.83	1.75	30.33	28.55
21	-108.50	15.43	50.53	79.26	1.75	7.11	38.37	57.13
22	4.23	10.00	38.46	100.00	29.71	48.63	62.15	55.39
23	-169.64	-62.72	-72.01	62.81	-6.67	7.78	4.44	60.00

Table A (cont.)

Compound	% Growth Inhibition at (ppm)							
	Root				Shoot			
	1	10	100	1000	1	10	100	1000
24	10.11	28.2	13.30	80.85	-16.11	10.68	14.26	35.69
25	-105.84	-56.91	17.56	95.21	-3.61	-21.47	17.83	62.49
26	-70.20	-118.61	-24.99	67.02	1.75	30.33	-7.18	21.40
27	7.70	-16.53	51.92	98.46	43.23	12.14	41.88	63.50
28	0.39	25.39	17.31	75.39	56.75	62.15	55.39	49.99
29	-10.00	14.62	30.00	60.39	5.38	44.58	45.93	55.39
30	-42.96	-34.82	-101.07	73.27	5.56	-23.33	45.56	70.00
31	-17.69	28.08	9.62	60.39	51.34	56.75	41.88	52.69
32	13.08	49.62	85.77	93.08	60.80	62.15	47.28	64.86
33	1.16	29.62	29.04	100.00	67.56	72.97	59.45	55.39
34	20.00	39.62	63.85	78.46	67.56	64.86	66.21	51.34
35	33.97	30.20	22.66	30.20	-151.85	-152.78	-112.04	100.00
36	39.63	33.97	32.09	88.68	-172.22	-125.93	28.70	98.15
37	43.41	45.29	43.41	100.00	-123.15	-131.48	-12.04	100.00
38	-19.13	-14.18	-20.78	7.93	3.00	-23.46	-5.82	0.06
39	-108.13	-145.24	16.10	85.48	15.20	-10.66	15.11	77.26
40	-14.55	25.78	48.37	80.64	36.33	18.14	43.91	77.26
41	-55.74	-96.42	-101.07	59.32	6.67	-3.33	-11.11	26.67
42	7.11	32.12	46.41	100.00	-5.47	41.81	49.08	96.36
43	-21.47	42.84	35.69	100.00	-3.66	12.71	54.54	63.63
44	-14.33	14.26	28.55	39.26	-3.66	25.44	21.80	44.54
45	45.22	69.64	91.09	97.03	17.70	23.57	38.27	88.24
46	11.56	58.09	82.18	84.49	8.88	29.45	29.45	44.15
47	-2.63	4.63	-15.17	2.32	-26.40	5.94	-20.52	-44.03
48	-113.47	-11.42	-64.53	21.90	5.44	-18.20	-20.02	-36.39
49	-56.20	26.06	4.20	23.98	-1.84	-51.85	-39.12	4.53
50	-1.12	-67.36	-73.18	-42.96	2.22	-28.89	-46.67	8.89

Table A (cont.)

Compound	% Growth Inhibition at (ppm)							
	Root				Shoot			
	1	10	100	1000	1	10	100	1000
<b>51</b>	67.46	16.32	54.67	16.32	-1.12	-67.36	-73.18	-42.96
<b>52</b>	30.70	63.04	80.53	84.82	11.82	11.82	-8.76	41.21
<b>53</b>	41.92	68.32	79.87	93.40	11.82	-44.03	38.27	50.03
<b>54</b>	46.54	68.62	72.11	77.92	-32.22	17.78	42.22	72.22
<b>55</b>	37.75	26.43	39.63	75.48	-46.30	44.44	86.11	92.59
<b>56</b>	60.07	77.23	90.10	91.75	8.88	-14.64	50.03	67.67
<b>57</b>	75.01	80.21	76.05	79.17	11.80	43.63	56.36	57.26
<b>58</b>	75.01	78.13	79.17	63.55	21.80	41.81	59.99	80.91
<b>59</b>	6.28	67.72	73.97	86.46	-40.93	29.08	56.36	87.27
<b>60</b>	61.47	78.13	75.01	76.05	16.35	46.35	48.17	59.99
<b>61</b>	70.84	80.21	76.05	87.50	19.99	49.08	56.36	84.54
<b>62</b>	76.05	79.17	76.05	92.71	8.17	50.90	55.45	92.73
<b>63</b>	74.67	84.00	87.34	94.67	-7.29	-14.57	18.17	52.72
<b>64</b>	79.34	84.00	88.67	92.00	-12.75	-21.84	45.44	69.09
<b>65</b>	14.68	56.01	78.67	86.67	-7.29	-0.02	-40.03	49.08
<b>66</b>	5.35	78.67	88.00	92.00	-3.66	-12.75	14.53	38.17
<b>67</b>	5.21	31.54	63.14	73.67	-32.43	-0.13	32.17	28.94
<b>68</b>	10.48	-7.95	15.75	34.18	-9.82	-25.97	-25.97	19.25
<b>69</b>	-5.32	21.01	31.54	44.71	-45.35	-29.20	-19.51	25.71

**Table B** Percent growth inhibition at concentration of 1, 10, 100 and 1000 ppm of some commercially available herbicides against *M. pigra* Linn.

Herbicide*	% Growth Inhibition at (ppm)							
	Root				Shoot			
	1	10	100	1000	1	10	100	1000
<b>H1</b>	45.67	80.39	80.71	89.39	40.01	18.76	10.01	30.01
<b>H2</b>	19.30	-1.59	83.92	92.93	26.26	42.51	50.01	66.25
<b>H3</b>	85.85	85.85	89.71	95.82	33.76	41.26	52.51	67.50
<b>H4</b>	-1.92	52.74	81.67	96.78	1.26	46.26	52.51	81.25

**Herbicides\***

**H1** = Mets, active ingredient: methyl-2[[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl) amino]-sulfonyl]-benzoate

**H2** = Diuron, active ingredient: [3-(3,4-dichlorophenyl)-1,1-dimethylurea]

**H3** = Broom, active ingredient: 5-bromo-3-*sec*-butyl-6-methyluracil

**H4** = Hexaz, active ingredient: 3-cyclohexyl-6-(dimethylamino)-1-methyl-1,3,5-triazine-2,4-(1*H*, 3*H*)-dione

**Table C** The percent growth promotion of root of substituted phenoxyacetic acids commercial substances against *C. atropurpureus* at  $10^{-6}$  ppm

Compound	Dry weight (mg)		
	Average	SD*	% Promotion
1	4.450	0.542	34.0
2	6.330	0.581	90.7
3	3.190	1.309	-3.9
4	2.290	0.694	-31.0
5	2.970	1.877	-10.5
6	5.330	0.596	60.5
7	5.320	0.587	60.2
8	4.860	0.883	46.4
9	4.810	0.871	44.9
10	2.330	0.783	-29.8
11	5.760	0.508	73.5
12	5.550	0.495	67.2
13	2.990	0.829	-9.9
14	3.120	0.541	-6.0
15	2.830	0.727	-14.8
16	2.930	0.368	-11.7
17	3.510	0.725	5.7
18	4.690	0.745	-41.3
19	3.300	0.616	-0.6
20	3.460	0.749	4.2
21	3.600	0.414	8.4
22	3.020	0.636	-9.0
23	3.350	1.504	0.9
24	2.260	0.378	-31.9
25	1.640	0.435	-50.6
26	3.040	0.381	-8.4
27	2.230	0.211	-32.8



Compound	Dry weight (mg)		
	Average	SD*	% Promotion
28	2.370	0.440	-28.6
29	2.620	0.459	-21.1
30	2.380	0.644	-28.3
31	3.150	0.731	-5.1
32	3.460	0.734	4.2
33	3.970	0.663	19.6
34	4.190	0.745	26.2
35	2.720	0.786	-18.1
36	3.000	0.860	-9.6
37	2.710	0.637	-18.4
38	3.990	0.749	20.2
39	4.350	0.701	31.0
40	3.670	0.589	10.5
41	3.170	0.729	-4.5
42	2.770	0.495	16.9
43	2.363	0.708	-0.3
44	3.540	0.700	49.4
45	3.240	0.648	36.7
46	4.080	1.146	72.2
47	4.120	0.801	73.8
52	4.250	0.732	79.3
53	3.000	0.789	26.6
54	2.130	0.495	-10.1
55	2.830	0.514	19.4
56	4.100	0.514	73.0
57	2.170	0.783	-8.4
58	1.990	0.398	-16.0
59	3.110	0.791	31.2
60	3.300	0.655	39.2
61	2.980	0.961	25.7



Compound	Dry weight (mg)		
	Average	SD*	% Promotion
<b>62</b>	2.160	0.659	-8.86
<b>63</b>	3.430	1.031	44.7
<b>64</b>	3.000	1.048	26.6
<b>65</b>	2.250	1.151	-5.1
<b>66</b>	1.450	1.202	-38.8
<b>C1</b>	3.210	2.880	35.4
<b>C2</b>	0.720	0.530	21.5

\* SD = Standard derivation values

**C1** =  $\alpha$ -Naphthalene acetic acid

**C2** = Exotic Brand, active ingredient was not mentioned.

## CURRICULUM VITAE

Miss Wanida Munbunjong was born on November 13, 1975 in Bangkok, Thailand. She received a Bachelor Degree of Science, majoring in Chemistry from Chulalongkorn University in 1998. Since 1998, she has been a graduate student studying Organic Chemistry as her major course at Chulalongkorn University. During her studies towards the Master's degree, she was awarded a teaching assistant scholarship by the Faculty of Science during 1998-2000 and was supported by a research grant for her Master degree's thesis from the Graduate School, Chulalongkorn University.

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