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APPENDIX

APPENDIX A

Azadirachtin analysis by using High Performance Liquid Chromatography (HPLC)

Azadirachtin quantity were determined by using High performance liquid chromatoghaphy of methods of Agricultural Toxic Substance Division Agricultural Department.

Adjusting condition of HPLC

Instrument	: Shimadzu LC-6A
Column	: RP-8 lichrospher 5 um (Merck) 125x4 mm
Mobile phase	: Acetonitrile : water, 30:70
Flow rate	: 1 ml/min
detector	: UV 210 nm
Attenuation	: 0.02 AUFS
Elution system	: Isocratic system
Sample size	: 10 μl

Preparing sample to analyze

(1). Standard solution of 95 % azadirachtin were prepared with methanol into concentration ranging 0.01-0.18 mg/ml.

(2). Extracts samples solution 1 ml were fitered through a 0.45 μm microfilter membrane after preparing samples.

Methodology to prepare samples for HPLC analysis.

Neem seed extract

1. A suspension of ten grams of crushed Thai neem extract in 100 ml of hexane was stirred occasionally at room temperature for five hours.

2. Then, filtered through a filter paper.

3. The defatted mare was then extracted with 100 ml of methanol in the same manner as the hexane extraction for 24 hours.

4. Then, filtered through a filter paper.

5. Solution were added to 100 ml of methanol.

6. one ml of sample were prepared for HPLC analysis.

Neem oil

Follow the modified clean up procedure of Isman et al., 1990.

1. Add 10 ml of 50 % aqueous methanol and 10 ml dietheyl ether to one gram crude neem oil.

2. Mix the phases by vigorous shaking in a separatory funnel and allow to separate over night.

3. Remove the aqueous methanol layer.

4. Re-extract the diethyl ether phase twice with 10 ml of 50 % aqueous methanol.

5. Combine the aqueous methanol up to 10 ml in a volumetric flask and filter the sample.

6. For HPLC analysis dilute the sample 1: 10 with mobile phase.

7. Azadirachtin content is calculated 95 %(w/w).

Neem leave extract and commercial neem extract were dilute 1:100 . Then extracts samples solution 1 ml were fitered through a 0.45 μm microfilter membrane.

(3). Ten μl standard solution were injected until area or peak were contant and different each times less than 1 %, then sample were injected.

(4). Samples Value were compared with standard value and calculated. Quanlitative of azadirachtin in sample were determined.

<u>Calibration curves</u>

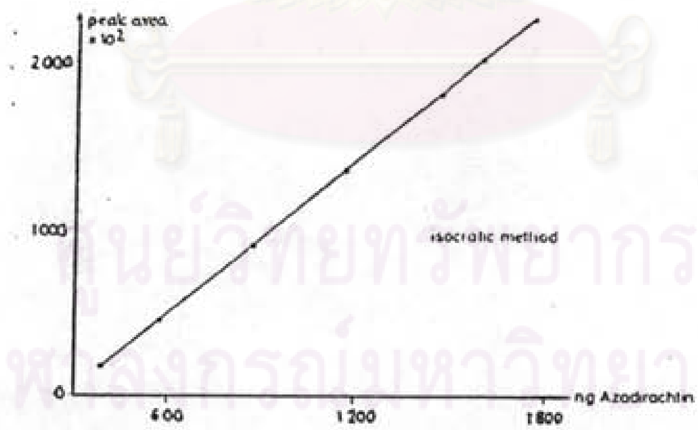


Figure 1 : Calibration curve of azadirachtin standard in averge of 100 -1800 ng run under isocratic conditions. Peak area vs ng azadirachtin.

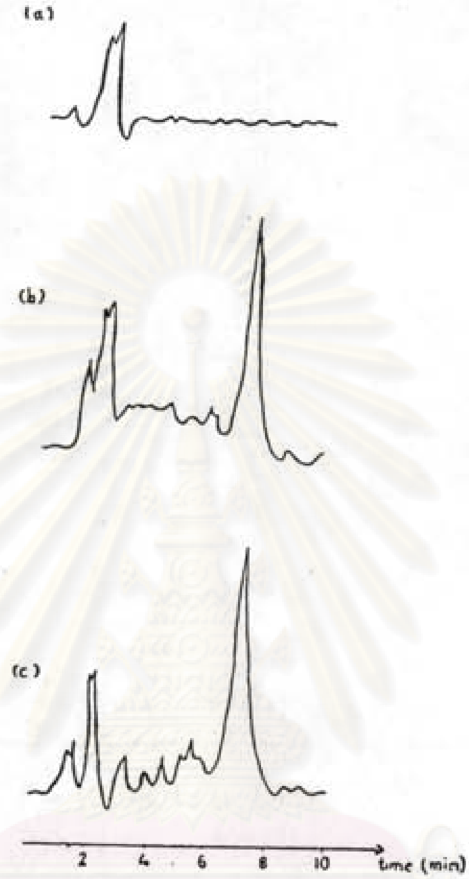
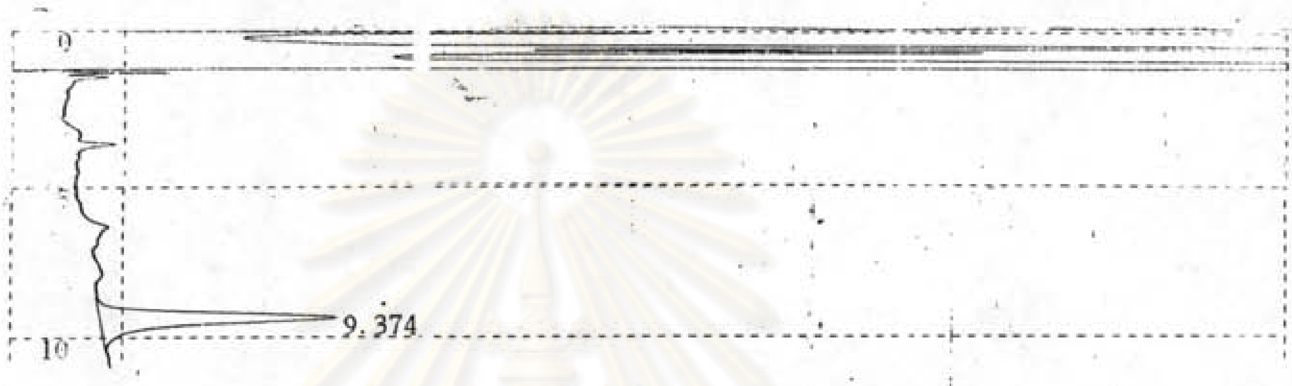


Figure 2 : HPLC chromatogram of (a). methanol control, (b). azadirachtin standard, and (c).Neem extract run under isocratic conditions. Peak area vs time.

HPLC CHROMATOGRAM OF SAMPLE

Analysis File : 2:DETER.

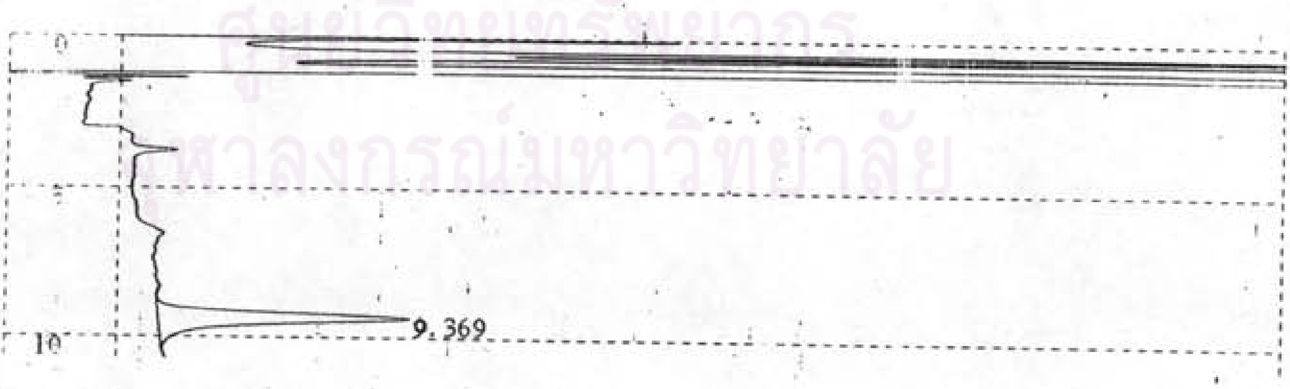
azadirachtin determination.RP-18 125*4mn sum CH3CN:H2O=30:70
flow 1ml min;uv 210mn.



** CALCULATION REPORT **

CH	PKNO	TIME	AREA	HEIGHT	MK	IDNO	CONC	NAME
1	3	9.374	43178	1649			100	
	TOTAL		43178	1649			100	

azadirachtin determination.RP-8 125*4mn sum CH3CN:H2O=30:70
flow 1ml/min;uv 210mn.



APPENDIX B

ESTIMATION OF THE MEDIAN LETHAL DOSE (THE LD_{50} VALUE)

The LD_{50} value were determined by using probit analysis (Finney , 1971).

Probit analysis

Probit analysis is a system of statistical techniques chiefly concerned with the relation between the frequency of occurrence of a specific response and the numerical amount of a dose or other stimulus that tends to induce the response which known as "biological variation" that show relation in sigmoid curve.

Then probability of response on a thranformed is transformed on normal equivalent diviate (or N.E.D) scale. So that the relation between the dose parameter and the N.E.D. of the probability of response is transformed into a straight line, i.e. linear relationship.
dose is a straight line.

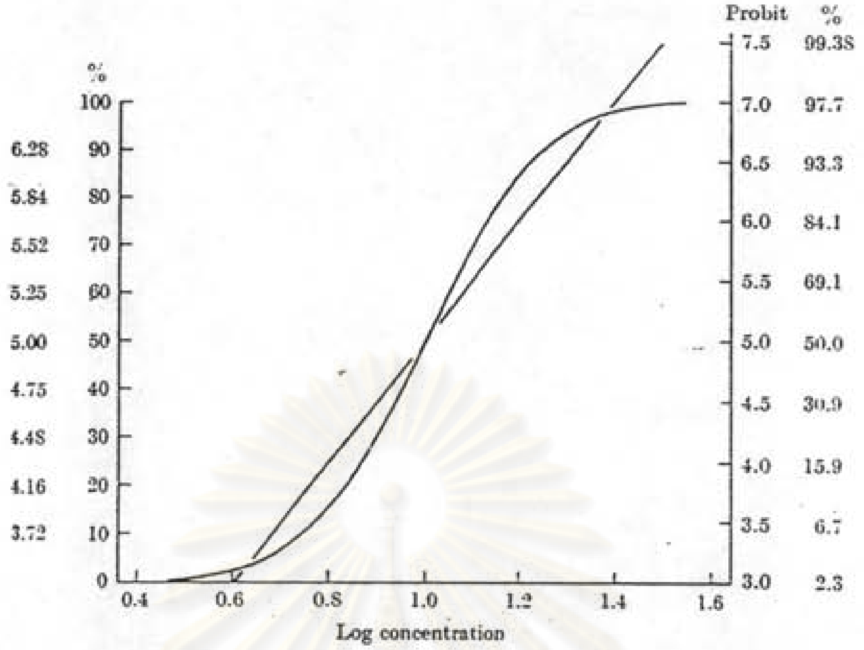


Figure 1: Effect of probit tranformation. The normal sigmoid curve is transformed to a straight line when the ordinates are measured on a scale linear in probits instead og in percentages.

Table 1 : Transformation of percentages to probits.

%	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1	2	3	4	5
0	—	1.9098	2.1218	2.2522	2.3479	2.4242	2.4879	2.5427	2.5911	2.6344					
1	2.6737	2.7096	2.7429	2.7738	2.8027	2.8299	2.8556	2.8799	2.9031	2.9251					
2	2.9463	2.9665	2.9859	3.0046	3.0226	3.0400	3.0569	3.0732	3.0890	3.1043	For more detail see values for 95–100				
3	3.1192	3.1337	3.1478	3.1616	3.1750	3.1881	3.2009	3.2134	3.2256	3.2376					
4	3.2493	3.2608	3.2721	3.2831	3.2940	3.3046	3.3151	3.3253	3.3354	3.3454					
5	3.3551	3.3648	3.3742	3.3836	3.3928	3.4018	3.4107	3.4195	3.4282	3.4368	9	18	27	36	45
6	3.4452	3.4536	3.4618	3.4699	3.4780	3.4859	3.4937	3.5015	3.5091	3.5167	8	16	24	32	40
7	3.5242	3.5316	3.5389	3.5462	3.5534	3.5605	3.5675	3.5745	3.5813	3.5882	7	14	21	28	36
8	3.5949	3.6016	3.6083	3.6148	3.6213	3.6278	3.6342	3.6405	3.6468	3.6531	6	13	19	26	32
9	3.6592	3.6654	3.6715	3.6775	3.6835	3.6894	3.6953	3.7012	3.7070	3.7127	6	12	18	24	30
10	3.7184	3.7241	3.7298	3.7354	3.7409	3.7464	3.7519	3.7574	3.7628	3.7681	6	11	17	22	28
11	3.7735	3.7788	3.7840	3.7893	3.7945	3.7996	3.8048	3.8099	3.8150	3.8200	5	10	16	21	26
12	3.8250	3.8300	3.8350	3.8399	3.8448	3.8497	3.8545	3.8593	3.8641	3.8689	5	10	15	20	24
13	3.8736	3.8783	3.8830	3.8877	3.8923	3.8969	3.9015	3.9061	3.9107	3.9152	5	9	14	18	23
14	3.9197	3.9242	3.9286	3.9331	3.9375	3.9419	3.9463	3.9506	3.9550	3.9593	4	9	13	18	22
15	3.9636	3.9678	3.9721	3.9763	3.9806	3.9848	3.9890	3.9931	3.9973	4.0014	4	8	13	17	21
16	4.0055	4.0096	4.0137	4.0178	4.0218	4.0259	4.0299	4.0339	4.0379	4.0419	4	8	12	16	20
17	4.0458	4.0498	4.0537	4.0576	4.0615	4.0654	4.0693	4.0731	4.0770	4.0808	4	8	12	16	19
18	4.0846	4.0884	4.0922	4.0960	4.0998	4.1035	4.1073	4.1110	4.1147	4.1184	4	8	11	15	19
19	4.1221	4.1258	4.1295	4.1331	4.1367	4.1404	4.1440	4.1476	4.1512	4.1548	4	7	11	15	18
20	4.1584	4.1619	4.1655	4.1690	4.1726	4.1761	4.1796	4.1831	4.1866	4.1901	4	7	11	14	18
21	4.1936	4.1970	4.2005	4.2039	4.2074	4.2108	4.2142	4.2176	4.2210	4.2244	3	7	10	14	17
22	4.2278	4.2312	4.2345	4.2379	4.2412	4.2446	4.2479	4.2512	4.2546	4.2579	3	7	10	13	17
23	4.2612	4.2644	4.2677	4.2710	4.2743	4.2775	4.2808	4.2840	4.2872	4.2905	3	7	10	13	16
24	4.2937	4.2969	4.3001	4.3033	4.3065	4.3097	4.3129	4.3160	4.3192	4.3224	3	6	10	13	16

Table 1 : Transformation of percentages to probits.(continue)

%	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1	2	3	4	5
25	4.3255	4.3287	4.3318	4.3349	4.3380	4.3412	4.3443	4.3474	4.3505	4.3536	3	6	9	12	16
26	4.3567	4.3597	4.3628	4.3659	4.3689	4.3720	4.3750	4.3781	4.3811	4.3842	3	6	9	12	15
27	4.3872	4.3902	4.3932	4.3962	4.3992	4.4022	4.4052	4.4082	4.4112	4.4142	3	6	9	12	15
28	4.4172	4.4201	4.4231	4.4260	4.4290	4.4319	4.4349	4.4378	4.4408	4.4437	3	6	9	12	15
29	4.4466	4.4495	4.4524	4.4554	4.4583	4.4612	4.4641	4.4670	4.4698	4.4727	3	6	9	12	14
30	4.4756	4.4785	4.4813	4.4842	4.4871	4.4899	4.4928	4.4956	4.4985	4.5013	3	6	9	11	14
31	4.5041	4.5070	4.5098	4.5126	4.5155	4.5183	4.5211	4.5239	4.5267	4.5295	3	6	8	11	14
32	4.5323	4.5351	4.5379	4.5407	4.5435	4.5462	4.5490	4.5518	4.5546	4.5573	3	6	8	11	14
33	4.5601	4.5628	4.5656	4.5684	4.5711	4.5739	4.5766	4.5793	4.5821	4.5848	3	5	8	11	14
34	4.5875	4.5903	4.5930	4.5957	4.5984	4.6011	4.6039	4.6066	4.6093	4.6120	3	5	8	11	14
35	4.6147	4.6174	4.6201	4.6228	4.6255	4.6281	4.6308	4.6335	4.6362	4.6389	3	5	8	11	13
36	4.6415	4.6442	4.6469	4.6495	4.6522	4.6549	4.6575	4.6602	4.6628	4.6655	3	5	8	11	13
37	4.6681	4.6708	4.6734	4.6761	4.6787	4.6814	4.6840	4.6866	4.6893	4.6919	3	5	8	11	13
38	4.6945	4.6971	4.6998	4.7024	4.7050	4.7076	4.7102	4.7129	4.7155	4.7181	3	5	8	10	13
39	4.7207	4.7233	4.7259	4.7285	4.7311	4.7337	4.7363	4.7389	4.7415	4.7441	3	5	8	10	13
40	4.7467	4.7492	4.7518	4.7544	4.7570	4.7596	4.7622	4.7647	4.7673	4.7699	3	5	8	10	13
41	4.7725	4.7750	4.7776	4.7802	4.7827	4.7853	4.7879	4.7904	4.7930	4.7955	3	5	8	10	13
42	4.7981	4.8007	4.8032	4.8058	4.8083	4.8109	4.8134	4.8160	4.8185	4.8211	3	5	8	10	13
43	4.8236	4.8262	4.8287	4.8313	4.8338	4.8363	4.8389	4.8414	4.8440	4.8465	3	5	8	10	13
44	4.8490	4.8516	4.8541	4.8566	4.8592	4.8617	4.8642	4.8668	4.8693	4.8718	3	5	8	10	13
45	4.8743	4.8769	4.8794	4.8819	4.8844	4.8870	4.8895	4.8920	4.8945	4.8970	3	5	8	10	13
46	4.8996	4.9021	4.9046	4.9071	4.9096	4.9122	4.9147	4.9172	4.9197	4.9222	3	5	8	10	13
47	4.9247	4.9272	4.9298	4.9323	4.9348	4.9373	4.9398	4.9423	4.9448	4.9473	3	5	8	10	13
48	4.9498	4.9524	4.9549	4.9574	4.9599	4.9624	4.9649	4.9674	4.9699	4.9724	3	5	8	10	13
49	4.9749	4.9774	4.9799	4.9825	4.9850	4.9875	4.9900	4.9925	4.9950	4.9975	3	5	8	10	13
50	5.0000	5.0025	5.0050	5.0075	5.0100	5.0125	5.0150	5.0175	5.0201	5.0226	3	5	8	10	13
51	5.0251	5.0276	5.0301	5.0326	5.0351	5.0376	5.0401	5.0426	5.0451	5.0476	3	5	8	10	13
52	5.0502	5.0527	5.0552	5.0577	5.0602	5.0627	5.0652	5.0677	5.0702	5.0728	3	5	8	10	13
53	5.0753	5.0778	5.0803	5.0828	5.0853	5.0878	5.0904	5.0929	5.0954	5.0979	3	5	8	10	13
54	5.1004	5.1030	5.1055	5.1080	5.1105	5.1130	5.1156	5.1181	5.1206	5.1231	3	5	8	10	13
55	5.1257	5.1282	5.1307	5.1332	5.1358	5.1383	5.1408	5.1434	5.1459	5.1484	3	5	8	10	13
56	5.1510	5.1535	5.1560	5.1586	5.1611	5.1637	5.1662	5.1687	5.1713	5.1738	3	5	8	10	13
57	5.1764	5.1789	5.1815	5.1840	5.1866	5.1891	5.1917	5.1942	5.1968	5.1993	3	5	8	10	13
58	5.2019	5.2045	5.2070	5.2096	5.2121	5.2147	5.2173	5.2198	5.2224	5.2250	3	5	8	10	13
59	5.2275	5.2301	5.2327	5.2353	5.2378	5.2404	5.2430	5.2456	5.2482	5.2508	3	5	8	10	13
60	5.2533	5.2559	5.2585	5.2611	5.2637	5.2663	5.2689	5.2715	5.2741	5.2767	3	5	8	10	13
61	5.2793	5.2819	5.2845	5.2871	5.2898	5.2924	5.2950	5.2976	5.3002	5.3029	3	5	8	10	13
62	5.3055	5.3081	5.3107	5.3134	5.3160	5.3186	5.3213	5.3239	5.3266	5.3292	3	5	8	11	13
63	5.3319	5.3345	5.3372	5.3398	5.3425	5.3451	5.3478	5.3505	5.3531	5.3558	3	5	8	11	13
64	5.3585	5.3611	5.3638	5.3665	5.3692	5.3719	5.3745	5.3772	5.3799	5.3826	3	5	8	11	13
65	5.3853	5.3880	5.3907	5.3934	5.3961	5.3989	5.4016	4.4043	5.4070	5.4097	3	5	8	11	14
66	5.4125	5.4152	5.4179	5.4207	5.4234	5.4261	5.4289	5.4316	5.4344	5.4372	3	5	8	11	14
67	5.4399	5.4427	5.4454	5.4482	5.4510	5.4538	5.4565	5.4593	5.4621	5.4649	3	6	8	11	14
68	5.4677	5.4705	5.4733	5.4761	5.4789	5.4817	5.4845	5.4874	5.4902	5.4930	3	6	8	11	14
69	5.4959	5.4987	5.5015	5.5044	5.5072	5.5101	5.5129	5.5158	5.5187	5.5215	3	6	9	11	14
70	5.5244	5.5273	5.5302	5.5330	5.5359	5.5388	5.5417	5.5446	5.5476	5.5505	3	6	9	12	14
71	5.5534	5.5563	5.5592	5.5622	5.5651	5.5681	5.5710	5.5740	5.5769	5.5799	3	6	9	12	15
72	5.5828	5.5858	5.5888	5.5918	5.5948	5.5978	5.6008	5.6038	5.6068	5.6098	3	6	9	12	15
73	5.6128	5.6158	5.6189	5.6219	5.6250	5.6280	5.6311	5.6341	5.6372	5.6403	3	6	9	12	15
74	5.6433	5.6464	5.6495	5.6526	5.6557	5.6588	5.6620	5.6651	5.6682	5.6713	3	6	9	12	16

Table 1 : Transformation of percentages to probits.(continue)

%	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1	2	3	4	5
75	5.6745	5.6776	5.6808	5.6840	5.6871	5.6903	5.6936	5.6967	5.6999	5.7031	3	6	10	13	16
76	5.7063	5.7095	5.7128	5.7160	5.7192	5.7225	5.7257	5.7290	5.7323	5.7356	3	7	10	13	16
77	5.7388	5.7421	5.7454	5.7488	5.7521	5.7554	5.7588	5.7621	5.7655	5.7688	3	7	10	13	17
78	5.7722	5.7756	5.7790	5.7824	5.7858	5.7892	5.7926	5.7961	5.7995	5.8030	3	7	10	14	17
79	5.8064	5.8099	5.8134	5.8169	5.8204	5.8239	5.8274	5.8310	5.8345	5.8381	4	7	11	14	18
80	5.8416	5.8452	5.8488	5.8524	5.8560	5.8596	5.8633	5.8669	5.8705	5.8742	4	7	11	14	18
81	5.8779	5.8816	5.8853	5.8890	5.8927	5.8965	5.9002	5.9040	5.9078	5.9116	4	7	11	15	19
82	5.9154	5.9192	5.9230	5.9269	5.9307	5.9346	5.9385	5.9424	5.9463	5.9502	4	8	12	15	19
83	5.9542	5.9581	5.9621	5.9661	5.9701	5.9741	5.9782	5.9822	5.9863	5.9004	4	8	12	16	20
84	5.9945	5.9986	6.0027	6.0069	6.0110	6.0152	6.0194	6.0237	6.0279	6.0322	4	8	13	17	21
85	6.0364	6.0407	6.0450	6.0494	6.0537	6.0581	6.0625	6.0669	6.0714	6.0758	4	9	13	18	22
86	6.0803	6.0848	6.0893	6.0939	6.0985	6.1031	6.1077	6.1123	6.1170	6.1217	5	9	14	18	23
87	6.1264	6.1311	6.1359	6.1407	6.1455	6.1503	6.1552	6.1601	6.1650	6.1700	5	10	15	19	24
88	6.1750	6.1800	6.1850	6.1901	6.1952	6.2004	6.2055	6.2107	6.2160	6.2212	5	10	15	21	26
89	6.2265	6.2319	6.2372	6.2426	6.2481	6.2536	6.2591	6.2646	6.2702	6.2759	5	11	16	22	27
90	6.2816	6.2873	6.2930	6.2988	6.3047	6.3106	6.3165	6.3225	6.3285	6.3346	6	12	18	24	29
91	6.3408	6.3469	6.3532	6.3595	6.3658	6.3722	6.3787	6.3852	6.3917	6.3984	6	13	19	26	32
92	6.4051	6.4118	6.4187	6.4255	6.4325	6.4395	6.4466	6.4538	6.4611	6.4684	7	14	21	28	35
93	6.4758	6.4833	6.4909	6.4985	6.5063	6.5141	6.5220	6.5301	6.5382	6.5464	8	16	24	31	39
94	6.5548	6.5632	6.5718	6.5805	6.5893	6.5982	6.6072	6.6164	6.6258	6.6352	9	18	27	36	45
95	6.6449	6.6546	6.6646	6.6747	6.6849	6.6954	6.7060	6.7169	6.7279	6.7392					
	97	100	101	102	105	106	109	110	113	115					
96	6.7507	6.7624	6.7744	6.7866	6.7991	6.8119	6.8250	6.8384	6.8522	6.8663					
	117	120	122	125	128	131	134	138	141	145					
97	6.8808	6.8957	6.9110	6.9268	6.9431	6.9600	6.9774	6.9954	7.0141	7.0335					
	149	153	158	163	169	174	180	187	194	202					

%	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	1	2	3	4	5
98.0	7.0537	7.0558	7.0579	7.0600	7.0621	7.0642	7.0663	7.0684	7.0706	7.0727	2	4	6	8	11
98.1	7.0749	7.0770	7.0792	7.0814	7.0836	7.0858	7.0880	7.0902	7.0924	7.0947	2	4	7	9	11
98.2	7.0969	7.0992	7.1015	7.1038	7.1061	7.1084	7.1107	7.1130	7.1154	7.1177	2	5	7	9	12
98.3	7.1201	7.1224	7.1248	7.1272	7.1297	7.1321	7.1345	7.1370	7.1394	7.1419	2	5	7	10	12
98.4	7.1444	7.1469	7.1494	7.1520	7.1545	7.1571	7.1596	7.1622	7.1648	7.1675	3	5	8	10	13
98.5	7.1701	7.1727	7.1754	7.1781	7.1808	7.1835	7.1862	7.1890	7.1917	7.1945	3	5	8	11	14
98.6	7.1973	7.2001	7.2029	7.2058	7.2086	7.2115	7.2144	7.2173	7.2203	7.2232	3	6	9	12	14
98.7	7.2262	7.2292	7.2322	7.2353	7.2383	7.2414	7.2445	7.2476	7.2508	7.2539	3	6	9	12	15
98.8	7.2571	7.2603	7.2636	7.2668	7.2701	7.2734	7.2768	7.2801	7.2835	7.2869	3	7	10	13	17
98.9	7.2904	7.2938	7.2973	7.3009	7.3044	7.3080	7.3116	7.3152	7.3189	7.3226	4	7	11	14	18
99.0	7.3263	7.3301	7.3339	7.3378	7.3416	7.3455	7.3495	7.3535	7.3575	7.3615	4	8	12	16	20
99.1	7.3656	7.3698	7.3739	7.3781	7.3824	7.3867	7.3911	7.3954	7.3999	7.4044	4	9	13	17	22
99.2	7.4089	7.4135	7.4181	7.4228	7.4276	7.4324	7.4372	7.4422	7.4471	7.4522	5	10	14	19	24
99.3	7.4573	7.4624	7.4677	7.4730	7.4783	7.4838	7.4893	7.4949	7.5006	7.5063	5	11	16	22	27
99.4	7.5121	7.5181	7.5241	7.5302	7.5364	7.5427	7.5491	7.5556	7.5622	7.5690	6	13	19	25	32
99.5	7.5758	7.5828	7.5899	7.5972	7.6045	7.6121	7.6197	7.6276	7.6356	7.6437					
99.6	7.6521	7.6606	7.6693	7.6783	7.6874	7.6968	7.7065	7.7164	7.7266	7.7370					
99.7	7.7478	7.7589	7.7703	7.7822	7.7944	7.8070	7.8202	7.8338	7.8480	7.8627					
99.8	7.8782	7.8943	7.9112	7.9290	7.9478	7.9677	7.9889	8.0115	8.0357	8.0618					
99.9	8.0902	8.1214	8.1559	8.1947	8.2389	8.2905	8.3528	8.4316	8.5401	8.7190					

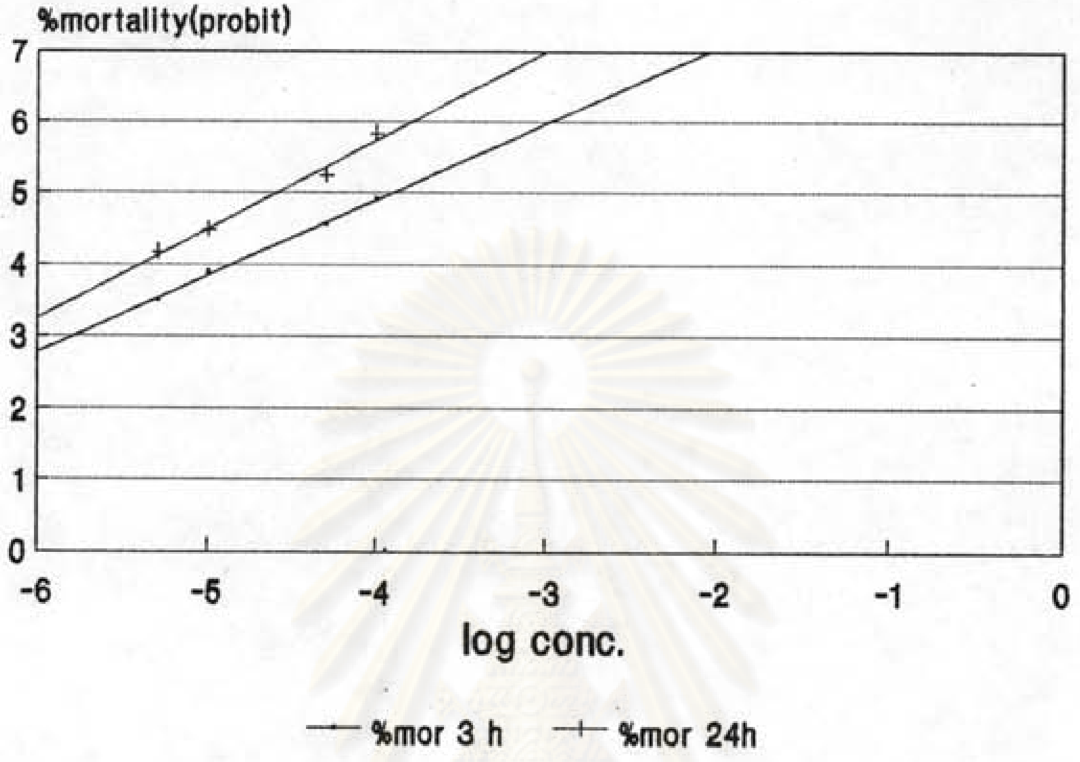


Figure 2 : Contact toxicity of cyhalothrin on *A. florea* at 3 h and 24 h

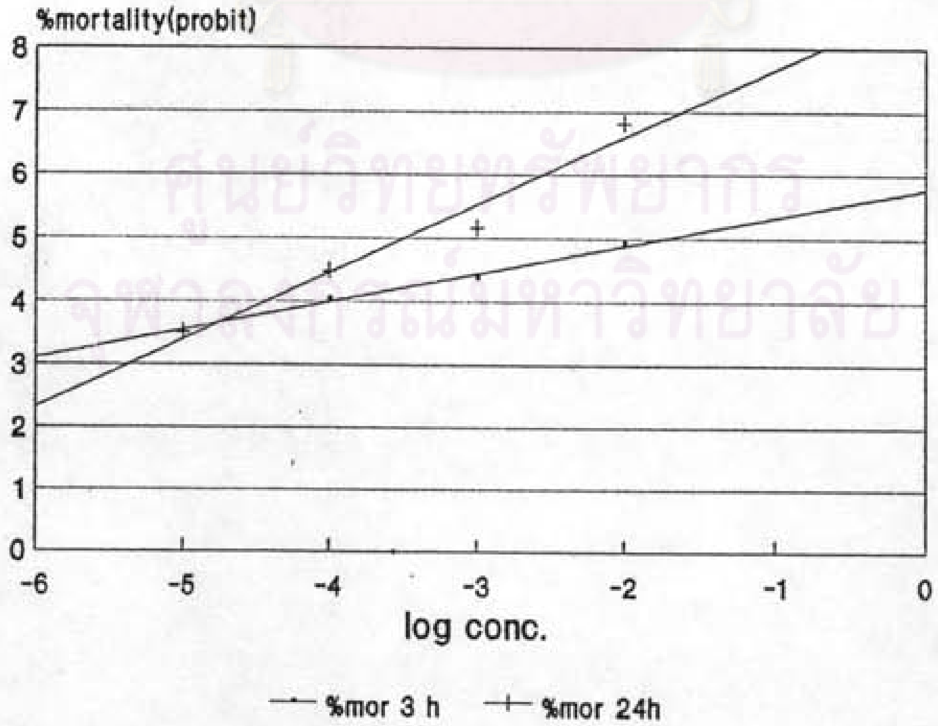


Figure 3 : Contact toxicity of cyhalothrin on *A. cerana* at 3 h and 24 h

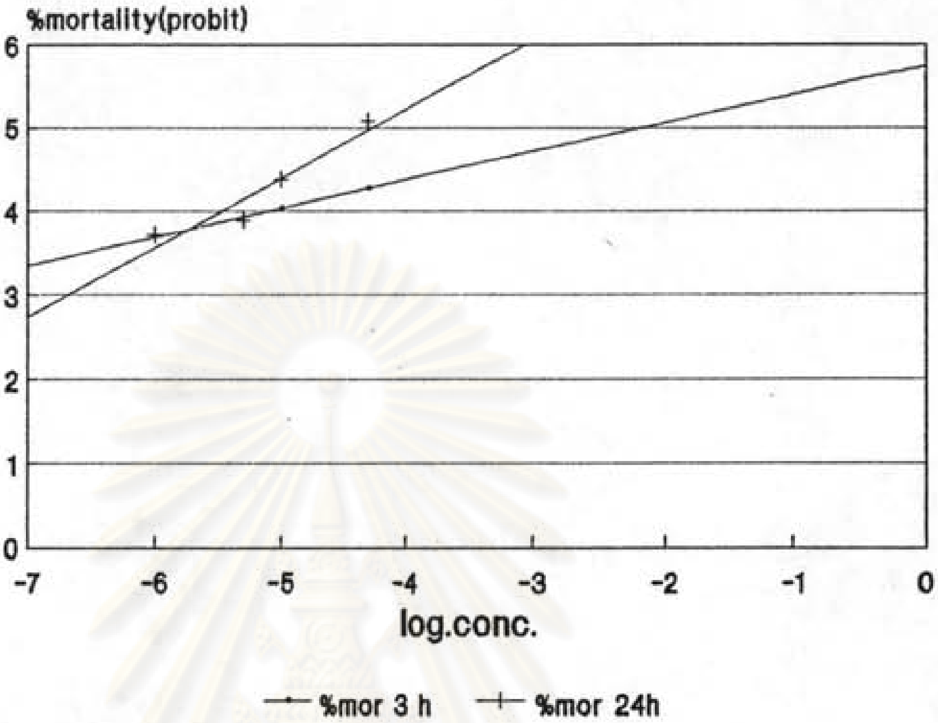


Figure 4 : Oral toxicity of cyhalothrin on *A. florea* at 3 h and 24 h

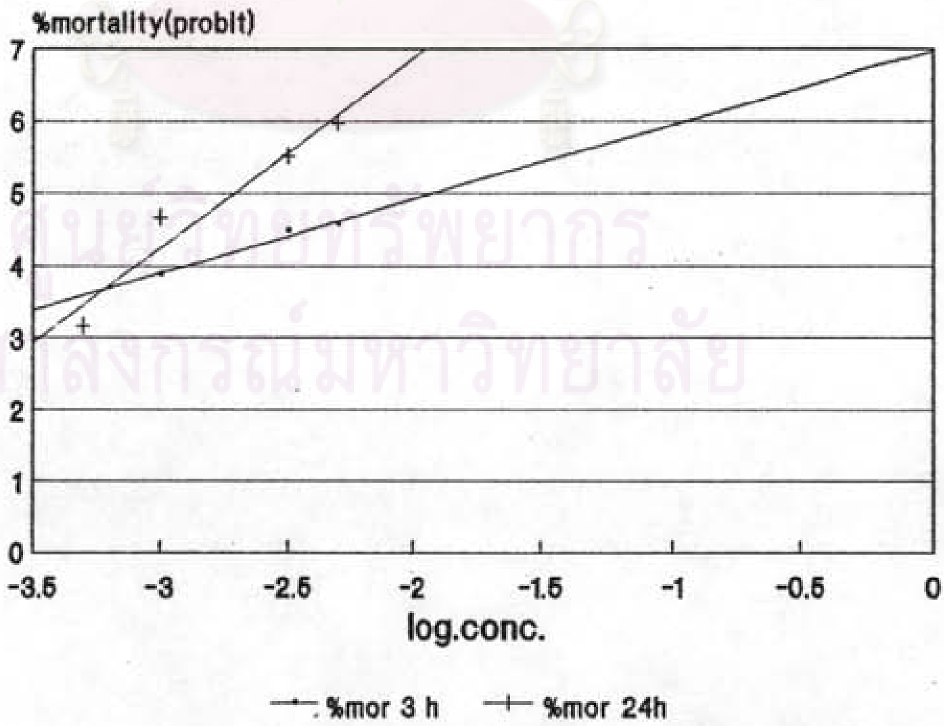


Figure 5 : Oral toxicity of cyhalothrin on *A. cerana* at 3 h and 24 h

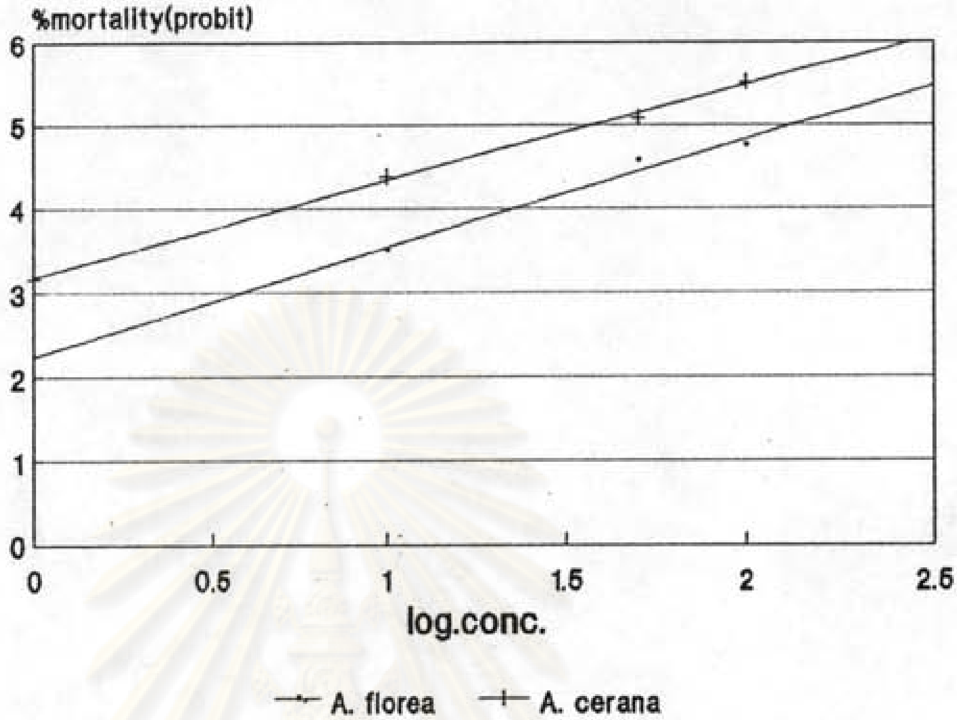


Figure 6 : Contact toxicity of neem-seed crude extract on *A. florea* and *A. cerana* at 24 h.

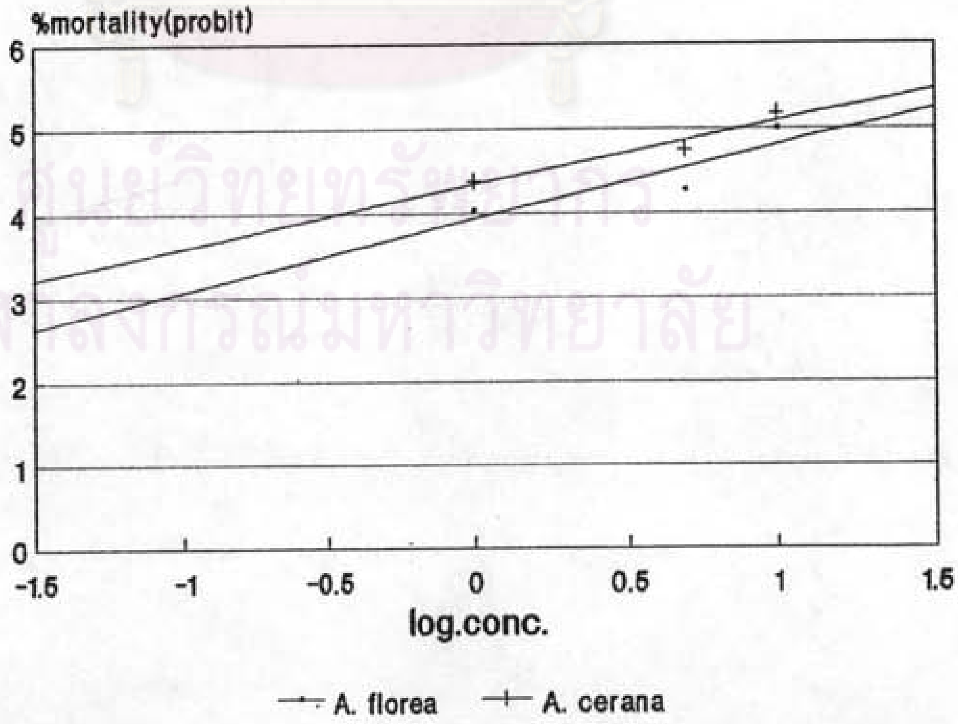


Figure 7 : Contact toxicity of neem-seed extract on *A. florea* and *A. cerana* at 24 h.

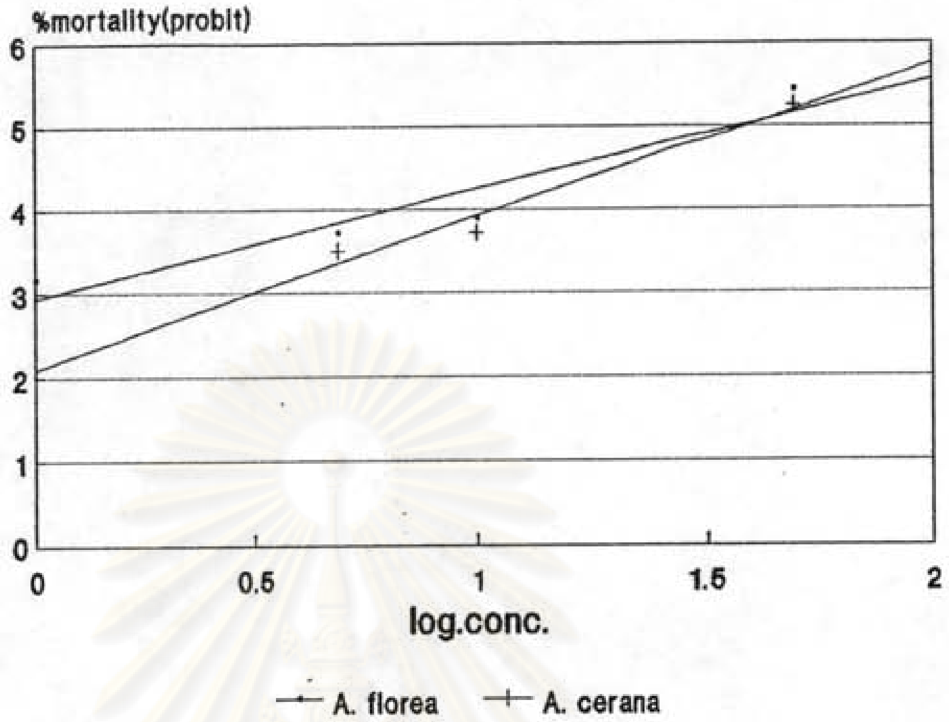


Figure 8 : Contact toxicity of neem oil on *A. florea* and *A. cerana* at 24 h.

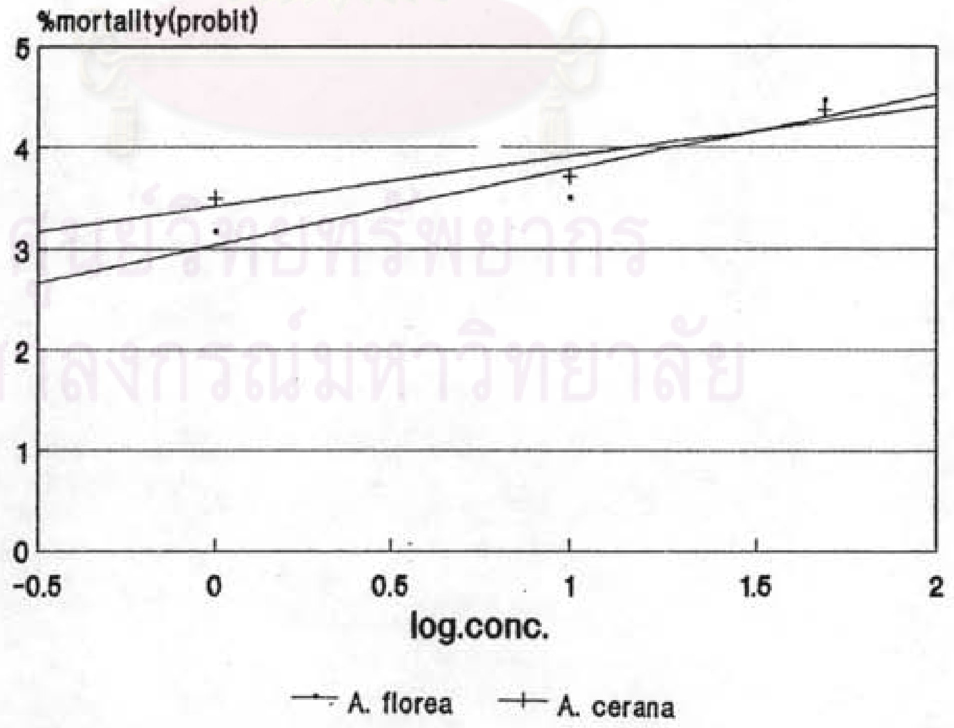


Figure 9 : Oral toxicity of neem oil on *A. florea* and *A. cerana* at 24 h.

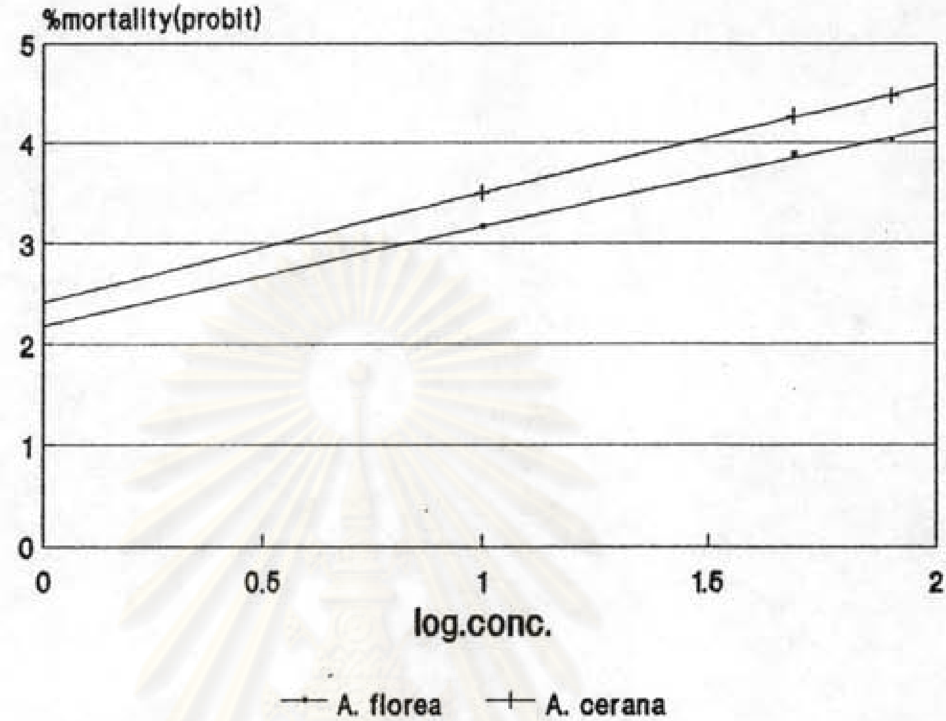


Figure 10 : Contact toxicity of Margosan-O ® on *A. florea* and *A. cerana* at 24 h.

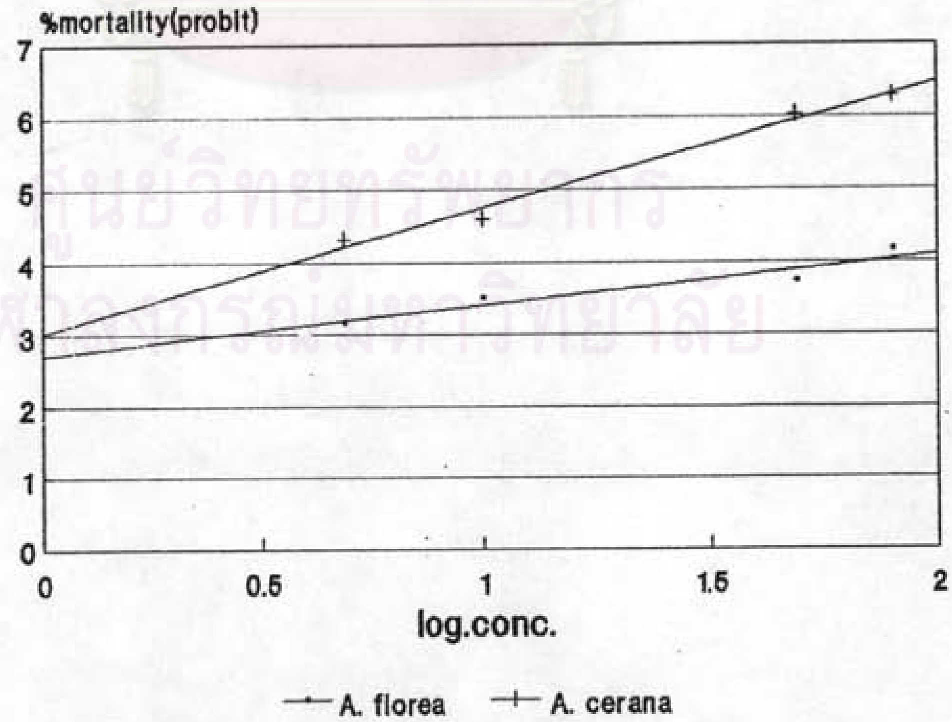


Figure 11 : Oral toxicity of Margosan-O ® on *A. florea* and *A. cerana* at 24 h.

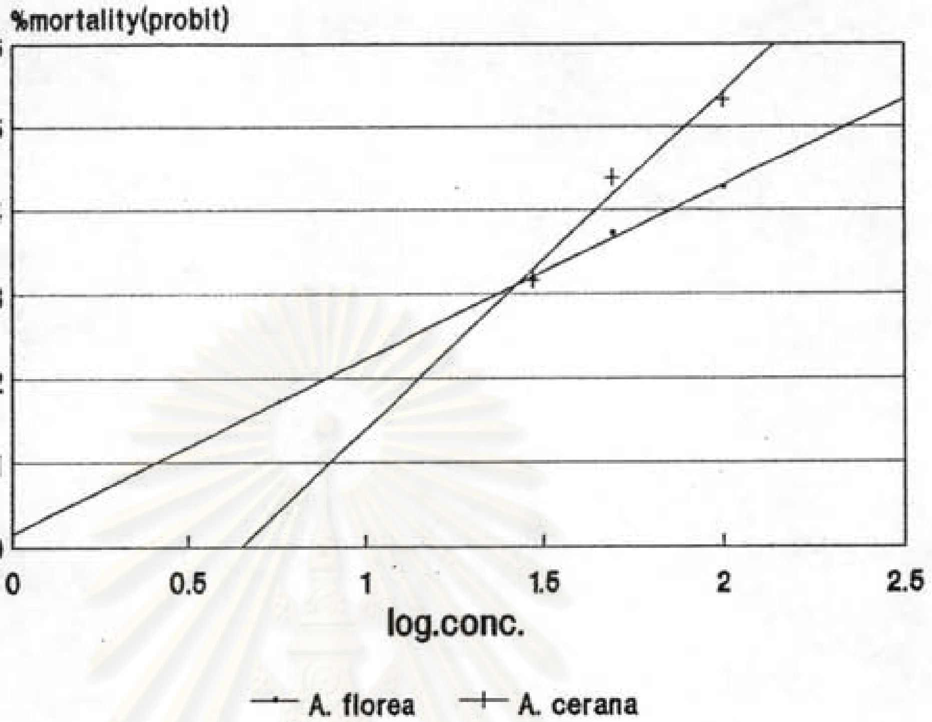


Figure 12 : Contact toxicity of Neemix ® on *A. florea* and *A. cerana* at 24 h.

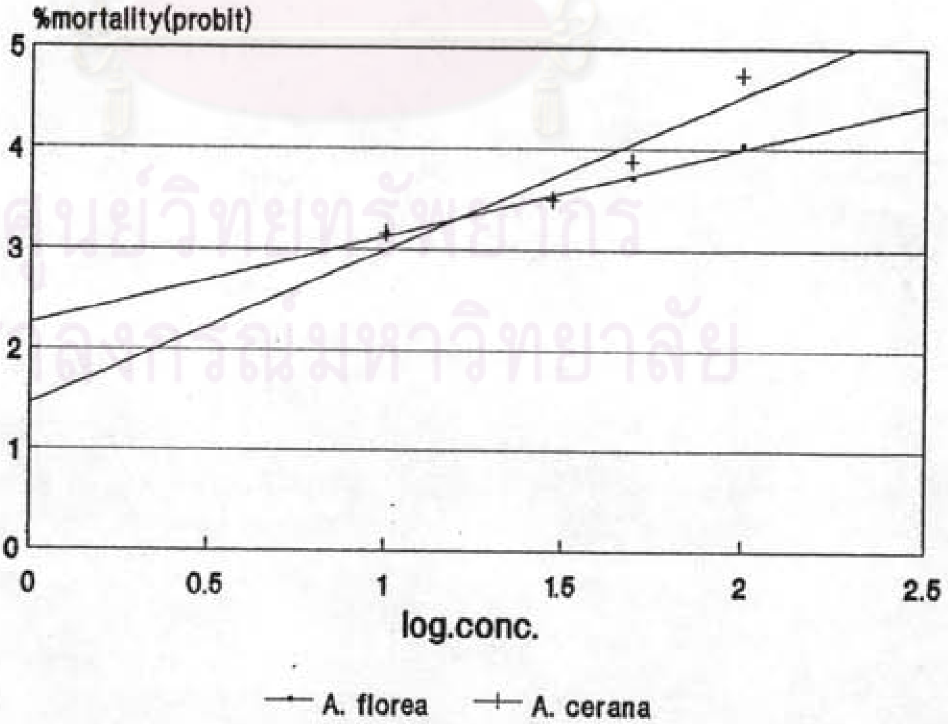


Figure 13 : Contact toxicity of Advantage ® on *A. florea* at 24 h.

ESTIMATATION THE LD_{50} VALUE BY USING PROBIT ANALYSIS PROGRAM (SPSS-PC COMPUTER PROGRAM)

```
title A.CERANA
data list free / hr conc n RES1 .
begin data
end data
     4 cases are written to the compressed active file.

This procedure was completed at 14:12:32
 probit res1 of n with conc /MODEL PROBIT /PRINT ALL.

PROBIT requires 304 BYTES of workspace for execution.
          A.CERANA                                              12/20/93

* * * * * * * * * * * *  P R O B I T   A N A L Y S I S  * * * * * * * * * * * *

DATA  Information

          4 unweighted cases accepted.
          0 cases rejected because of missing data.
          0 Cases rejected because LOG-transform can't be done.


MODEL Information

     ONLY Normal Sigmoid is requested.

-------------------------------------------------------------------------------

          A.CERANA                                              12/20/93

                          LOG(CONC) VS. PROBIT

         --+----+----+----+----+----+----+----+----+----+----+---
         :                                                1   :
         :                                                    :
P     5  +                                                    +
R        :                                                    :
O        :                                                    :
B        :                                                    :
I        :                           1                        :
T  3.75  +                 1                                  +
         :                                                    :
         :  1                                                 :
         :                                                    :
         --+----+----+----+----+----+----+----+----+----+----+---
               .15       .45       .75      1.05      1.35      1.65
           0        .3        .6        .9       1.2       1.5

                              LOG(CONC)
```

A.CERANA 12/20/93

Confidence Limits for Effective CONC

		95% Confidence Limits	
Prob	CONC	Lower	Upper
.01	1.00899	.17289	2.31513
.02	1.51599	.33061	3.15047
.03	1.96280	.49755	3.84044
.04	2.38378	.67546	4.46541
.05	2.79197	.86489	5.05543
.06	3.19402	1.06608	5.62577
.07	3.59390	1.27918	6.18565
.08	3.99425	1.50429	6.74127
.09	4.39695	1.74145	7.29725
.10	4.80343	1.99072	7.85721
.15	6.92689	3.41827	10.81325
.20	9.26607	5.13987	14.24437
.25	11.89321	7.13256	18.45044
.30	14.88156	9.36709	23.78685
.35	18.31713	11.82504	30.69401
.40	22.30780	14.51298	39.73619
.45	26.99449	17.46727	51.67392
	A.CERANA		
.50	32.56720	20.75396	67.58717
.55	39.29034	24.47106	89.08023
.60	47.54493	28.75800	118.63940
.65	57.90334	33.81691	160.30241
.70	71.27094	39.95479	221.01409
.75	89.17888	47.66949	313.64455
.80	114.46306	57.84326	464.60291
.85	153.11674	72.25077	736.75900
.90	220.80510	95.25976	1320.51266
.91	241.21764	101.79370	1521.03336
.92	265.53731	109.38342	1773.80842
.93	295.11747	118.36277	2100.86166
.94	332.06561	129.23996	2538.40387
.95	379.88383	142.83810	3150.41277
.96	444.93330	160.60861	4061.61275
.97	540.36113	185.44642	5552.54852
.98	699.62419	224.39190	8418.48182
.99	1051.17627	302.73697	16237.96980

12/20/93

A.CERANA 12/20/93

This procedure was completed at 14:12:53
finish.0;37;40m

End of Include file.

APPENDIX C

Table 1 : Quantity of neem oil and crude extract in difference step of Thai neem-seed extract (method 2.2.2).

Neem-seed kernel	Neem oil (dark green)	Crude extract (dark green)	Azadirachtin
10 g 10 g	3.23 g 3.34 g	1.22 g 1.18 g	0.0084 g 0.0097 g
average	3.285 ± 0.08	1.2 ± 0.03	0.009 ± 0.0009
percentage	32.85%	12.0 %	0.09 %

Table 2 : Characterization of neem seed.

Type	lenght (cm)	weight/seed (g)	100 g neem seed	
			seed kernel	seed coat
-*Azadirachta indica*	1.2	0.2	45.09 g	54.91 g

Table 2 (cont.): Characterization of neem seed.

Type	lenght (cm)	weight/seed (g)	100 g neem seed	
			seed kernel	seed coat
-*Azadirachta indica* var. *siamensis*	1.5	0.3	45.20 g	54.80 g
-*Azadirachta excelsa*	2.0	1.1	44.35 g	55.45 g

Source : Chirathamjaree, C., Pitiyon, B., and Seangvanit, A., 1993.

APPENDIX D

<u>Neem-seed extract</u>

Rice Insect Pests Research Unit, Entomology & Zoology Division recommend 5% neem-seed extract for control brown planthopper,green rice leafhoppers, rice stem borers.

Agricultural Toxic Substance Division recommend 5% neem-seed extract for control many insect pests.

<u>Neem-leaf extract</u>

Pimsamarn, S. (Kongan University) recommend 5% neem-leaf extract for control diamond back moth.

Makmon, A. (Crop Protection by Natural Method Project) recommend 2 kg. neem-leaf and 1 kg. galanga extract per 20 litre water for control brown planthopper.

<u>Neem oil</u>

Sombatsiri, K. (Kasetsart University) recommend that seed were attacked with 50% neem oil for control lesser grain borer.

Source : Farm Research Institute and Appropiated Technology Associate, 1989.

COMMERCIAL NEEM EXTRACT

<u>Margosan-O ®</u> from Grace-Sierra Crop Protection Co., USA.

For effective management of whiteflies, thrips, mealybugs, leafminers, loopers, caterpillars, and gypsy moths, on ornamentals, tree, and shrubs in and around greenhouses, commercial nurseries, and homes.

Active ingredients : Azadirachtin...................0.3 %

Application rate : Dilute Margosan-O ® to a concentration of 2.5 to 5.0 pints per 100 gallons of water (2.5 to 5 teaspoons of Margosan-O ® per gallon of water) = 0.04 - 0.08 %

<u>Neemix ®</u> from Peachpanthummachad Co., Thailand.

For effective management of oriental fruit fly, leaf-eating caterpillar, thrips, red spider mite.

Ingredients : Neem seed..............................50%

Galanga..............................25%

Citronella grass......................25%

Application rate : 40 - 60 ml/ 5 l of water = 0.8 - 1.2 %

<u>Advantage ®</u> from Nonkasert Co., Thailand.

For effective management of thrips, mealybug, aphid, diamond back moth, red spider mite.

Active ingredients : Meliantriol, azadiractin, salannin, nimbidin,citronellal, geraniol.

Application rate : 40 - 80 ml/ 20 l of water = 2.4 - 4.0 %

BIOGRAPHY OF THE AUTHOR

Miss Chuleemas Boonthai was born on September 13, 1969 in Amphur Maung,Changwat Uttaradit and graduated from Chiang Mai University with a Bachelor of Science degree (Biology) in 1990. She enrolled for a Master degree of Science in the Interdepartment of Environmental Science at Chulalongkorn University in 1991 under a UDC grant and graduated in 1993.