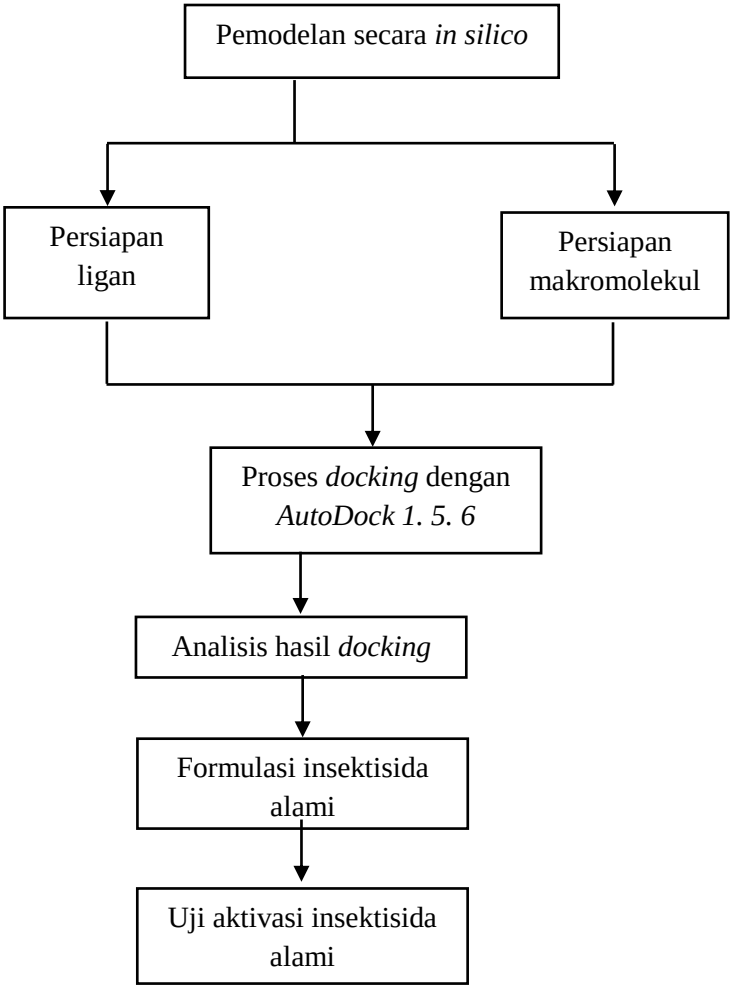
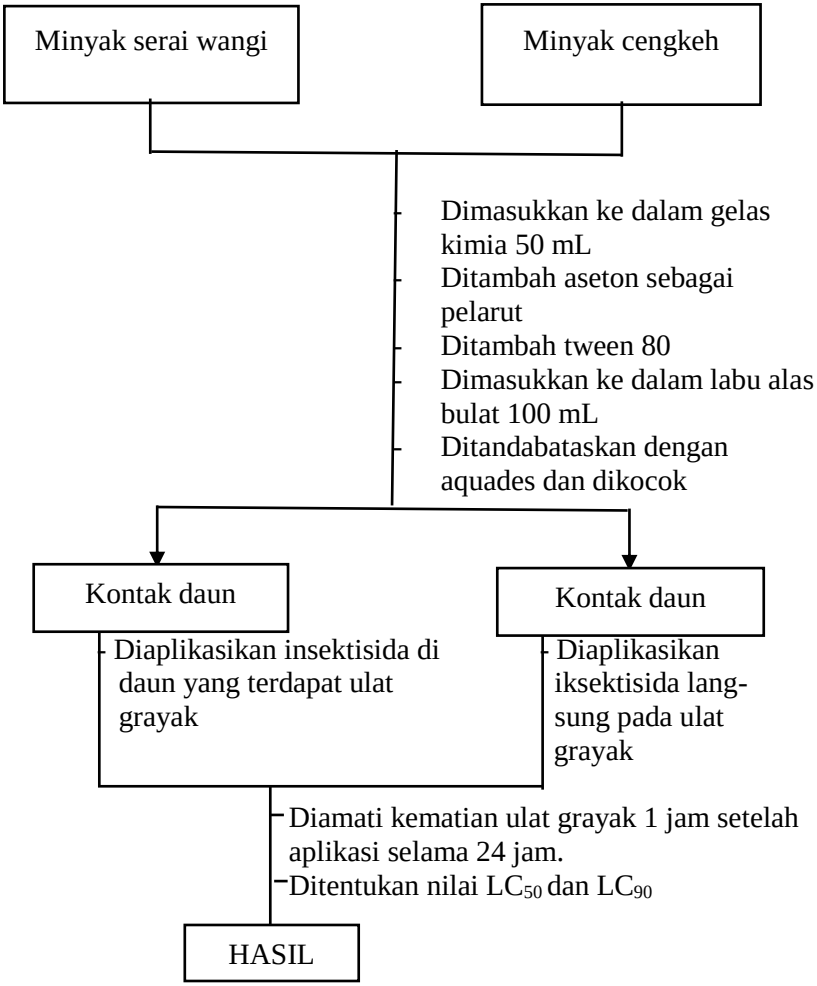
LAMPIRAN

LAMPIRAN A: Skema Kerja

A.1 Diagram Alir Penelitian



A.2 Uji Aktivitas Insektisida Alami



LAMPIRAN B: Perhitungan

B.1 Penentuan Konsentrasi Sitronelal dan Eugenol berdasarkan Nilai Ki

$$[M] + [L] \rightleftarrows [M - L] \quad \text{(b.1)}$$

$$Kd = \frac{[M][L]}{[ML]} \quad \text{(b.2)}$$

Jika [M] ⋙, maka [ML] = [M]

Jadi $Kd = \frac{\cancel{[M]}[L]}{\cancel{[M]}} = [L]$

$$Kd = [L] \qquad (Ki \backsim Kd)$$

$$Ki = \frac{IC_{50}}{1+\frac{LT}{Kd}} \quad \text{(b.3)}$$

$$Ki = \frac{IC_{50}}{1+\frac{Kd}{Kd}} \quad \text{(b.4)}$$

$$Ki = \frac{IC_{50}}{1+1} = \frac{IC_{50}}{2} \quad \text{(b.5)}$$

$$IC_{50} = 2Ki_2 \quad \text{(b.6)}$$

Nilai Ki hasil *multiple ligand docking* antara makromolekul 2DJC dan ligan (eugenol dan sitronelal) adalah 1,75 mM, sehingga:

IC_{50} = $2Ki_2$
= 2 x 1,75 mM
= 3,5 mM

Konsentrasi sitronelal dalam minyak serai wangi

[L] = IC_{50} x $BM_{sitronelal}$
= 3,5 mM x 154, 25 g/mol
= 539,875 mg/L
= 0,5399 mg/mL

Konsentrasi eugenol dalam minyak cengkeh

[L] = IC_{50} x $BM_{eugenol}$
= 3,5 mM x 164,2 g/mol
= 574,7 mg/L
= 0,5747 mg/mL

B.2 Penentuan Formulasi Insektisida

$$W = Kadar \times BJ \times V \quad \text{(b.7)}$$

$$V_{sitronelal} = \frac{W}{Kadar\ x\ BJ}$$

$$= \frac{0{,}5399\ x\ 10^{-3} g}{\frac{17{,}26}{100}\ x\ 0{,}85\ g/mL}$$

$= 3{,}68 \times 10^{-3}$ mL ≈ 4×10^{-3} mL

$V_{eugenol} = \frac{W}{Kadar\ x\ BJ}\ 0{,}64582$

$= \frac{0{,}5747\ x\ 10^{-3} g}{\frac{65{,}90}{100}\ x\ 0{,}98\ g/mL}$

$= 0{,}88 \times 10^{-3}$ mL $\approx$ 1×10^{-3} mL

Diperoleh formula insektisida minyak serai wangi : minyak cengkeh adalah 4 : 1.

Tabel L.1: Komposisi Formula Insektisida Alami

Konsen-trasi (%)	**Tween 80 (*μ*L)**	**Komposisi minyak(mL)** **Minyak Serai : Minyak Cengkeh** **4 : 1**	**Ase-ton (mL)**	
	1000	11.600	20.000	Pinheiro, dkk (2013)
0	0,0862	-	1,724	Kontrol (pelarut)
0,0625	0,0054	4 : 1	0,108	
0,125	0,011	4 : 1	0,216	

0,25	0,022	4 : 1	0,43
0,5	0,043	4 : 1	0,862
1	0,086	4 : 1	1, 724

B.3 Perbandingan Konsentrasi *In Silico* dan *In Vitro*

B.3.1 Konsentrasi *In Silico*

Nilai Ki = 1,75 mM

IC_{50} = 2 x Ki
= 2 x 1,75 mM
= 3,5 mM

B.3.2 Konsentrasi *In Vitro*

a. Konsentrasi 1%

$\frac{1}{100}$ ($\frac{0,8}{100}$ mL ms + $\frac{0,2}{100}$ mL mc)

Minyak Serai Wangi:

M = $\frac{1000\ x\ \rho\ x\ \%massa}{Mr}$

= $\frac{1000\ x\ 0,85\ g/mL\ x\ 0,008}{154,25\ g/mol}$

= 0,04 M = 40 mM

Minyak Cengkeh:

M = $\frac{1000\ x\ \rho\ x\ \%massa}{Mr}$

= $\frac{1000\ x\ 0,98\ g/mL\ x\ 0,002}{164,2\ g/mol}$

= 0,012 M = 12 mM

b. Konsentrasi 0,5%

$\frac{0,5}{100}$ ($\frac{0,4}{100}$ mL ms + $\frac{0,1}{100}$ mL mc)

Minyak Serai Wangi:

Minyak Cengkeh:

M $= \frac{1000\ x\ \rho\ x\ \%massa}{Mr}$

$= \frac{1000\ x\ 0{,}85\ g/mL\ x\ 0{,}004}{154{,}25\ g/mol}$

= 0,02 M = 20 mM

M $= \frac{1000\ x\ \rho\ x\ \%massa}{Mr}$

$= \frac{1000\ x\ 0{,}98\ g/mL\ x\ 0{,}001}{164{,}2\ g/mol}$

= 0,005 M = 5 mM

c. Konsentrasi 0,25%

$\frac{0{,}25}{100}$ ($\frac{0{,}2}{100}$ mL ms + $\frac{0{,}05}{100}$ mL mc)

Minyak Serai Wangi:

M $= \frac{1000\ x\ \rho\ x\ \%massa}{Mr}$

$= \frac{1000\ x\ 0{,}85\ g/mL\ x\ 0{,}002}{154{,}25\ g/mol}$

= 0,01 M = 10 mM

Minyak Cengkeh:

M $= \frac{1000\ x\ \rho\ x\ \%massa}{Mr}$

$= \frac{1000\ x\ 0{,}98\ g/mL\ x\ 0{,}0005}{164{,}2\ g/mol}$

= 0,003 M = 3 mM

d. Konsentrasi 0,125%

$\frac{0{,}125}{100}$ ($\frac{0{,}1}{100}$ mL ms + $\frac{0{,}025}{100}$ mL mc)

Minyak Serai Wangi:

M $= \frac{1000\ x\ \rho\ x\ \%massa}{Mr}$

$= \frac{1000\ x\ 0{,}85\ g/mL\ x\ 0{,}001}{154{,}25\ g/mol}$

= 0,005 M = 5 mM

Minyak Cengkeh:

M $= \frac{1000\ x\ \rho\ x\ \%massa}{Mr}$

$= \frac{1000\ x\ 0{,}98\ g/mL\ x\ 0{,}00025}{164{,}2\ g/mol}$

= 0,0015 M = 1,5 mM

e. Konsentrasi 0,0625

$\frac{0{,}0625}{100}$ ($\frac{0{,}05}{100}$ mL ms + $\frac{0{,}0125}{100}$ mL mc)

Minyak Serai Wangi:

M $= \frac{1000\ x\ \rho\ x\ \%massa}{Mr}$

$= \frac{1000\ x\ 0{,}85\ g/mL\ x\ 0{,}0005}{154{,}25\ g/mol}$

= 0,0027 M = 2,7 mM

Minyak Cengkeh:

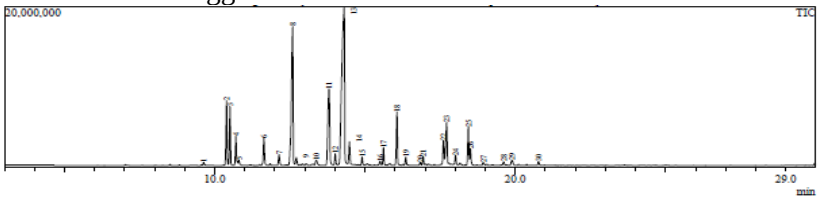
M $= \frac{1000\ x\ \rho\ x\ \%massa}{Mr}$

$= \frac{1000\ x\ 0{,}98\ g/mL\ x\ 0{,}000125}{164{,}2\ g/mol}$

= 0,00075 M = 0,75 mM

LAMPIRAN C: Data Hasil Analisis

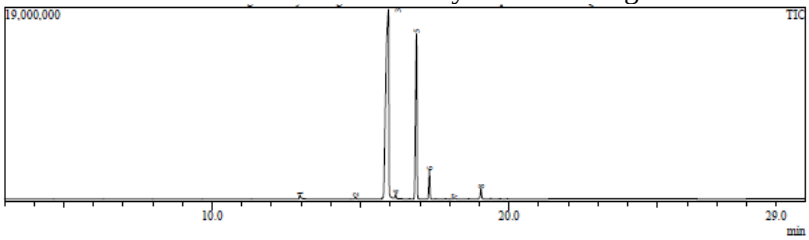
C.1 Analisis menggunakan GC-MS



Peak Report TIC

Peak#	R.Time	I.Time	F.Time	Area	Area%	Height	Height%	A/H	Mark	Name
1	9.626	9.592	9.675	814542	0.21	359030	0.33	2.26		
2	10.390	10.325	10.450	19758340	5.00	8131876	7.48	2.42		
3	10.506	10.450	10.567	16388698	4.15	7465255	6.86	2.19	V	
4	10.700	10.567	10.742	8104664	2.05	3628561	3.34	2.23	V	
5	10.801	10.775	10.867	1477863	0.37	628913	0.58	2.34	V	
6	11.635	11.575	11.717	8501742	2.15	3351548	3.08	2.53		
7	12.138	12.083	12.217	3675740	0.93	1339118	1.23	2.74		
8	12.589	12.450	12.667	68163267	17.26	17517989	16.11	3.89		
9	12.714	12.667	12.783	2903981	0.74	958318	0.88	3.03	V	
10	13.381	13.317	13.450	2371040	0.60	578037	0.53	4.10		
11	13.800	13.700	13.900	41696274	10.56	9620652	8.85	4.33		
12	14.009	13.900	14.067	3469592	0.88	1426705	1.31	2.43	V	
13	14.304	14.092	14.408	127552191	32.30	19786271	18.19	6.44		
14	14.481	14.408	14.550	7745362	1.96	2883181	2.65	2.68	V	
15	14.902	14.858	14.958	2332447	0.59	1009233	0.93	2.31		
16	15.499	15.458	15.550	1196140	0.30	486754	0.45	2.45		
17	15.613	15.558	15.675	5229596	1.32	2208725	2.03	2.36		
18	16.061	15.992	16.133	17041555	4.32	6711926	6.17	2.53		
19	16.357	16.308	16.408	2430906	0.62	1003089	0.92	2.42		
20	16.841	16.808	16.883	717071	0.18	342805	0.32	2.09		
21	16.937	16.892	16.983	2495741	0.63	1038467	0.95	2.40		
22	17.609	17.550	17.650	7922865	2.01	2983423	2.74	2.65		
23	17.714	17.650	17.767	16565187	4.20	5269995	4.85	3.14	V	
24	18.013	17.967	18.067	2731448	0.69	1187573	1.09	2.30		
25	18.438	18.383	18.475	12382582	3.14	4866770	4.47	2.54		
26	18.506	18.475	18.583	5380964	1.36	2060870	1.89	2.61	V	
27	18.933	18.892	19.008	1064428	0.27	376013	0.35	2.83		
28	19.613	19.567	19.667	1126932	0.29	425082	0.39	2.65		
29	19.889	19.833	19.967	2414495	0.61	609159	0.56	3.96		
30	20.773	20.733	20.833	1228621	0.31	503041	0.46	2.44		
				394883086	100.00	108758381	100.00			

Gambar L.1: TIC Minyak Serai Wangi

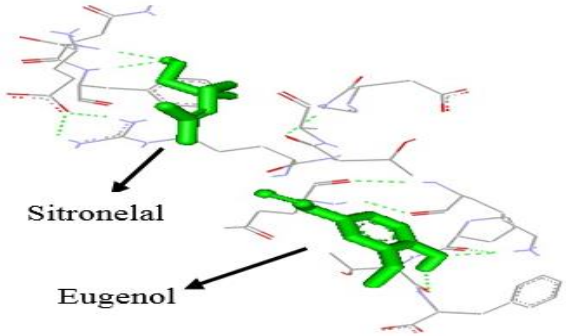


Peak Report TIC

Peak#	R.Time	I.Time	F.Time	Area	Area%	Height	Height%	A/H	Mark	Name
1	12.949	12.908	13.142	1435196	0.71	407230	1.01	3.52	MI	
2	14.825	14.742	14.925	702185	0.35	242109	0.60	2.89	MI	
3	15.938	15.758	16.033	132714094	65.90	18739498	46.71	7.08		
4	16.179	16.033	16.225	1333488	0.66	418878	1.04	3.18	V	
5	16.882	16.783	16.942	54872769	27.25	16370514	40.80	3.35		
6	17.317	17.258	17.383	7281608	3.62	2833336	7.06	2.56		
7	18.157	18.083	18.267	522468	0.26	134101	0.33	3.89	MI	
8	19.056	19.008	19.117	2511820	1.25	977405	2.44	2.56		
				201373628	100.00	40123071	100.00			

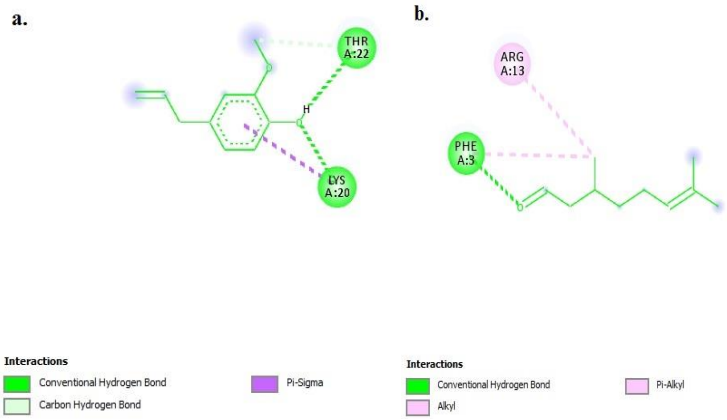
Gambar L.2: TIC Minyak Cengkeh

C.2 Analisis Hasil *Docking*



Gambar L.3: Hasil *multiple ligand docking*
Tabel L.2: Nilai Ki Hasil *Multiple Ligand Docking*

Ligan	**Nilai Ki_1 (mM)**	**Ligan**	**Nilai Ki_2 (mM)**
Eugenol-Sitronelal	1,75	Sitronelal-Eugenol	3,09



Gambar L.4: Interaksi Makromolekul 2DJC dengan Ligan (a) Eugenol dan (b) Sitronelal

LAMPIRAN D: Hasil Uji Aktivitas Insektisida

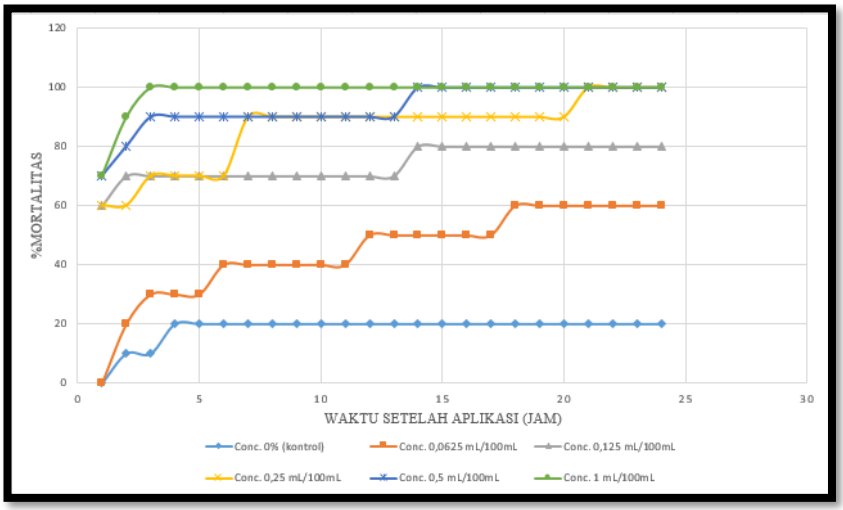
D.1 Mortalitas *S.litura* terhadap Metode Kontak Racun dan Kontak Daun

Tabel L.3 Mortalitas *S.litura* pada Metode Kontak Racun

Waktu Setelah Aplikasi (jam)	%Mortalitas					
	Kontrol	**0,0625**	**0,125**	**0,25**	**0,5**	**1**
1	0	0	60	60	70	70
2	10	20	70	60	80	90
3	10	30	70	70	90	100
4	20	30	70	70	90	100
5	20	30	70	70	90	100
6	20	40	70	70	90	100
7	20	40	70	90	90	100
8	20	40	70	90	90	100
9	20	40	70	90	90	100
10	20	40	70	90	90	100
11	20	40	70	90	90	100
12	20	50	70	90	90	100
13	20	50	70	90	90	100
14	20	50	80	90	100	100
15	20	50	80	90	100	100
16	20	50	80	90	100	100
17	20	50	80	90	100	100
18	20	60	80	90	100	100
19	20	60	80	90	100	100
20	20	60	80	90	100	100
21	20	60	80	100	100	100
22	20	60	80	100	100	100
23	20	60	80	100	100	100
24	20	60	80	100	100	100

Perhitungan %mortalitas:

$$\%\text{Mortalitas} = \frac{S.litura\ yang\ mati}{Total\ jumlah\ S.litura} \text{ x } 100\%$$

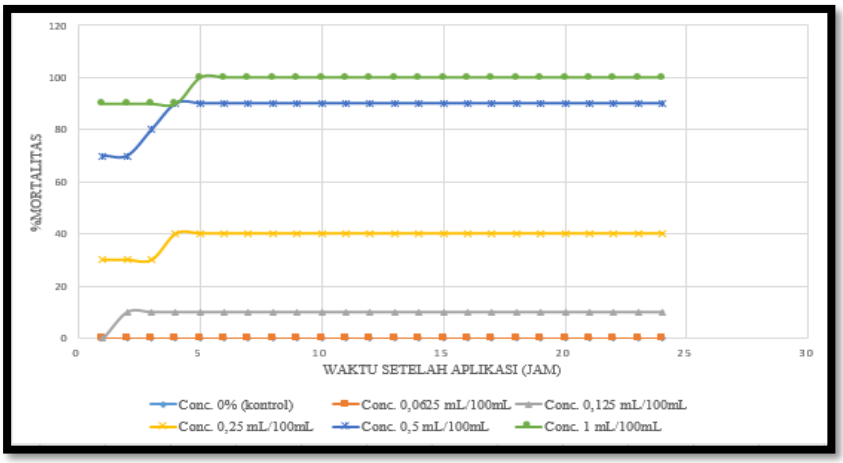


Gambar L.5: Grafik Hubungan Waktu Setelah Aplikasi dengan %Mortalitas Metode Kontak Racun

Tabel L.4 Mortalitas *S.litura* pada Metode Kontak Daun

Waktu Setelah Aplikasi (jam)	%Mortalitas					
	Kontrol	**0,0625**	**0,125**	**0,25**	**0,5**	**1**
1	0	0	0	30	70	90
2	0	0	10	30	70	90
3	0	0	10	30	80	90
4	0	0	10	40	90	90
5	0	0	10	40	90	100
6	0	0	10	40	90	100
7	0	0	10	40	90	100
8	0	0	10	40	90	100
9	0	0	10	40	90	100
10	0	0	10	40	90	100
11	0	0	10	40	90	100
12	0	0	10	40	90	100
13	0	0	10	40	90	100
14	0	0	10	40	90	100

15	0	0	10	40	90	100
16	0	0	10	40	90	100
17	0	0	10	40	90	100
18	0	0	10	40	90	100
19	0	0	10	40	90	100
20	0	0	10	40	90	100
21	0	0	10	40	90	100
22	0	0	10	40	90	100
23	0	0	10	40	90	100
24	0	0	10	40	90	100



Gambar L.6: Grafik Hubungan Waktu Setelah Aplikasi dengan %Mortalitas Metode Kontak Daun

D.2 Penentuan LC_{50}

Tabel L.5 Penentuan LC_{50} dan LC_{90} Insektisida Menggunakan Metode Kontak Racun

Konsentrasi (%)	Mati	Total
0	2	10
0,0625	6	10
0,125	8	10
0,25	10	10
0,5	10	10
1	10	10

LC_{50} dan LC_{90} Metode Kontak Racun

Confidence Limits

Probability		konsentrasi Estimate	Lower Bound	Upper Bound
PROBIT	.010	-.207	-1.321	-.038
	.020	-.177	-1.195	-.018
	.030	-.157	-1.115	-.006
	.040	-.143	-1.055	.004
	.050	-.131	-1.006	.012
	.060	-.121	-.965	.019
	.070	-.112	-.928	.025
	.080	-.105	-.896	.030
	.090	-.097	-.867	.035
	.100	-.091	-.840	.040
	.150	-.064	-.729	.060
	.200	-.042	-.641	.077
	.250	-.023	-.567	.092
	.300	-.007	-.501	.106
	.350	.009	-.441	.121
	.400	.024	-.385	.135
	.450	.038	-.332	.151
	.500	.052	-.281	.167
	.550	.066	-.232	.185
	.600	.080	-.184	.206
	.650	.095	-.138	.230
	.700	.110	-.093	.260
	.750	.127	-.050	.296
	.800	.145	-.007	.344
	.850	.167	.034	.407
	.900	.194	.076	.496
	.910	.201	.084	.519
	.920	.208	.093	.545
	.930	.216	.103	.573
	.940	.225	.113	.605
	.950	.235	.123	.643
	.960	.247	.135	.688
	.970	.261	.149	.744
	.980	.280	.165	.820
	.990	.311	.190	.941

Tabel L.5 Penentuan LC_{50} Insektisida menggunakan Metode Kontak Daun

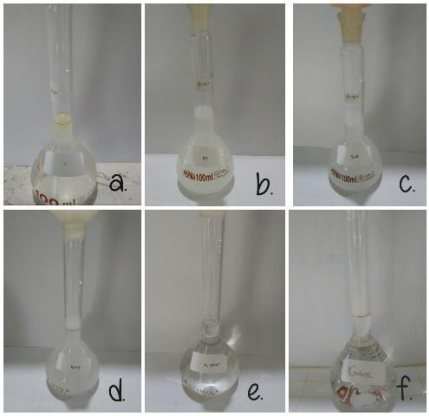
Konsentrasi (%)	Mati	Total
0	0	10
0,0625	0	10
0,125	10	10
0,25	40	10
0,5	90	10
1	100	10

LC_{50} dan LC_{90} Metode Kontak Daun

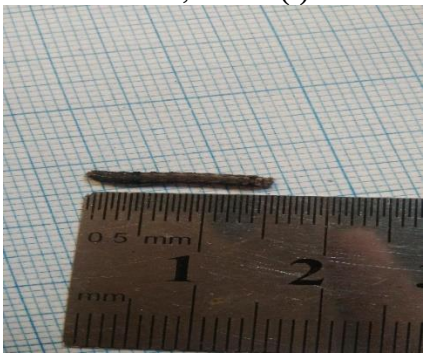
Confidence Limits

		konsentrasi		
Probability		Estimate	Lower Bound	Upper Bound
PROBIT	.010	.004	-.360	.141
	.020	.038	-.290	.168
	.030	.062	-.246	.186
	.040	.079	-.213	.199
	.050	.093	-.187	.210
	.060	.105	-.165	.219
	.070	.115	-.145	.228
	.080	.124	-.128	.236
	.090	.133	-.112	.243
	.100	.140	-.097	.249
	.150	.172	-.039	.277
	.200	.198	.007	.301
	.250	.220	.045	.322
	.300	.239	.078	.342
	.350	.258	.108	.361
	.400	.275	.135	.381
	.450	.292	.160	.401
	.500	.308	.184	.422
	.550	.324	.206	.444
	.600	.341	.228	.467
	.650	.358	.250	.492
	.700	.377	.271	.520
	.750	.396	.293	.551
	.800	.418	.316	.587
	.850	.444	.341	.631
	.900	.476	.371	.688
	.910	.484	.378	.702
	.920	.492	.385	.718
	.930	.501	.393	.735
	.940	.512	.402	.754
	.950	.523	.412	.776
	.960	.537	.423	.802
	.970	.554	.437	.834
	.980	.577	.455	.878
	.990	.613	.482	.947

LAMPIRAN E: Dokumentasi Penelitian



Gambar L.9: Formulasi Insektisida Alami (a) Konsentrasi 1% (b) Konsentrasi 0,5% (c) Konsentrasi 0,25% (d) Konsentrasi 0,125% (e) Konsentrasi 0,0625% (f) Kontrol



Gambar L.10: Pengukuran Panjang Ulat Grayak (*S.litura*)

Gambar L.11: Penimbangan Ulat Grayak (*S.litura*)

Gambar L.12: Uji Aktivitas Insektisida Metode (a) Kontak Racun (b) Kontak Daun

Gambar L.13: Kematian *S.litura* Setelah Pengaplikasian Insektisida