

APPENDICES

Table A1 Mean of physico-chemical parameters, biological components, chironomid ChE activity ($\mu\text{mol}/\text{min}/\text{mg}$ protein) and concentrations of methyl-parathion causing 50% inhibition of chironomid ChE activity (50% inh M-P conc; μM) in the control stream at elevation 1050, 900 and 700 mAMSL (S1050, S900 and S700) respectively and in Mae Sa Noi stream at same elevation (M1050, M900 and M700) in dry 1999, rainy 1999 and cold season 2000

	Stream velocity (m/s)	Temperature ($^{\circ}\text{C}$)	Conductivity ($\mu\text{s}/\text{cm}$)	TDS (mg/l)	pH	Population density (individual/ m^2)	Richness index	Diversity index	Evenness	Chironomids density (individual/ m^2)	Chironomids ChE activity	50% inh M-P conc (μM)
Dry 1050	Control	19.3	57.2	29.2	7.05	163.2	3.68	2.17	0.75	81.6	ND	ND
	Mae Sa Noi	0.25	88.1	44.0	4.94	288	4.02	2.41	0.78	120	ND	ND
Dry 900	Control	0.67	469.0	243.0	7.67	1028.8	2.01	1.42	0.54	868.8	ND	ND
	Mae Sa Noi	0.45	100.1	50.5	4.84	752	2.6	1.21	0.43	54.4	ND	ND
Dry 700	Control	0.31	405.0	209.3	7.35	531.2	1.38	1.45	0.66	139.2	ND	ND
	Mae Sa Noi	0.24	203.0	101.3	5.39	30.4	2.04	1.73	0.89	8	ND	ND
Rainy 1050	Control	0.36	58.8	29.6	6.41	116.8	2.56	1.98	0.79	24	0.065	ND
	Mae Sa Noi	0.16	73.3	36.8	6.48	468.8	3.34	1.86	0.62	48	0.017	ND

(Table A1 Continued)

		Stream velocity (m/s)	Temperature (°C)	Conductivity (µs/cm)	TDS (mg/l)	pH	Population density (individual/m ²)	Richness index	Diversity index	Evenness	Chironomids density (individual/m ²)	Chironomids ChE activity	50% inh M-P conc (µM)
Rainy 900	Control	0.52	17.6	112.5	55.0	6.74	1160	1.06	1.13	0.54	680	0.012	ND
	Mae Sa Noi	0.42	16.6	106.9	52.8	6.70	553.6	2.56	1.86	0.67	99.2	0.011	ND

Rainy 700	Control	0.60	18.1	139.7	69.9	7.00	315.2	1.7	1.54	0.67	67.2	0.006	ND
	Mae Sa Noi	0.40	17.9	190.7	94.8	7.40	224	2.63	2	0.76	49.6	0.009	ND

Cold 1050	Control	0.20	10.1	66.4	33.3	6.50	123.2	2.07	1.65	0.72	16	0.012	225
	Mae Sa Noi	0.28	9.7	75.2	37.8	6.60	324.8	2.82	1.98	0.71	33.6	0.008	135

Cold 900	Control	0.36	11.0	159.3	79.8	6.81	1579.2	1.02	1.23	0.59	793.6	0.007	190
	Mae Sa Noi	0.32	9.9	113.0	56.5	6.80	728	2.29	1.6	0.59	86.4	0.004	90

Cold 700	Control	0.38	11.5	164.9	82.6	6.99	646.4	1.83	1.34	0.58	83.2	0.009	180
	Mae Sa Noi	0.31	11.4	214.0	110.0	7.30	179.2	3.39	2.05	0.72	57.6	0.006	135

Table A2. Taxa and number of macroinvertebrates sampled with surber sampler from the control and Mae Sa Noi Streams at 1050, 900 and 700 mAMSL in dry season

Order	Family	Dry, 1050 mAMSL		Dry, 900 mAMSL		Dry, 700 mAMSL	
		Control	Mea Sa Noi	Control	Mea Sa Noi	Control	Mea Sa Noi
Coleoptera	Dytiscidae					6	
Coleoptera	Hydrophilidae					1	
Coleoptera	Limnichidae	1					
Coleoptera	Elmidae				3		
Diptera	Chironomidae	51	82	480	34	87	5
Diptera	Culicidae		1	3		103	
Diptera	Athericidae						
Diptera	Ephydriidae						1
Diptera	Simuliidae	1	1		340		2
Diptera	Tanyderidae	4	20		4		
Diptera	Ceratopogonidae	1	5		1		
Diptera	Psychodidae			2			
Diptera	Syrphidae			1			
Diptera	Tipulidae	3	1				
Diptera	Empididae						
Diptera	Tabanidae						
Diptera	Dixidae						
Ephemeroptera	Baetidae	6	1		31	107	5
Ephemeroptera	Leptophlebiidae	1			5	1	
Ephemeroptera	Heptageniidae	5	1		16		

Table A2 (continued)

Order	Family	Dry, 1050 mAMSL		Dry, 900 mAMSL		Dry, 700 mAMSL	
		Control	Mea Sa Noi	Control	Mea Sa Noi	Control	Mea Sa Noi
Ephemeroptera	Caenidae		5	1	6		
Ephemeroptera	Ephemeridae		16				
Ephemeroptera	Siphonuridae						
Hemiptera	Corixidae	3		1		19	
Hemiptera	Gerridae	2	2		2		
Hemiptera	Veliidae		1				
Hemiptera	Herbridae	1	4				
Hemiptera	Notonectidae	1					
NEMATOD						7	
Trichoptera	Hydropsychidae				8	1	
Trichoptera	Helicopsychidae				1		1
OLIGO 1				3			
OLIGO 2			6		17		5
OLIGO 3		18	14		1		
Odonata	Corduliidae			34			
Odonata	Coenagrionidae	1		1			
Odonata	Gomphidae				1		
Odonata	Macromiidae	3	21				
Odonata	Libellulidae		2				
Odonata	Cordulegastridae						
Lepidoptera	Pyralidae		3				
Leech				6			
Hydracarina							
Mollusk				48			
Ostracoda			6				
Aranida			1				

Table A3. Taxa and number of macroinvertebrates sampled with surber sampler from the control and Mae Sa Noi Stream at 1050, 900 and 700 mAMS L in rainy season

Order	Family	Rainy, 1050 mAMS L		Rainy, 900 mAMS L		Rainy, 700 mAMS L	
		Control	Mea Sa Noi	Control	Mea Sa Noi	Control	Mea Sa Noi
Coleoptera	Amphizoidae	1					
Coleoptera	Dytiscidae		1				
Coleoptera	Hydrophilidae		1				
Coleoptera	Elmidae		10		5		2
Coleoptera	Psephenidae						1
Coleoptera	Hydroscaphidae						
Diptera	Chironomidae	15	30	425	62	42	31
Diptera	Athericidae	1	3				
Diptera	Ephydriidae						
Diptera	Simuliidae	1	141		38	2	22
Diptera	Tanyderidae				1	1	
Diptera	Ceratopogonidae				3		3
Diptera	Psychodidae			1			
Diptera	Tipulidae		3		1		
Diptera	Empididae		2				
Ephemeroptera	Baetidae	19	33	45	92	82	23
Ephemeroptera	Leptophlebiidae		16		4		
Ephemeroptera	Heptageniidae	13	4		15	16	5
Ephemeroptera	Caenidae		5		3	3	1
Ephemeroptera	Ephemeridae		1				
Ephemeroptera	Siphonuridae						36
Hemiptera	Corixidae						4

Table A3 (continued)

Order	Family	Rainy, 1050 mAMSL		Rainy, 900 mAMSL		Rainy, 700 mAMSL	
		Control	Mea Sa Noi	Control	Mea Sa Noi	Control	Mea Sa Noi
Hemiptera	Herbridae						
Hemiptera	Notonectidae						
Hemiptera	Pleidae						
NEMATOD							
Trichoptera	Hydropsychidae		31	5	99	42	8
Trichoptera	Helicopsychidae	11				2	
Trichoptera	Glossosomatidae	1	2				
Trichoptera	Lepidostomatidae						
Plecoptera	Leuctridae	3	1				
Plecoptera	Perlidae	5					
Plecoptera	Pletopeiridae						
OLIGO 1		2	2	175	18		2
OLIGO 2				1			
OLIGO 3		1				1	
Odonata	Corduliidae						
Odonata	Coenagrionidae		4				
Odonata	Gomphidae		2		2		
Odonata	Macromiidae						
Odonata	Libellulidae						1
Odonata	Cordulegastridae				1		
Odonata	Aeshnidae		1		1		
Odonata	Lestidae				1		
Lepidoptera	Pyralidae						
Leech				4			
Hydracarina							
Mollusk				69		6	1

Table A4. Taxa and number of macroinvertebrates sampled with surber sampler from the control and Mae Sa Noi Stream at 1050, 900 and 700 mAMS L in cold season

Order	Family	Cold, 1050 mAMS L		Cold, 900 mAMS L		Cold, 700 mAMS L	
		Control	Mea Sa Noi	Control	Mea Sa Noi	Control	Mea Sa Noi
Coleoptera	Hydrophilidae		2				
Coleoptera	Elmidae		11		6	1	2
Coleoptera	Psephenidae						2
Coleoptera	Hydroscaphidae				1		
Diptera	Chironomidae	10	21	496	54	52	36
Diptera	Athericidae	2	2		2		1
Diptera	Ephydriidae					1	
Diptera	Simuliidae	1	77		29		1
Diptera	Tanyderidae						
Diptera	Ceratopogonidae				1		1
Diptera	Psychodidae			1			
Diptera	Tipulidae		1	66		1	2
Diptera	Empididae						
Diptera	Tabanidae		2		2		
Diptera	Dixidae		1				
Ephemeroptera	Baetidae	28	33		144	251	25
Ephemeroptera	Leptophlebiidae	2	19				
Ephemeroptera	Heptageniidae	3	8		23	28	2
Ephemeroptera	Caenidae		2	1	2	10	3
Ephemeroptera	Ephemeridae						
Ephemeroptera	Siphonuridae						19
Hemiptera	Corixidae						
Hemiptera	Gerridae	3					

Table A4 (continued)

Order	Family	Cold, 1050 mAMS L		Cold, 900 mAMS L		Cold, 700 mAMS L	
		Control	Mea Sa Noi	Control	Mea Sa Noi	Control	Mea Sa Noi
Hemiptera	Notonectidae						2
Hemiptera	Pleidae		1				
NEMATOD		2					
Trichoptera	Hydropsychidae	25	19	5	178	22	7
Trichoptera	Helicopsychidae					1	
Trichoptera	Glossosomatidae			1			1
Trichoptera	Lepidostomatidae				1		
Plecoptera	Leuctridae						
Plecoptera	Perlidae		3				
Plecoptera	Plecoptera	1					
OLIGO 1				193	7	26	5
OLIGO 2						1	
OLIGO 3							
Odonata	Corduliidae						
Odonata	Coenagrionidae						
Odonata	Gomphidae				4		1
Odonata	Macromiidae						
Odonata	Libellulidae						
Odonata	Cordulegastridae						
Odonata	Aeshnidae						
Odonata	Lestidae						2
Lepidoptera	Pyralidae		1				
Leech							
Hydracarina					1		
Mollusk				224		10	

Table A5. ChE activity ($\mu\text{mol}/\text{min}/\text{mg}$), absorbance at 412 nm and protein content of chironomids sampled from the control and Mae Sa Noi streams at 1050, 900 and 700 mAMSL in rainy season

R=dA/13600*3.16/0.1*1/cp*1/15				protein	R	R	AVG activity	SD activity
site	blank Abs	test Abs	delta Abs	mg/ml	mol/min/gm	$\mu\text{mol}/\text{min}/\text{mg}$	$\mu\text{mol}/\text{min}/\text{mg}$	$\mu\text{mol}/\text{min}/\text{mg}$
RS1050	0.342	0.585	0.243	0.178	0.00021147	0.211	0.089	0.063
		0.385	0.043		3.742E-05	0.037		
		0.45	0.108		9.3985E-05	0.094		
		0.397	0.055		4.7863E-05	0.048		
		0.416	0.074		6.4397E-05	0.064		
		0.433	0.091		7.9191E-05	0.079		
RS900	0.39	0.41	0.02	0.522	5.9349E-06	0.006	0.012	0.005
		0.417	0.027		8.0122E-06	0.008		
		0.427	0.037		1.098E-05	0.011		
		0.433	0.043		1.276E-05	0.013		
		0.456	0.066		1.9585E-05	0.020		
		0.433	0.043		1.276E-05	0.013		
RS700	0.39	0.392	0.002	0.374	8.2835E-07	0.001	0.006	0.003
		0.4	0.01		4.1418E-06	0.004		
		0.411	0.021		8.6977E-06	0.009		
		0.412	0.022		9.1119E-06	0.009		
		0.411	0.021		8.6977E-06	0.009		
		0.404	0.014		5.7985E-06	0.006		
RM1050	0.366	0.377	0.011	0.322	5.2917E-06	0.005	0.017	0.007
		0.4	0.034		1.6356E-05	0.016		
		0.41	0.044		2.1167E-05	0.021		
		0.393	0.027		1.2989E-05	0.013		
		0.414	0.048		2.3091E-05	0.023		
		0.419	0.053		2.5496E-05	0.025		
RM900	0.361	0.365	0.004	0.34	1.8224E-06	0.002	0.011	0.005
		0.38	0.019		8.6563E-06	0.009		
		0.395	0.034		1.549E-05	0.015		
		0.382	0.021		9.5675E-06	0.010		
		0.384	0.023		1.0479E-05	0.010		
		0.399	0.038		1.7313E-05	0.017		
RM700	0.355	0.359	0.004	0.227	2.7295E-06	0.003	0.009	0.003
		0.373	0.018		1.2283E-05	0.012		
		0.372	0.017		1.1601E-05	0.012		
		0.368	0.013		8.871E-06	0.009		
		0.371	0.016		1.0918E-05	0.011		
		0.37	0.015		1.0236E-05	0.010		

Table A6. ChE activity ($\mu\text{mol}/\text{min}/\text{mg}$), absorbance at 412 nm and protein content of chironomids sampled from the control and Mae Sa Noi Stream at 1050, 900 and 700 mAMSL in cold season

R=dA/13600*3.16/0.1*1/cp*1/15				protein(cp)	R	R	AVG activity	SD activity
site	blank Abs	test Abs	delta Abs	mg/ml	mol/min/gm	$\mu\text{mol}/\text{min}/\text{mg}$	$\mu\text{mol}/\text{min}/\text{mg}$	$\mu\text{mol}/\text{min}/\text{mg}$
CS1050	0.365	0.385	0.02	0.295	1.0502E-05	0.011	0.012	0.002
		0.384	0.019		9.9767E-06	0.010		
		0.384	0.019		9.9767E-06	0.010		
		0.39	0.025		1.3127E-05	0.013		
		0.39	0.025		1.3127E-05	0.013		
		0.392	0.027		1.4177E-05	0.014		
CS900	0.419	0.468	0.049	0.887	8.5572E-06	0.009	0.007	0.001
		0.46	0.041		7.1601E-06	0.007		
		0.466	0.047		8.2079E-06	0.008		
		0.464	0.045		7.8586E-06	0.008		
		0.446	0.027		4.7152E-06	0.005		
		0.461	0.042		7.3347E-06	0.007		
CS700	0.375	0.407	0.032	0.658	7.5332E-06	0.008	0.009	0.001
		0.417	0.042		9.8874E-06	0.010		
		0.409	0.034		8.0041E-06	0.008		
		0.412	0.037		8.7103E-06	0.009		
		0.421	0.046		1.0829E-05	0.011		
		0.406	0.031		7.2978E-06	0.007		
CM1050	0.359	0.38	0.021	0.377	8.6285E-06	0.009	0.008	0.001
		0.379	0.02		8.2176E-06	0.008		
		0.381	0.022		9.0394E-06	0.009		
		0.374	0.015		6.1632E-06	0.006		
		0.379	0.02		8.2176E-06	0.008		
		0.381	0.022		9.0394E-06	0.009		
CM900	0.419	0.433	0.014	0.792	2.7382E-06	0.003	0.004	0.001
		0.445	0.026		5.0852E-06	0.005		
		0.439	0.02		3.9117E-06	0.004		
		0.445	0.026		5.0852E-06	0.005		
		0.437	0.018		3.5205E-06	0.004		
		0.439	0.02		3.9117E-06	0.004		
CM700	0.378	0.406	0.028	0.487	8.9061E-06	0.009	0.006	0.001
		0.398	0.02		6.3615E-06	0.006		
		0.395	0.017		5.4073E-06	0.005		
		0.396	0.018		5.7253E-06	0.006		
		0.399	0.021		6.6796E-06	0.007		
		0.394	0.016		5.0892E-06	0.005		

Table A7. ChE activity ($\mu\text{mol}/\text{min}/\text{mg}$) at each concentration (μm) of methyl-parathion (MP), absorbance at 412 nm and protein content of chironomids sampled from the control and Mae Sa Noi Stream at 1050, 900 and 700 mAMS L in cold season

site	MP conc	r1	r2	avg	blank	delta abs	protein(cp)	R	R
							mg/ml	mol/min/gm	umol/min/mg
CS1050	0	0.452	0.448	0.450	0.358	0.092	1.327	1.10791E-05	0.011
	19	0.451	0.436	0.444	0.355	0.089		1.06576E-05	0.011
	38	0.441	0.440	0.441	0.362	0.079		9.45336E-06	0.009
	77	0.445	0.443	0.444	0.373	0.071		8.55017E-06	0.009
	153	0.440	0.445	0.443	0.377	0.066		7.88783E-06	0.008
	307	0.463	0.438	0.451	0.430	0.021		2.46871E-06	0.002
CS900	0	0.273	0.276	0.275	0.249	0.026	0.534	3.07084E-06	0.003
	38	0.281	0.282	0.282	0.255	0.027		3.19126E-06	0.003
	77	0.284	0.286	0.285	0.262	0.023		2.76977E-06	0.003
	153	0.286	0.297	0.292	0.280	0.012		1.38489E-06	0.001
	230	0.301	0.318	0.310	0.299	0.011		1.26446E-06	0.001
	307	0.409	0.539	0.474	0.493	-0.019		-2.28807E-06	-0.002
CS700	0	0.277	0.280	0.279	0.252	0.027	0.852	3.19126E-06	0.003
	38	0.280	0.283	0.282	0.259	0.023		2.70956E-06	0.003
	77	0.285	0.288	0.287	0.268	0.019		2.22786E-06	0.002
	153	0.299	0.298	0.299	0.281	0.018		2.10744E-06	0.002
	230	0.308	0.309	0.309	0.297	0.012		1.38489E-06	0.001
	307	0.319	0.406	0.363	0.424	-0.061		-7.40614E-06	-0.007
CM1050	0	0.241	0.244	0.243	0.222	0.021	0.261	2.46871E-06	0.002
	19	0.245	0.246	0.246	0.229	0.017		1.98701E-06	0.002
	38	0.248	0.249	0.249	0.232	0.017		1.98701E-06	0.002
	77	0.253	0.255	0.254	0.240	0.014		1.68595E-06	0.002
	153	0.256	0.259	0.258	0.248	0.010		1.14404E-06	0.001
	307	0.324	0.352	0.338	0.379	-0.041		-4.93742E-06	-0.005
CM900	0	0.418	0.385	0.402	0.338	0.063	0.94	7.64698E-06	0.008
	19	0.390	0.388	0.389	0.341	0.048		5.7804E-06	0.006
	38	0.388	0.389	0.389	0.347	0.042		4.99764E-06	0.005
	77	0.389	0.387	0.388	0.348	0.040		4.817E-06	0.005
	153	0.392	0.373	0.383	0.364	0.019		2.22786E-06	0.002
	307	0.406	0.451	0.429	0.418	0.011		1.26446E-06	0.001
CM700	0	0.270	0.267	0.269	0.238	0.031	0.352	3.67296E-06	0.004
	19	0.268	0.267	0.268	0.239	0.029		3.43211E-06	0.003
	38	0.270	0.265	0.268	0.241	0.027		3.19126E-06	0.003
	77	0.271	0.267	0.269	0.244	0.025		3.01062E-06	0.003
	153	0.270	0.274	0.272	0.260	0.012		1.4451E-06	0.001

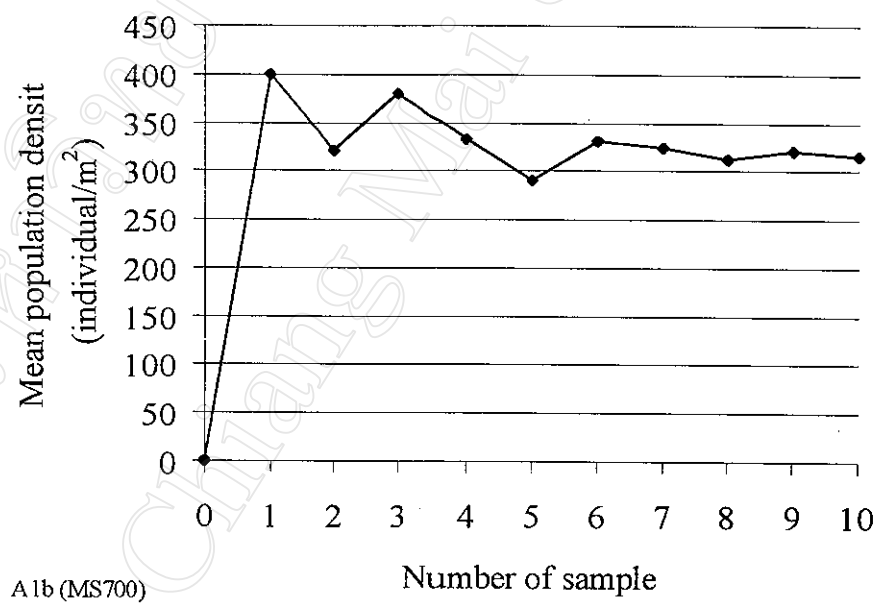
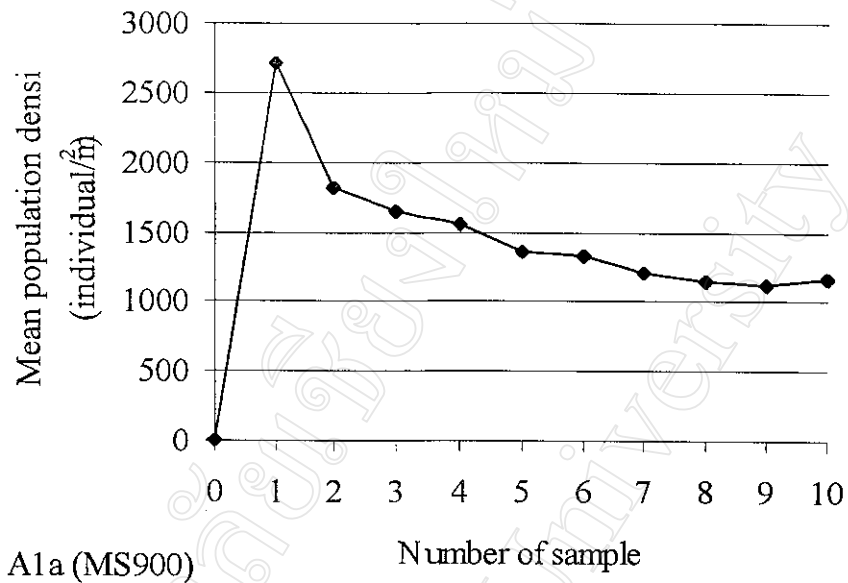


Fig A1. Graph of mean population density (individual/m²) and number of sample using for selection appropriate replications in macroinvertebrate sampling, A1a and A1b using raw data of population density from MS900 and MS700 respectively

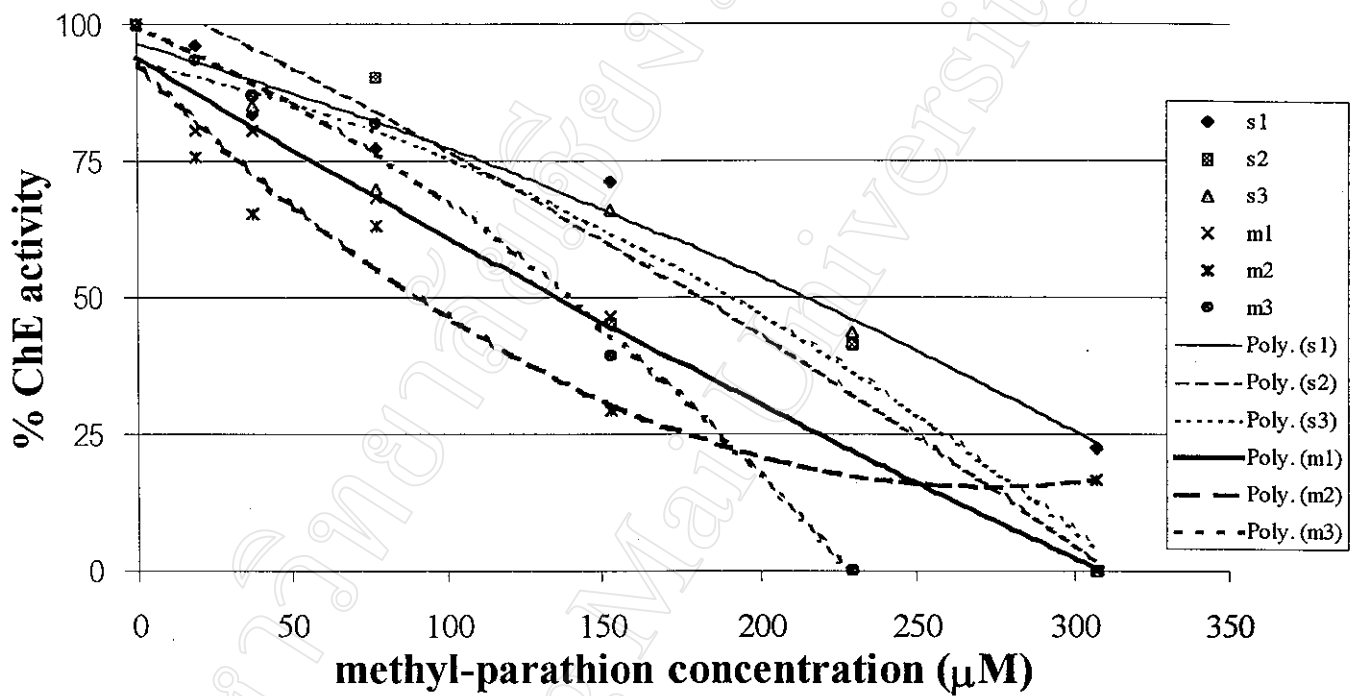


Fig A2. Graph showed ChE activity ($\mu\text{mol}/\text{min}/\text{mg}$) at each concentration (μM) of methyl-parathion, of chironomids sampled from the control and Mae Sa Noi streams at 1050, 900 and 700 mAMSL in cold season

Table A8. Daily Rainfall (mm) in Chiang Mai province from 1 April 1999 to 29 February 2000. Source: Meteorology Center, Chiang Mai

Day	1999										2000	
	April	May	June	July	August	September	October	November	December	January	February	
1	0.0	0.0	0.0	0.0	1.2	7.5	0.2	12.5	0.0	0.0	0.0	
2	0.0	0.0	0.2	0.0	3.4	1.6	10.2	7.9	0.0	0.0	0.0	
3	0.0	0.0	0.0	0.2	1.7	0.0	0.0	0.1	0.0	0.0	0.0	
4	0.0	0.2	7.1	0.8	22.5	0.7	0.0	0.2	0.1	0.0	0.0	
5	0.0	78.6	0.3	13.2	3.3	4.1	0.0	0.0	0.5	0.0	0.0	
6	0.0	0.0	0.0	0.2	0.6	0.0	0.0	0.0	1.9	0.0	0.0	
7	1.7	0.2	0.0	T	0.5	0.0	0.0	0.0	0.1	0.0	0.0	
8	0.3	30.5	0.0	0.0	0.0	12.6	0.0	0.0	0.0	0.0	0.0	
9	T	2.4	17.6	0.1	0.0	1.0	0.0	9.4	0.0	0.0	0.0	
10	0.2	6.0	1.3	1.0	12.2	7.7	0.1	2.4	0.0	0.0	0.0	
11	1.5	15.8	27.2	16.7	4.4	5.0	0.1	2.1	0.0	0.0	0.0	
12	0.0	7.4	1.0	0.0	9.7	6.2	0.0	0.0	0.0	0.0	0.0	
13	0.0	7.2	0.0	0.0	3.4	0.2	0.0	0.0	0.0	0.0	0.0	
14	0.7	T	2.6	0.0	2.1	0.0	10.8	0.0	0.0	0.0	0.0	
15	22.9	2.1	11.8	0.0	2.9	46.9	4.0	1.1	0.0	0.0	0.0	
16	2.4	T	0.0	T	0.0	T	8.4	0.0	0.0	0.0	0.0	
17	1.6	0.0	0.0	9.0	2.2	1.1	2.4	0.0	0.0	0.0	0.0	
18	0.0	16.9	0.0	0.0	4.1	2.1	0.0	0.0	0.0	0.0	0.0	
19	0.0	96.0	T	5.7	T	1.1	0.0	0.0	0.0	0.0	0.0	
20	T	0.2	0.5	0.0	0.0	20.0	2.4	0.0	0.0	0.0	0.0	
21	0.0	8.1	1.0	0.0	0.0	8.5	0.1	0.0	0.0	0.0	0.0	
22	0.0	24.2	5.6	0.0	16.0	0.8	1.1	0.0	0.0	0.0	0.0	
23	0.0	10.6	3.6	10.6	0.0	5.1	0.0	0.0	0.0	0.0	0.0	
24	0.0	0.2	5.7	T	10.6	9.1	0.0	0.0	0.0	0.0	0.0	
25	0.0	0.6	0.6	0.1	26.1	14.0	1.3	0.0	0.0	0.0	0.0	
26	0.0	0.6	7.4	2.6	0.1	T	22.1	0.0	0.0	0.0	45.6	
27	0.0	12.5	0.0	1.0	18.3	T	6.5	0.0	0.0	0.0	11.8	
28	0.0	0.0	1.4	10.1	1.5	4.9	2.1	0.0	0.0	0.0	T	
29	0.0	0.5	0.0	4.3	2.9	4.7	6.8	0.0	0.0	0.0	0.0	
30	0.0	0.0	0.0	29.0	0.5	0.0	17.9	0.0	0.0	0.0		
31		0.0		1.2	0.2		7.9		0.0	0.0		
Total	31.3	320.8	94.9	105.8	150.4	164.9	104.4	35.7	2.6	0.0	57.4	
Average	1.1	11.1	3.3	3.8	5.0	6.1	3.4	1.2	0.1	0.0	2.1	

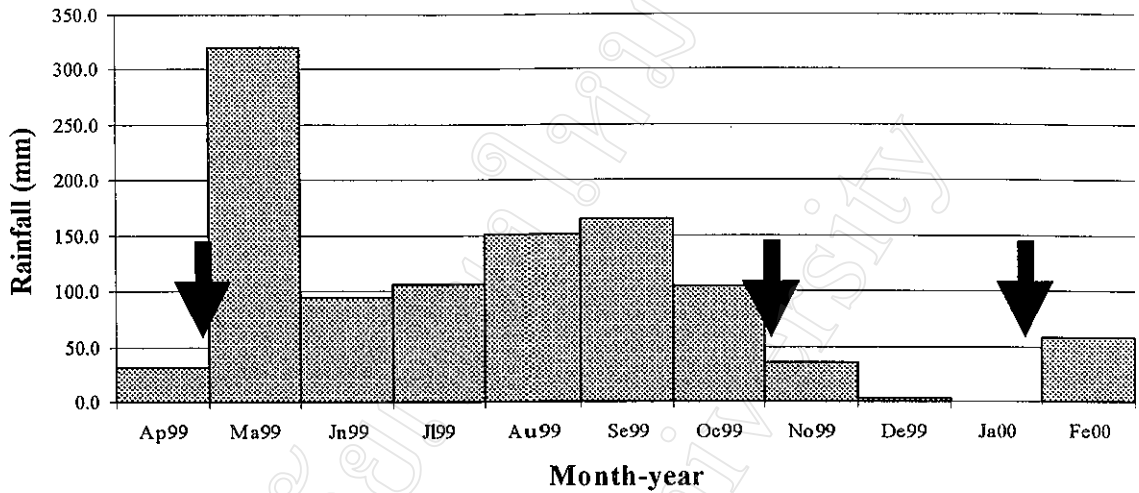


Fig A3. Monthly Rainfall (mm) in Chiang Mai province from April 1999 to February 2000. Source: Meteorology Center, Chiang Mai. Arrows show sampling time of ecological work and chironomids sampling

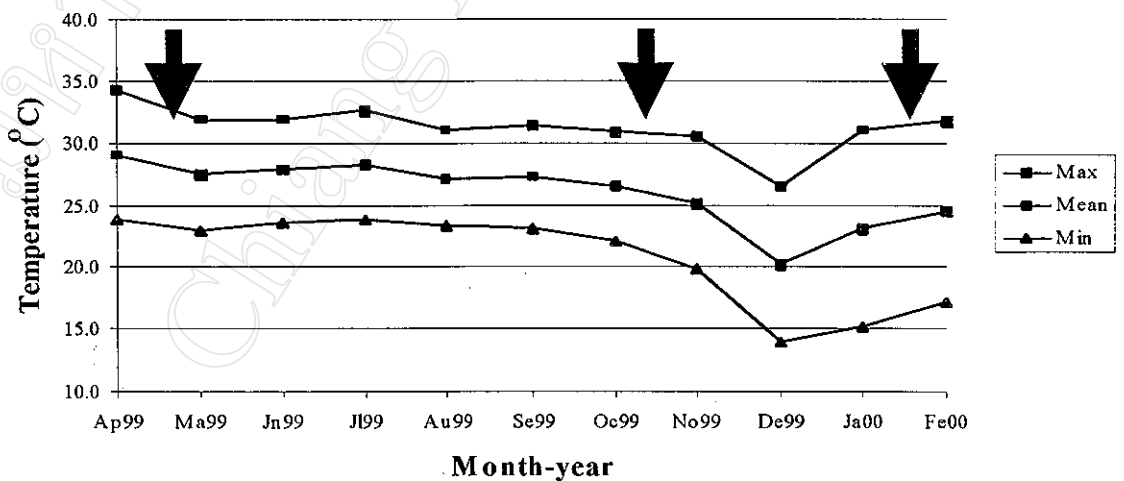


Fig A4. Maximum, minimum and mean of air temperature (°C) in Chiang Mai province from April 1999 to February 2000. Source: Meteorology Center, Chiang Mai. Arrows show sampling time of ecological work and chironomids sampling

Table A9. Organophosphates (OPs) and Carbamates (CAs) Pesticides used in Mae Sa Mai with their properties. Source: Stuetz (1999)

Chemical	brand names	chemical classification	Water solubility (mg/l)	Field Half-life (days)	Sorption coefficient (mg/g)	Vapor pressure (mm Hg)	physiological effect on insects, environment and human being
Parathion C ₁₀ H ₁₄ NO ₃ PS (291.3)	Folidol	Phenylthio-phosphate (OPs)	24 ^a 11 ^b 24 ^c	14	5000E	5 X 10 ⁻⁶	<p>Neurotoxic effect : Acetylcholinesterase inhibition</p> <ul style="list-style-type: none"> slowly decreasing Levels after repeatedly exposure (50 -70%) less protection <p>Symptoms after intoxication</p> <ul style="list-style-type: none"> headache, fatigue muscularly Fibrillation. tremor, convulsions, cramps, paralyses <p>Environmental contamination water , soil , microorganisms , useful insects , vegetables , fruits and human body.</p>
Malathion C ₁₀ H ₁₉ O ₆ PS ₂ (330.3)	Malathions	Dithio-Phosphate (OPs)	130 ^a 145 ^b	1	1800	8 X 10 ⁻⁶	
Metamidophos C ₂ H ₈ NO ₂ PS (141.1)	Tamaron Metaron ,	Amidothio-Phosphate (OPs)	1,000,000 E ^a 200,000 ^b 2,000,000 ^c	6	5	8 X 10 ⁻⁴	
Mevinphos C ₇ H ₁₃ O ₆ P (224.1)	Anglophos Rockphos	Organo-Phosphate (OPs)	600,000 ^a	3	44	1.3 X 10 ⁻⁴	
Monocrotophos C ₇ H ₁₄ NO ₃ P (223.2)	Ozo Daeng Maelin 24 Runin - Tresodrin	Organo-Phosphate (OPs)	1,000,000 ^a 1,000,000 ^b 1,000,000 ^c	30	1 E	7 X 10 ⁻⁵	
EPN C ₁₄ H ₁₄ NO ₄ PS (323.3)	Kumiphos Tamaphos	Thio-Phosphonate (OPs)	0.5 ^a	15	4000 E	3.4 X 10 ⁻⁷	
Prothiofos C ₁₁ H ₁₃ Cl ₂ O ₂ PS ₂ (345.2)	Tokuthion -	Thio-Phosphonate (OPs)	0.05 ^b	-	-	-	
Methomyl C ₅ H ₁₀ N ₂ O ₂ S (162.2)	Lannate	Carbamate s (CAs)	58000 ^a 58000 ^b 57000 ^c	30	72	5.0 X 10 ⁻⁵	
Carbaryl C ₁₂ H ₁₁ N ₀₂ (201.2)	Sevin 85	Carbamates (CAs)	120 ^a 40 ^b 40 ^c	10	300	1.2 X 10 ⁻⁶	

Note: a= Hornsby *et al.*, (1996), b= Worthing and Hance,(1991), c= Milne, (1995)

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