SUPPLEMENTARY MATERIAL

Comparative Laboratory Efficacy of Three Commercial Organophosphate Insecticides against Fall Armyworm (*Spodoptera frugiperda*) Larvae

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This document contains the reconciled data and statistical details supporting the main article. Final 168-h analyses were based on replicate-level counts cross-checked against the cumulative time-course dataset. Control mortality was pooled across the five water-treated control sets.

Analytical conventions: each insecticide × concentration combination comprised three experimental units of six larvae (18 larvae in total); Abbott-corrected values below zero were set to zero; the concentration–mortality probit analysis used a fixed natural-response proportion of 0.1889; and mortality development over time was summarized descriptively at the common 95% label-dose fraction.

Contents

- Table S1. Pooled control mortality during the 168-h bioassay
- Table S2. Replicate-level mortality and Abbott correction at 168 h
- Table S3. Descriptive mortality summary at 168 h
- Table S4. Factorial ANOVA and Tukey HSD comparisons
- Table S5. Input data for exploratory concentration–mortality probit analysis
- Table S6. Probit parameters and exploratory LC estimates
- Table S7. Cumulative treatment mortality across all concentrations and observation times
- Table S8. Detailed mortality correction at the 95% label-dose fraction
- Supplementary statistical syntax and analytical specifications

Table S1. Pooled control mortality during the 168-h bioassay

Observation time (h)	Dead larvae	Total larvae	Mortality (%)
24	0	90	0.00
48	2	90	2.22
72	4	90	4.44
96	6	90	6.67
120	11	90	12.22
144	11	90	12.22
168	17	90	18.89

Note. Values are pooled across 15 water-treated control units (five nominal concentration sets × three replications), comprising 90 larvae at each observation time.

Table S2. Replicate-level mortality and Abbott correction at 168 h

Insecticide	Label-dose fraction (%)	Replicate	Dead	Total	Raw mortality (%)	Pooled control (%)	Abbott-corrected mortality (%)
Chlorpyrifos	5	1	4	6	66.7	18.89	58.9
Chlorpyrifos	5	2	4	6	66.7	18.89	58.9
Chlorpyrifos	5	3	3	6	50.0	18.89	38.4
Chlorpyrifos	20	1	6	6	100.0	18.89	100.0
Chlorpyrifos	20	2	3	6	50.0	18.89	38.4
Chlorpyrifos	20	3	0	6	0.0	18.89	0.0
Chlorpyrifos	50	1	2	6	33.3	18.89	17.8
Chlorpyrifos	50	2	3	6	50.0	18.89	38.4
Chlorpyrifos	50	3	0	6	0.0	18.89	0.0
Chlorpyrifos	75	1	1	6	16.7	18.89	0.0
Chlorpyrifos	75	2	1	6	16.7	18.89	0.0
Chlorpyrifos	75	3	2	6	33.3	18.89	17.8
Chlorpyrifos	95	1	4	6	66.7	18.89	58.9
Chlorpyrifos	95	2	2	6	33.3	18.89	17.8
Chlorpyrifos	95	3	3	6	50.0	18.89	38.4
Profenofos	5	1	6	6	100.0	18.89	100.0
Profenofos	5	2	6	6	100.0	18.89	100.0
Profenofos	5	3	2	6	33.3	18.89	17.8
Profenofos	20	1	6	6	100.0	18.89	100.0
Profenofos	20	2	4	6	66.7	18.89	58.9
Profenofos	20	3	6	6	100.0	18.89	100.0
Profenofos	50	1	6	6	100.0	18.89	100.0
Profenofos	50	2	6	6	100.0	18.89	100.0
Profenofos	50	3	5	6	83.3	18.89	79.5
Profenofos	75	1	6	6	100.0	18.89	100.0
Profenofos	75	2	6	6	100.0	18.89	100.0
Profenofos	75	3	6	6	100.0	18.89	100.0
Profenofos	95	1	6	6	100.0	18.89	100.0
Profenofos	95	2	6	6	100.0	18.89	100.0
Profenofos	95	3	6	6	100.0	18.89	100.0
Diazinon	5	1	5	6	83.3	18.89	79.5
Diazinon	5	2	5	6	83.3	18.89	79.5
Diazinon	5	3	5	6	83.3	18.89	79.5
Diazinon	20	1	5	6	83.3	18.89	79.5

Insecticide	Label-dose fraction (%)	Replicate	Dead	Total	Raw mortality (%)	Pooled control (%)	Abbott-corrected mortality (%)
Diazinon	20	2	6	6	100.0	18.89	100.0
Diazinon	20	3	6	6	100.0	18.89	100.0
Diazinon	50	1	6	6	100.0	18.89	100.0
Diazinon	50	2	6	6	100.0	18.89	100.0
Diazinon	50	3	6	6	100.0	18.89	100.0
Diazinon	75	1	5	6	83.3	18.89	79.5
Diazinon	75	2	6	6	100.0	18.89	100.0
Diazinon	75	3	6	6	100.0	18.89	100.0
Diazinon	95	1	6	6	100.0	18.89	100.0
Diazinon	95	2	6	6	100.0	18.89	100.0
Diazinon	95	3	6	6	100.0	18.89	100.0

Note. Abbott-corrected mortality = [(T − C)/(100 − C)] × 100, where T is replicate-level raw mortality and C is pooled control mortality at 168 h (18.89%). Corrected values below zero were set to zero.

Table S3. Descriptive mortality summary at 168 h

Insecticide	5%	20%	50%	75%	95%	Mean across concentrations
Chlorpyrifos	52.1 ± 11.9	46.1 ± 50.4	18.7 ± 19.2	5.9 ± 10.3	38.4 ± 20.5	32.2 ± 28.9 b
Profenofos	72.6 ± 47.5	86.3 ± 23.7	93.2 ± 11.9	100.0 ± 0.0	100.0 ± 0.0	90.4 ± 23.1 a
Diazinon	79.5 ± 0.0	93.2 ± 11.9	100.0 ± 0.0	93.2 ± 11.9	100.0 ± 0.0	93.2 ± 10.0 a

Note. Values are mean ± SD of three experimental units. Means in the final column followed by different letters differ according to Tukey's HSD test at $P < 0.05$.

Table S4a. Factorial ANOVA of Abbott-corrected mortality at 168 h

Source	df	Mean square	F	P
Insecticide	2	17,753.58	39.06	<0.001
Label-dose fraction	4	258.95	0.57	0.687
Insecticide × label-dose fraction	8	734.68	1.62	0.162
Error	30	454.62	—	—

Table S4b. Tukey HSD pairwise comparisons for the insecticide main effect

Comparison	Mean difference (percentage points)	Adjusted P
Chlorpyrifos vs profenofos	−58.17	<0.001
Chlorpyrifos vs diazinon	−60.91	<0.001
Profenofos vs diazinon	−2.74	0.939

Note. The experimental unit was the replicate containing six individually maintained larvae. Post hoc comparisons were performed only for the significant insecticide main effect.

Table S5. Input data for exploratory concentration–mortality probit analysis

Insecticide	Label-dose fraction (%)	Formulation concentration (mL L^{-1})	Active ingredient (mg a.i. L^{-1})	Dead larvae	Total larvae	Observed mortality (%)
Chlorpyrifos	5	0.10	20	11	18	61.1
Chlorpyrifos	20	0.40	80	9	18	50.0
Chlorpyrifos	50	1.00	200	5	18	27.8
Chlorpyrifos	75	1.50	300	4	18	22.2
Chlorpyrifos	95	1.90	380	9	18	50.0
Profenofos	5	0.10	50	14	18	77.8
Profenofos	20	0.40	200	16	18	88.9
Profenofos	50	1.00	500	17	18	94.4
Profenofos	75	1.50	750	18	18	100.0
Profenofos	95	1.90	950	18	18	100.0
Diazinon	5	0.10	60	15	18	83.3
Diazinon	20	0.40	240	17	18	94.4
Diazinon	50	1.00	600	18	18	100.0
Diazinon	75	1.50	900	17	18	94.4
Diazinon	95	1.90	1140	18	18	100.0

Note. Counts were pooled across three experimental units (18 larvae per concentration). SPSS probit regression used log10 concentration and a fixed natural-response proportion of 0.1889.

Table S6. Probit parameters and exploratory lethal-concentration estimates at 168 h

Insecticide	Intercept	Slope ± SE	P for slope	Pearson χ^2 (df)	P for fit	LC_{50}, % label dose (95% CI)	LC_{90}, % label dose (95% CI)
Chlorpyrifos	0.588	−0.785 ± 0.408	0.054	4.500 (3)	0.212	Not estimable	Not estimable
Profenofos	−0.389	1.283 ± 0.487	0.008	1.253 (3)	0.740	2.01 (0.004–6.05)	20.05 (7.28–91.13)
Diazinon	0.151	0.999 ± 0.491	0.042	2.265 (3)	0.519	0.71 (0.000–4.14)	13.57 (0.002–112.46)

Note. LC estimates are exploratory. Profenofos and diazinon LC_{50} estimates were below the lowest tested concentration (5% of the standardized label dose), and several confidence intervals were wide. Chlorpyrifos LC values were not reported because its fitted slope was negative and not statistically significant.

Table S7. Cumulative treatment mortality across all concentrations and observation times

Insecticide	Label-dose fraction (%)	Observation time (h)	Cumulative dead larvae	Total larvae	Observed mortality (%)
Chlorpyrifos	5	24	2	18	11.1
Chlorpyrifos	5	48	3	18	16.7
Chlorpyrifos	5	72	3	18	16.7
Chlorpyrifos	5	96	7	18	38.9
Chlorpyrifos	5	120	7	18	38.9
Chlorpyrifos	5	144	10	18	55.6
Chlorpyrifos	5	168	11	18	61.1

Insecticide	Label-dose fraction (%)	Observation time (h)	Cumulative dead larvae	Total larvae	Observed mortality (%)
Chlorpyrifos	20	24	1	18	5.6
Chlorpyrifos	20	48	4	18	22.2
Chlorpyrifos	20	72	4	18	22.2
Chlorpyrifos	20	96	6	18	33.3
Chlorpyrifos	20	120	6	18	33.3
Chlorpyrifos	20	144	6	18	33.3
Chlorpyrifos	20	168	9	18	50.0
Chlorpyrifos	50	24	0	18	0.0
Chlorpyrifos	50	48	0	18	0.0
Chlorpyrifos	50	72	2	18	11.1
Chlorpyrifos	50	96	3	18	16.7
Chlorpyrifos	50	120	3	18	16.7
Chlorpyrifos	50	144	3	18	16.7
Chlorpyrifos	50	168	5	18	27.8
Chlorpyrifos	75	24	1	18	5.6
Chlorpyrifos	75	48	1	18	5.6
Chlorpyrifos	75	72	2	18	11.1
Chlorpyrifos	75	96	3	18	16.7
Chlorpyrifos	75	120	3	18	16.7
Chlorpyrifos	75	144	3	18	16.7
Chlorpyrifos	75	168	4	18	22.2
Chlorpyrifos	95	24	2	18	11.1
Chlorpyrifos	95	48	2	18	11.1
Chlorpyrifos	95	72	6	18	33.3
Chlorpyrifos	95	96	6	18	33.3
Chlorpyrifos	95	120	7	18	38.9
Chlorpyrifos	95	144	7	18	38.9
Chlorpyrifos	95	168	9	18	50.0
Profenofos	5	24	4	18	22.2
Profenofos	5	48	6	18	33.3
Profenofos	5	72	9	18	50.0
Profenofos	5	96	10	18	55.6
Profenofos	5	120	10	18	55.6
Profenofos	5	144	12	18	66.7
Profenofos	5	168	14	18	77.8
Profenofos	20	24	4	18	22.2

Insecticide	Label-dose fraction (%)	Observation time (h)	Cumulative dead larvae	Total larvae	Observed mortality (%)
Profenofos	20	48	7	18	38.9
Profenofos	20	72	8	18	44.4
Profenofos	20	96	15	18	83.3
Profenofos	20	120	15	18	83.3
Profenofos	20	144	15	18	83.3
Profenofos	20	168	16	18	88.9
Profenofos	50	24	6	18	33.3
Profenofos	50	48	8	18	44.4
Profenofos	50	72	11	18	61.1
Profenofos	50	96	13	18	72.2
Profenofos	50	120	14	18	77.8
Profenofos	50	144	16	18	88.9
Profenofos	50	168	17	18	94.4
Profenofos	75	24	5	18	27.8
Profenofos	75	48	14	18	77.8
Profenofos	75	72	16	18	88.9
Profenofos	75	96	18	18	100.0
Profenofos	75	120	18	18	100.0
Profenofos	75	144	18	18	100.0
Profenofos	75	168	18	18	100.0
Profenofos	95	24	9	18	50.0
Profenofos	95	48	12	18	66.7
Profenofos	95	72	17	18	94.4
Profenofos	95	96	17	18	94.4
Profenofos	95	120	18	18	100.0
Profenofos	95	144	18	18	100.0
Profenofos	95	168	18	18	100.0
Diazinon	5	24	0	18	0.0
Diazinon	5	48	3	18	16.7
Diazinon	5	72	5	18	27.8
Diazinon	5	96	7	18	38.9
Diazinon	5	120	11	18	61.1
Diazinon	5	144	12	18	66.7
Diazinon	5	168	15	18	83.3
Diazinon	20	24	4	18	22.2
Diazinon	20	48	8	18	44.4

Insecticide	Label-dose fraction (%)	Observation time (h)	Cumulative dead larvae	Total larvae	Observed mortality (%)
Diazinon	20	72	10	18	55.6
Diazinon	20	96	13	18	72.2
Diazinon	20	120	16	18	88.9
Diazinon	20	144	17	18	94.4
Diazinon	20	168	17	18	94.4
Diazinon	50	24	6	18	33.3
Diazinon	50	48	11	18	61.1
Diazinon	50	72	13	18	72.2
Diazinon	50	96	15	18	83.3
Diazinon	50	120	15	18	83.3
Diazinon	50	144	18	18	100.0
Diazinon	50	168	18	18	100.0
Diazinon	75	24	5	18	27.8
Diazinon	75	48	10	18	55.6
Diazinon	75	72	11	18	61.1
Diazinon	75	96	16	18	88.9
Diazinon	75	120	16	18	88.9
Diazinon	75	144	17	18	94.4
Diazinon	75	168	17	18	94.4
Diazinon	95	24	6	18	33.3
Diazinon	95	48	10	18	55.6
Diazinon	95	72	12	18	66.7
Diazinon	95	96	12	18	66.7
Diazinon	95	120	16	18	88.9
Diazinon	95	144	17	18	94.4
Diazinon	95	168	18	18	100.0

Note. Values are pooled cumulative counts across three experimental units (18 larvae) for each insecticide × concentration combination. These data were used to describe mortality development over time.

Table S8. Detailed mortality correction at the 95% standardized label-dose fraction

Insecticide	Observation time (h)	Dead larvae	Total larvae	Observed mortality (%)	Time-specific control mortality (%)	Abbott-corrected mortality (%)
Chlorpyrifos	24	2	18	11.1	0.00	11.1
Chlorpyrifos	48	2	18	11.1	2.22	9.1
Chlorpyrifos	72	6	18	33.3	4.44	30.2
Chlorpyrifos	96	6	18	33.3	6.67	28.6
Chlorpyrifos	120	7	18	38.9	12.22	30.4
Chlorpyrifos	144	7	18	38.9	12.22	30.4

Insecticide	Observation time (h)	Dead larvae	Total larvae	Observed mortality (%)	Time-specific control mortality (%)	Abbott-corrected mortality (%)
Chlorpyrifos	168	9	18	50.0	18.89	38.4
Profenofos	24	9	18	50.0	0.00	50.0
Profenofos	48	12	18	66.7	2.22	65.9
Profenofos	72	17	18	94.4	4.44	94.2
Profenofos	96	17	18	94.4	6.67	94.0
Profenofos	120	18	18	100.0	12.22	100.0
Profenofos	144	18	18	100.0	12.22	100.0
Profenofos	168	18	18	100.0	18.89	100.0
Diazinon	24	6	18	33.3	0.00	33.3
Diazinon	48	10	18	55.6	2.22	54.5
Diazinon	72	12	18	66.7	4.44	65.1
Diazinon	96	12	18	66.7	6.67	64.3
Diazinon	120	16	18	88.9	12.22	87.3
Diazinon	144	17	18	94.4	12.22	93.7
Diazinon	168	18	18	100.0	18.89	100.0

Note. The first observed times at which corrected mortality reached at least 50% were 24 h for profenofos, 48 h for diazinon, and >168 h for chlorpyrifos. These are descriptive observation thresholds, not model-derived LT_{50} estimates.

Supplementary statistical syntax and analytical specifications

Factorial ANOVA

```
UNIANOVA CorrectedMortality BY Insecticide Concentration
 /METHOD = SSTYPE(3)
 /INTERCEPT = INCLUDE
 /POSTHOC = Insecticide(TUKEY)
 /PRINT = DESCRIPTIVE HOMOGENEITY
 /CRITERIA = ALPHA(.05)
 /DESIGN = Insecticide Concentration Insecticide*Concentration.
```

Exploratory concentration–mortality probit analysis

```
USE ALL.
COMPUTE filter_$ = (Treatment = "P1").
FILTER BY filter_$.
EXECUTE.
PROBIT Dead OF Total WITH Concentration
 /LOG 10
 /MODEL PROBIT
 /PRINT FREQ CI
 /NATRES = .1889
 /CRITERIA P(.15) ITERATE(20) STEPLIMIT(.1).

[The filter was repeated separately for P2 and P3.]
```

Final analytical scope

The final article uses the replicate-level factorial ANOVA, Tukey HSD comparisons, exploratory LC analysis, and descriptive mortality development at the 95% label-dose fraction. A binomial generalized linear model and extrapolated LT_{50}/LT_{90} estimates were not retained as final inferential outcomes.