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MRID No. 444721-01

DATA EVALUATION RECORD
ESTUARINE FISH EARLY LIFE-STAGE TEST
GUIDELINE 72-4

1. **CHEMICAL:** Ethoprop PC Code No.: 041101

2. **TEST MATERIAL:** Ethoprop Technical Purity: 96.8%

3. **CITATION:**

Author: Joseph V. Sousa
Title: Ethoprop Technical - Early Life-Stage Toxicity Test with Sheepshead Minnow (*Cyprinodon variegatus*)
Study Completion Date: December 12, 1997
Laboratory: Springborn Laboratories, Inc., Wareham, MA
Laboratory Report ID: 97-10-7127
Sponsor: Rhone-Poulenc Ag Company, Research Triangle Park, NC
MRID No.: 444721-01
DP Barcode: D242881

4. **REVIEWED BY:** Karl Bullock, M.S., Environmental Scientist, Golder Associates Inc.

Signature: Karl Bullock **Date:** 3/18/98

APPROVED BY: Pim Kosalwat, Ph.D., Senior Scientist, Golder Associates Inc.

Signature: P. Kosalwat **Date:** 3/18/98

5. **APPROVED BY:**

Signature: M.E. Tebeff **Date:** 3/20/98

6. **CONCLUSIONS:** This study is scientifically sound and fulfills the guideline requirements for an estuarine fish early life-stage test. Based on the most sensitive endpoints (length and wet weight), the NOEC and LOEC were 5.9 and 11 ppb ai, respectively. The geometric-mean MATC was determined to be 8.1 ppb ai.

7. **ADEQUACY OF THE STUDY:**

A. Classification: Core.

B. Rationale: N/A

C. Repairability: N/A

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8. **MAJOR GUIDELINE DEVIATIONS:**

1. The test consisted of only 2 true replicates; 4 replicates are recommended.

2. Embryos used in this test were ≤27 hours old at test initiation. The guidelines recommend embryos be ≤24 hours old.

9. **MATERIALS AND METHODS**

A. **Biological System**

Guideline Criteria	Reported Information
Species: An estuarine fish species, preferably a silversides species or sheepshead minnow (*Cyprinodon variegatus*).	*Cyprinodon variegatus*
Source	Embryos were obtained from Aquatic BioSystems, Inc., Ft. Collins, CO. Fertilization success was estimated to be 62%.
Age at beginning of test: Embryos 2 to 24 hours old.	Embryos ≤27 hours old.
Replicates: Minimum of 20 embryos per replicate cup, 4 replicates per concentration. Minimum of 30 fish per treatment for post-hatch exposure.	80 embryos per incubator cup; 1 cup per replicate vessel; 2 replicate vessels per treatment or control. Post hatch exposure: On test day 7 (3 days post-hatch), surviving larvae were thinned to 27 fish per replicate (54/treatment). Replicates A and B of the 25 µg ai/L group contained only 26 and 20 larvae, respectively.

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Guideline Criteria	Reported Information
Post Hatch: % of embryos that produce live fry must be ≥ 50% in each control; % hatch in any control embryo cup must be no more than 1.6 times that in another control cup.	54-58% of embryos in the control produced live fry.
Feeding: Fish should be fed at least twice daily. Fish should not be fed for at least 24 hr prior to termination on day 32.	Fish were fed live brine shrimp nauplii 3 times daily until the day prior to test termination when food was withheld.
Counts: At a minimum, live fish should be counted 11, 18, 25, and 32 days after hatching.	Survival of embryos and larvae was recorded daily.
Controls: Avg. survival at end of test must be ≥ 80%. Survival in any control chamber must not be < 70%.	100% survival in the control at test termination.
Controls: Negative control and carrier control (when applicable) are required.	A dilution water control was used.

Comments: Only two replicates per treatment level were used in this test.

B. Physical System

Guideline Criteria	Reported Information
Test Water: 1) May be natural (sterilized and filtered) or a commercial mixture; 2) Natural seawater should have weekly range of salinity less than 6%, monthly pH range less than 0.8 pH units; 3) Salinity should be ≥15 parts per thousand; 4) Water must be free of pollutants.	1) Natural filtered seawater. 2) pH range of 7.8-8.1 during test. 3) Salinity range of 30-32‰ during test. 4) No significant levels of pollutants were detected.

Guideline Criteria	Reported Information
Test Temperature: Depends upon test species; should not deviate by more than 2°C from appropriate temperature. For sheepshead minnow, either 25°C or 30°C is recommended.	Mean: 25°C Range: 25-26°C
Photoperiod: Recommend 16L/8D.	16 hours light/8 hours dark.
Dosing Apparatus: Intermittent flow proportional diluters or continuous flow serial diluters should be used. A minimum of 5 toxicant concentrations with a dilution factor not greater than 0.5 and controls should be used.	An intermittent-flow proportional diluter was used. The test consisted of a dilution water control and 6 concentrations with a dilution factor of 0.5.
Toxicant Mixing: 1) Mixing chamber is recommended but not required; 2) Aeration should not be used for mixing; 3) It must be demonstrated that the test solution is completely mixed before intro. into the test system; 4) Flow splitting accuracy must be within 10%.	1) A mixing chamber was used. 2) Aeration was not used in mixing. 3) No undissolved test material was observed. 4) Not reported.
Test Vessels: All glass or glass with stainless steel frame.	Test vessels were 39 X 20 X 25 cm and contained approximately 15 L of exposure solution.
Embryo Cups: 120 ml glass jars with bottoms replaced with 40 mesh stainless steel or nylon screen.	Embryo cups were constructed using glass jars (5 cm O.D., 8 cm high) with 475-µm Nitex® mesh screen bottoms.
Flow Rate: Flow rates to larval cups should provide 90% replacement in 8-12 hours. Flow rate must maintain D.O. at above 75% of saturation and maintain the toxicant level.	6.5 volume additions every 24 hours; 90% replacement in 8 hours.

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Guideline Criteria	Reported Information
Aeration: Dilution water should be aerated to insure D.O. concentration at or near 100% saturation. Test tanks and embryo cups should not be aerated.	D.O. ≥72% (5.1 mg/L) of saturation at all times.

C. **Chemical System**

Guideline Criteria	Reported Information
Concentrations: Minimum of 5 concentrations and a control, all replicated, plus solvent control if appropriate. - Toxicant conc. must be measured in one tank at each toxicant level every week. - One concentration must adversely affect a life stage and one concentration must not affect any life stage.	- Dilution water control and six nominal concentrations (1.6, 3.1, 6.3, 13, 25, and 50 µg ai/L). - Toxicant concentrations were measured on days 0, 5, 12, 19, 26, and 33 in each replicate vessel of the controls and treatments. - NOEC and LOEC were achieved.
Other Variables: 1) D.O. must be measured at each conc. at least once a week; 2) Natural seawater must maintain a constant salinity and not fluctuate more than 6% weekly; monthly pH range <0.8 pH units.	1) D.O., pH, temperature, and salinity was measured daily in each aquarium. 2) Salinity and pH did not fluctuate beyond recommended levels.
Solvents: Should not exceed 0.1 ml/L in a flow-through system. Following solvents are acceptable: dimethylformamide, triethylene glycol, methanol, acetone, ethanol.	None

Comments: Mean measured concentrations ranged from 84 to 110% of nominal concentrations and were consistent between each replicate.

10. REPORTED RESULTS

Guideline Criteria	Reported Information
Data Endpoints must include: - Number of embryos hatched; - Time to hatch; - Mortality of embryos, larvae, and juveniles; - Time to swim-up (if appropriate); - Measurement of growth; - Incidence of pathological or histological effects; - Observations of other effects or clinical signs.	All appropriate data endpoints listed were reported.
Raw data included? (Y/N)	Yes

Effects Data

Toxicant Concentration (µg ai/L)		Mean Percent Hatch	Percent Post-Hatch Survival (29 days)	Total Length (mm)	Wet Weight (g)	Dry Weight (g)
Nominal	Mean Measured					
Control	<0.43	56	100	25.4	0.27	0.077
1.6	1.5	63	100	25.6	0.28	0.083
3.1	3.3	77	98	24.4[a]	0.24[a]	0.070
6.3	5.9	78	100	25.0	0.26	0.076
13	11	73	100	24.2[a]	0.23[a]	0.068[a]
25	23	46	100	23.7[a]	0.23[a]	0.068[a]
50	46	67	100	24.2[a]	0.24[a]	0.072

[a] Significantly reduced when compared to the control ($p<0.05$).

Comments: Hatching was completed by day 7.

Toxicity Observations: No sublethal effects were observed.

Statistical Results:

Statistical Method: Williams' test with response comparisons made between the treatment concentrations and the negative control (percentage data were arc sine square-root transformed prior to analysis). Analyses were performed using the mean organism response in each treatment group rather than individual response values.

NOEC: 46 µg ai/L
LOEC: >46 µg ai/L
MATC: Not determined
Most sensitive endpoints: None were affected.

11. REVIEWER'S STATISTICAL RESULTS:

Statistical Method: Bonferroni's Test and Dunnett's Test were used for continuous data (length and weight) and Williams' Test was used for survival and hatching success (percentage data were arc sine square-root transformed prior to analysis). Analyses were performed using individual response values; comparisons were made against the negative control.

NOEC: 5.9 ppb ai
LOEC: 11 ppb ai
MATC: 8.1 ppb ai
Most sensitive endpoint: Growth (length and wet weight)

12. REVIEWER'S COMMENTS: This study is scientifically sound and fulfills the guideline requirements for an estuarine fish early life-stage test. Based on mean measured concentrations and the most sensitive endpoints (growth and wet weight), the NOEC and LOEC for sheepshead minnows exposed to Ethoprop technical were determined to be 5.9 and 11 ppb ai, respectively. The geometric mean MATC was determined to be 8.1 ppb ai. This study is classified as **Core**.

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Ethoprop Technical - Sheepshead ELS:29-day survival
File: 44472101 Transform: ARC SINE(SQUARE ROOT(Y))

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	Control	2	1.000	1.474	1.457
2	1.5	2	1.000	1.474	1.457
3	3.3	2	0.980	1.422	1.457
4	5.9	2	1.000	1.474	1.474
5	11	2	1.000	1.474	1.474
6	23	2	1.000	1.474	1.474
7	46	2	1.000	1.474	1.474

Ethoprop Technical - Sheepshead ELS:29-day survival
File: 44472101 Transform: ARC SINE(SQUARE ROOT(Y))

WILLIAMS TEST (Isotonic regression model) TABLE 2 OF 2

IDENTIFICATION	ISOTONIZED MEAN	CALC. WILLIAMS	SIG P=.05	TABLE WILLIAMS	DEGREES OF FREEDOM
Control	1.457				
1.5	1.457	0.623		1.89	k= 1, v= 7
3.3	1.457	0.623		2.00	k= 2, v= 7
5.9	1.474	0.000		2.04	k= 3, v= 7
11	1.474	0.000		2.06	k= 4, v= 7
23	1.474	0.000		2.07	k= 5, v= 7
46	1.474	0.000		2.08	k= 6, v= 7

s = 0.028
Note: df used for table values are approximate when v > 20.

Ethoprop Technical - Sheepshead ELS: % hatch
File: 44472101 Transform: ARC SINE(SQUARE ROOT(Y))

WILLIAMS TEST (Isotonic regression model) TABLE 1 OF 2

GROUP	IDENTIFICATION	N	ORIGINAL MEAN	TRANSFORMED MEAN	ISOTONIZED MEAN
1	Control	2	0.560	0.846	0.846
2	1.5	2	0.625	0.912	0.912
3	3.3	2	0.770	1.074	0.978
4	5.9	2	0.780	1.083	0.978
5	11	2	0.730	1.029	0.978
6	23	2	0.460	0.745	0.978
7	46	2	0.665	0.960	0.978

Ethoprop Technical - Sheepshead ELS: % hatch
File: 44472101 Transform: ARC SINE(SQUARE ROOT(Y))

WILLIAMS TEST (Isotonic regression model) TABLE 2 OF 2

IDENTIFICATION	ISOTONIZED MEAN	CALC. WILLIAMS	SIG P=.05	TABLE WILLIAMS	DEGREES OF FREEDOM
Control	0.846				
1.5	0.912	0.650		1.89	k= 1, v= 7
3.3	0.978	1.299		2.00	k= 2, v= 7
5.9	0.978	1.299		2.04	k= 3, v= 7
11	0.978	1.299		2.06	k= 4, v= 7
23	0.978	1.299		2.07	k= 5, v= 7
46	0.978	1.299		2.08	k= 6, v= 7

s = 0.102
Note: df used for table values are approximate when v > 20.

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TRT=Control

Variable	N	Mean	Std Dev	Minimum	Maximum
LENGTH	54	25.3844444	1.8997921	17.9100000	29.2100000
WETWT	54	0.2741778	0.0588938	0.0838000	0.3990000
DRYWT	54	0.0774519	0.0177743	0.0226000	0.1144000

TRT=I

Variable	N	Mean	Std Dev	Minimum	Maximum
LENGTH	54	25.5972222	1.7315316	21.7100000	28.7600000
WETWT	54	0.2839704	0.0619281	0.1863000	0.4395000
DRYWT	54	0.0827444	0.0181346	0.0514000	0.1240000

TRT=II

Variable	N	Mean	Std Dev	Minimum	Maximum
LENGTH	53	24.3509434	1.5310997	20.6300000	27.9500000
WETWT	53	0.2414491	0.0478666	0.1435000	0.3386000
DRYWT	53	0.0700679	0.0140383	0.0412000	0.0985000

TRT=III

Variable	N	Mean	Std Dev	Minimum	Maximum
LENGTH	54	24.9657407	1.5365590	22.4400000	29.7600000
WETWT	54	0.2624019	0.0500216	0.1833000	0.4315000
DRYWT	54	0.0757889	0.0156526	0.0498000	0.1308000

TRT=IV

Variable	N	Mean	Std Dev	Minimum	Maximum
LENGTH	54	24.1479630	2.0693034	17.1400000	28.9300000
WETWT	54	0.2339130	0.0611018	0.0761000	0.4040000
DRYWT	54	0.0682519	0.0183270	0.0189000	0.1190000

TRT=V

Variable	N	Mean	Std Dev	Minimum	Maximum
LENGTH	46	23.7380435	2.4515561	12.5500000	28.3900000
WETWT	46	0.2296848	0.0609172	0.0309000	0.3866000
DRYWT	46	0.0686022	0.0187609	0.0075000	0.1184000

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TRT=VI

Variable	N	Mean	Std Dev	Minimum	Maximum

LENGTH	54	24.2162963	2.1752521	16.0400000	28.1900000
WETWT	54	0.2447926	0.0589927	0.0535000	0.3873000
DRYWT	54	0.0715833	0.0180577	0.0129000	0.1083000

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General Linear Models Procedure
Class Level Information

Class	Levels	Values
TRT	7	Control I II III IV V VI
REP	2	A B

Number of observations in data set = 369

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General Linear Models Procedure

Dependent Variable: LENGTH

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	7	168.49743	24.07106	6.55	0.0001
Error	361	1326.64027	3.67490		
Corrected Total	368	1495.13770			

R-Square	C.V.	Root MSE	LENGTH Mean
0.112697	7.777294	1.9170	24.649

Source	DF	Type I SS	Mean Square	F Value	Pr > F
TRT	6	149.72545	24.95424	6.79	0.0001
REP	1	18.77198	18.77198	5.11	0.0244

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	6	147.36203	24.56034	6.68	0.0001
REP	1	18.77198	18.77198	5.11	0.0244

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General Linear Models Procedure

Dependent Variable: WETWT

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	7	0.1687269	0.0241038	7.53	0.0001
Error	361	1.1555309	0.0032009		
Corrected Total	368	1.3242578			

R-Square	C.V.	Root MSE	WETWT Mean
0.127412	22.32283	0.0566	0.2534

Source	DF	Type I SS	Mean Square	F Value	Pr > F
TRT	6	0.1361008	0.0226835	7.09	0.0001
REP	1	0.0326261	0.0326261	10.19	0.0015

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	6	0.1336660	0.0222777	6.96	0.0001
REP	1	0.0326261	0.0326261	10.19	0.0015

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General Linear Models Procedure

Dependent Variable: DRYWT

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	7	0.0105318	0.0015045	5.08	0.0001
Error	361	0.1069476	0.0002963		
Corrected Total	368	0.1174793			

R-Square	C.V.	Root MSE	DRYWT Mean
0.089648	23.38142	0.0172	0.0736

Source	DF	Type I SS	Mean Square	F Value	Pr > F
TRT	6	0.0091497	0.0015250	5.15	0.0001
REP	1	0.0013820	0.0013820	4.67	0.0314

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TRT	6	0.0090480	0.0015080	5.09	0.0001
REP	1	0.0013820	0.0013820	4.67	0.0314

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General Linear Models Procedure
Least Squares Means

TRT	LENGTH LSMEAN	LSMEAN Number
Control	25.3844444	1
I	25.5972222	2
II	24.3466831	3
III	24.9657407	4
IV	24.1479630	5
V	23.7674950	6
VI	24.2162963	7

Pr > |T| HO: LSMEAN(i)=LSMEAN(j)

i/j	1	2	3	4	5	6	7
1	.	0.5645	0.0054	0.2572	0.0009	0.0001	0.0017
2	0.5645	.	0.0008	0.0878	0.0001	0.0001	0.0002
3	0.0054	0.0008	.	0.0958	0.5922	0.1350	0.7252
4	0.2572	0.0878	0.0958	.	0.0273	0.0020	0.0429
5	0.0009	0.0001	0.5922	0.0273	.	0.3235	0.8532
6	0.0001	0.0001	0.1350	0.0020	0.3235	.	0.2443
7	0.0017	0.0002	0.7252	0.0429	0.8532	0.2443	.

TRT	WETWT LSMEAN	LSMEAN Number
Control	0.27417778	1
I	0.28397037	2
II	0.24127145	3
III	0.26240185	4
IV	0.23391296	5
V	0.23091260	6
VI	0.24479259	7

Pr > |T| HO: LSMEAN(i)=LSMEAN(j)

i/j	1	2	3	4	5	6	7
1	.	0.3691	0.0028	0.2802	0.0003	0.0002	0.0073
2	0.3691	.	0.0001	0.0484	0.0001	0.0001	0.0004
3	0.0028	0.0001	.	0.0542	0.5016	0.3645	0.7477
4	0.2802	0.0484	0.0542	.	0.0093	0.0059	0.1067
5	0.0003	0.0001	0.5016	0.0093	.	0.7918	0.3184
6	0.0002	0.0001	0.3645	0.0059	0.7918	.	0.2225
7	0.0073	0.0004	0.7477	0.1067	0.3184	0.2225	.

TRT	DRYWT LSMEAN	LSMEAN Number
Control	0.07745185	1
I	0.08274444	2
II	0.07003137	3
III	0.07578889	4
IV	0.06825185	5
V	0.06885488	6
VI	0.07158333	7

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General Linear Models Procedure
Least Squares Means

Least Squares Means for effect TRT
Pr > |T| HO: LSMEAN(i)=LSMEAN(j)

Dependent Variable: DRYWT

i/j	1	2	3	4	5	6	7
1	.	0.1110	0.0264	0.6160	0.0058	0.0133	0.0773
2	0.1110	.	0.0002	0.0364	0.0001	0.0001	0.0008
3	0.0264	0.0002	.	0.0845	0.5932	0.7348	0.6413
4	0.6160	0.0364	0.0845	.	0.0235	0.0455	0.2050
5	0.0058	0.0001	0.5932	0.0235	.	0.8616	0.3152
6	0.0133	0.0001	0.7348	0.0455	0.8616	.	0.4303
7	0.0773	0.0008	0.6413	0.2050	0.3152	0.4303	.

NOTE: To ensure overall protection level, only probabilities associated with pre-planned comparisons should be used.

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General Linear Models Procedure

Bonferroni (Dunn) T tests for variable: LENGTH

NOTE: This test controls the type I experimentwise error rate but generally has a higher type II error rate than Tukey's for all pairwise comparisons.

Alpha= 0.05 Confidence= 0.95 df= 361 MSE= 3.674904
Critical Value of T= 3.05974

Comparisons significant at the 0.05 level are indicated by '***'.

TRT Comparison	Simultaneous Lower Confidence Limit	Difference Between Means	Simultaneous Upper Confidence Limit	
I - Control	-0.9160	0.2128	1.3416	
I - III	-0.4973	0.6315	1.7603	
I - II	0.1121	1.2463	2.3804	***
I - VI	0.2521	1.3809	2.5097	***
I - IV	0.3204	1.4493	2.5781	***
I - V	0.6823	1.8592	3.0361	***
Control - I	-1.3416	-0.2128	0.9160	
Control - III	-0.7101	0.4187	1.5475	
Control - II	-0.1006	1.0335	2.1676	
Control - VI	0.0393	1.1681	2.2970	***
Control - IV	0.1077	1.2365	2.3653	***
Control - V	0.4695	1.6464	2.8233	***
III - I	-1.7603	-0.6315	0.4973	
III - Control	-1.5475	-0.4187	0.7101	
III - II	-0.5193	0.6148	1.7489	
III - VI	-0.3794	0.7494	1.8783	
III - IV	-0.3110	0.8178	1.9466	
III - V	0.0508	1.2277	2.4046	***
II - I	-2.3804	-1.2463	-0.1121	***
II - Control	-2.1676	-1.0335	0.1006	
II - III	-1.7489	-0.6148	0.5193	
II - VI	-0.9995	0.1346	1.2688	
II - IV	-0.9312	0.2030	1.3371	
II - V	-0.5691	0.6129	1.7949	
VI - I	-2.5097	-1.3809	-0.2521	***
VI - Control	-2.2970	-1.1681	-0.0393	***
VI - III	-1.8783	-0.7494	0.3794	
VI - II	-1.2688	-0.1346	0.9995	
VI - IV	-1.0605	0.0683	1.1972	
VI - V	-0.6986	0.4783	1.6551	
IV - I	-2.5781	-1.4493	-0.3204	***
IV - Control	-2.3653	-1.2365	-0.1077	***
IV - III	-1.9466	-0.8178	0.3110	
IV - II	-1.3371	-0.2030	0.9312	
IV - VI	-1.1972	-0.0683	1.0605	
IV - V	-0.7670	0.4099	1.5868	
V - I	-3.0361	-1.8592	-0.6823	***
V - Control	-2.8233	-1.6464	-0.4695	***
V - III	-2.4046	-1.2277	-0.0508	***
V - II	-1.7949	-0.6129	0.5691	
V - VI	-1.6551	-0.4783	0.6986	

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General Linear Models Procedure

TRT Comparison	Simultaneous Lower Confidence Limit	Difference Between Means	Simultaneous Upper Confidence Limit
V - IV	-1.5868	-0.4099	0.7670

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General Linear Models Procedure

Bonferroni (Dunn) T tests for variable: WETWT

NOTE: This test controls the type I experimentwise error rate but generally has a higher type II error rate than Tukey's for all pairwise comparisons.

Alpha= 0.05 Confidence= 0.95 df= 361 MSE= 0.003201
Critical Value of T= 3.05974

Comparisons significant at the 0.05 level are indicated by '***'.

TRT Comparison	Simultaneous Lower Confidence Limit	Difference Between Means	Simultaneous Upper Confidence Limit	
I - Control	-0.02352	0.00979	0.04311	
I - III	-0.01175	0.02157	0.05488	
I - VI	0.00586	0.03918	0.07249	***
I - II	0.00905	0.04252	0.07599	***
I - IV	0.01674	0.05006	0.08337	***
I - V	0.01955	0.05429	0.08902	***
Control - I	-0.04311	-0.00979	0.02352	
Control - III	-0.02154	0.01178	0.04509	
Control - VI	-0.00393	0.02939	0.06270	
Control - II	-0.00074	0.03273	0.06620	
Control - IV	0.00695	0.04026	0.07358	***
Control - V	0.00976	0.04449	0.07923	***
III - I	-0.05488	-0.02157	0.01175	
III - Control	-0.04509	-0.01178	0.02154	
III - VI	-0.01571	0.01761	0.05092	
III - II	-0.01252	0.02095	0.05442	
III - IV	-0.00483	0.02849	0.06180	
III - V	-0.00202	0.03272	0.06745	
VI - I	-0.07249	-0.03918	-0.00586	***
VI - Control	-0.06270	-0.02939	0.00393	
VI - III	-0.05092	-0.01761	0.01571	
VI - II	-0.03013	0.00334	0.03682	
VI - IV	-0.02244	0.01088	0.04419	
VI - V	-0.01963	0.01511	0.04984	
II - I	-0.07599	-0.04252	-0.00905	***
II - Control	-0.06620	-0.03273	0.00074	
II - III	-0.05442	-0.02095	0.01252	
II - VI	-0.03682	-0.00334	0.03013	
II - IV	-0.02594	0.00754	0.04101	
II - V	-0.02312	0.01176	0.04665	
IV - I	-0.08337	-0.05006	-0.01674	***
IV - Control	-0.07358	-0.04026	-0.00695	***
IV - III	-0.06180	-0.02849	0.00483	
IV - VI	-0.04419	-0.01088	0.02244	
IV - II	-0.04101	-0.00754	0.02594	
IV - V	-0.03051	0.00423	0.03896	
V - I	-0.08902	-0.05429	-0.01955	***
V - Control	-0.07923	-0.04449	-0.00976	***
V - III	-0.06745	-0.03272	0.00202	
V - VI	-0.04984	-0.01511	0.01963	

V	- II	-0.04665	-0.01176	0.02312

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TRT Comparison	Simultaneous Lower Confidence Limit	Difference Between Means	Simultaneous Upper Confidence Limit
V - IV	-0.03896	-0.00423	0.03051

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General Linear Models Procedure

Bonferroni (Dunn) T tests for variable: DRYWT

NOTE: This test controls the type I experimentwise error rate but generally has a higher type II error rate than Tukey's for all pairwise comparisons.

Alpha= 0.05 Confidence= 0.95 df= 361 MSE= 0.000296
Critical Value of T= 3.05974

Comparisons significant at the 0.05 level are indicated by '***'.

TRT Comparison	Simultaneous Lower Confidence Limit	Difference Between Means	Simultaneous Upper Confidence Limit	
I - Control	-0.004843	0.005293	0.015428	
I - III	-0.003180	0.006956	0.017091	
I - VI	0.001026	0.011161	0.021296	***
I - II	0.002494	0.012677	0.022859	***
I - V	0.003576	0.014142	0.024709	***
I - IV	0.004357	0.014493	0.024628	***
Control - I	-0.015428	-0.005293	0.004843	
Control - III	-0.008472	0.001663	0.011798	
Control - VI	-0.004267	0.005869	0.016004	
Control - II	-0.002799	0.007384	0.017567	
Control - V	-0.001717	0.008850	0.019416	
Control - IV	-0.000935	0.009200	0.019335	
III - I	-0.017091	-0.006956	0.003180	
III - Control	-0.011798	-0.001663	0.008472	
III - VI	-0.005930	0.004206	0.014341	
III - II	-0.004462	0.005721	0.015904	
III - V	-0.003380	0.007187	0.017753	
III - IV	-0.002598	0.007537	0.017672	
VI - I	-0.021296	-0.011161	-0.001026	***
VI - Control	-0.016004	-0.005869	0.004267	
VI - III	-0.014341	-0.004206	0.005930	
VI - II	-0.008668	0.001515	0.011698	
VI - V	-0.007586	0.002981	0.013548	
VI - IV	-0.006804	0.003331	0.013467	
II - I	-0.022859	-0.012677	-0.002494	***
II - Control	-0.017567	-0.007384	0.002799	
II - III	-0.015904	-0.005721	0.004462	
II - VI	-0.011698	-0.001515	0.008668	
II - V	-0.009147	0.001466	0.012078	
II - IV	-0.008367	0.001816	0.011999	

V - I	-0.024709	-0.014142	-0.003576	***
V - Control	-0.019416	-0.008850	0.001717	
V - III	-0.017753	-0.007187	0.003380	
V - VI	-0.013548	-0.002981	0.007586	
V - II	-0.012078	-0.001466	0.009147	
V - IV	-0.010216	0.000350	0.010917	
IV - I	-0.024628	-0.014493	-0.004357	***
IV - Control	-0.019335	-0.009200	0.000935	
IV - III	-0.017672	-0.007537	0.002598	
IV - VI	-0.013467	-0.003331	0.006804	
IV - II	-0.011999	-0.001816	0.008367	

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TRT Comparison	Simultaneous Lower Confidence Limit	Difference Between Means	Simultaneous Upper Confidence Limit
IV - V	-0.010917	-0.000350	0.010216

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General Linear Models Procedure

Dunnett's One-tailed T tests for variable: LENGTH

NOTE: This tests controls the type I experimentwise error for comparisons of all treatments against a control.

Alpha= 0.05 Confidence= 0.95 df= 361 MSE= 3.674904
Critical Value of Dunnett's T= 2.304

Comparisons significant at the 0.05 level are indicated by '***'.

TRT Comparison	Simultaneous Lower Confidence Limit	Difference Between Means	Simultaneous Upper Confidence Limit	
I - Control	-0.6371	0.2128	1.0626	
III - Control	-1.2686	-0.4187	0.4311	
II - Control	-1.8874	-1.0335	-0.1797	***
VI - Control	-2.0180	-1.1681	-0.3183	***
IV - Control	-2.0863	-1.2365	-0.3866	***
V - Control	-2.5324	-1.6464	-0.7604	***

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General Linear Models Procedure

Dunnett's One-tailed T tests for variable: WETWT

NOTE: This tests controls the type I experimentwise error for comparisons of all treatments against a control.

Alpha= 0.05 Confidence= 0.95 df= 361 MSE= 0.003201
Critical Value of Dunnett's T= 2.304

Comparisons significant at the 0.05 level are indicated by '***'.

TRT Comparison		Simultaneous Lower Confidence Limit	Difference Between Means	Simultaneous Upper Confidence Limit	
I	- Control	-0.01529	0.00979	0.03487	
III	- Control	-0.03686	-0.01178	0.01331	
VI	- Control	-0.05447	-0.02939	-0.00430	***
II	- Control	-0.05793	-0.03273	-0.00753	***
IV	- Control	-0.06535	-0.04026	-0.01518	***
V	- Control	-0.07064	-0.04449	-0.01834	***

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General Linear Models Procedure

Dunnett's One-tailed T tests for variable: DRYWT

NOTE: This tests controls the type I experimentwise error for comparisons of all treatments against a control.

Alpha= 0.05 Confidence= 0.95 df= 361 MSE= 0.000296
Critical Value of Dunnett's T= 2.304

Comparisons significant at the 0.05 level are indicated by '***'.

TRT Comparison		Simultaneous Lower Confidence Limit	Difference Between Means	Simultaneous Upper Confidence Limit	
I	- Control	-0.002338	0.005293	0.012923	
III	- Control	-0.009293	-0.001663	0.005968	
VI	- Control	-0.013499	-0.005869	0.001762	
II	- Control	-0.015050	-0.007384	0.000282	
V	- Control	-0.016805	-0.008850	-0.000894	***
IV	- Control	-0.016830	-0.009200	-0.001570	***