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# Relationship between diet composition and growth rate of the zoeal and mysis stages of *Penaeus japonicus* Bate

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**Relationship between diet composition and growth rate of the zoeal and mysis stages of *Penaeus japonicus* BATE**

**C. T. Villegas and A. Kanazawa**

Feeding experiments were conducted using *Chaetoceros gracilis* plus *Artemia* nauplii, artificially prepared diet, Diet-B, and two commercial feeds, *Tapes* and mysid meals, in a randomized complete block design with two replicates. The artificially prepared diets were dried and ground to size 10 to 50 microns and fed to the larvae. The larvae were reared in round plastic aquaria containing 5 liters of filtered seawater, each aquarium stocked with 250 larvae and provided with aeration. They were reared from zoea ( $Z_1$ ) to mysis ( $M_3$ ) stage and growth was measured daily.

Highest survival rate of 34.2% was obtained when the larvae were fed with the artificially prepared Diet-B. *C. gracilis* plus *Artemia* nauplii feeding gave a survival rate of 21.6%. On the other hand, growth measured in terms of development, was fastest using *C. gracilis* plus *Artemia* nauplii. Larvae metamorphosed into  $M_3$  stage in 7 days with an average gain in length of 0.46 mm/day. Diet-B feeding resulted in a comparable growth, the larvae reaching  $M_3$  stage in 8 days with an average gain in length of 0.30 mm/day. Analyses of the chemical composition of the diets showed no definite relationship between diet composition and growth and survival rates of the early larval stages of *P. japonicus*.

Results obtained in this study demonstrate that the early larval stages of *P. japonicus* can be reared in artificially prepared diet, Diet-B. Since the chemical composition of the diet is known, it can be used as supplemental data for larval feed development and nutritional requirements studies for the early larval stages of *P. japonicus* and/or other penaeids.

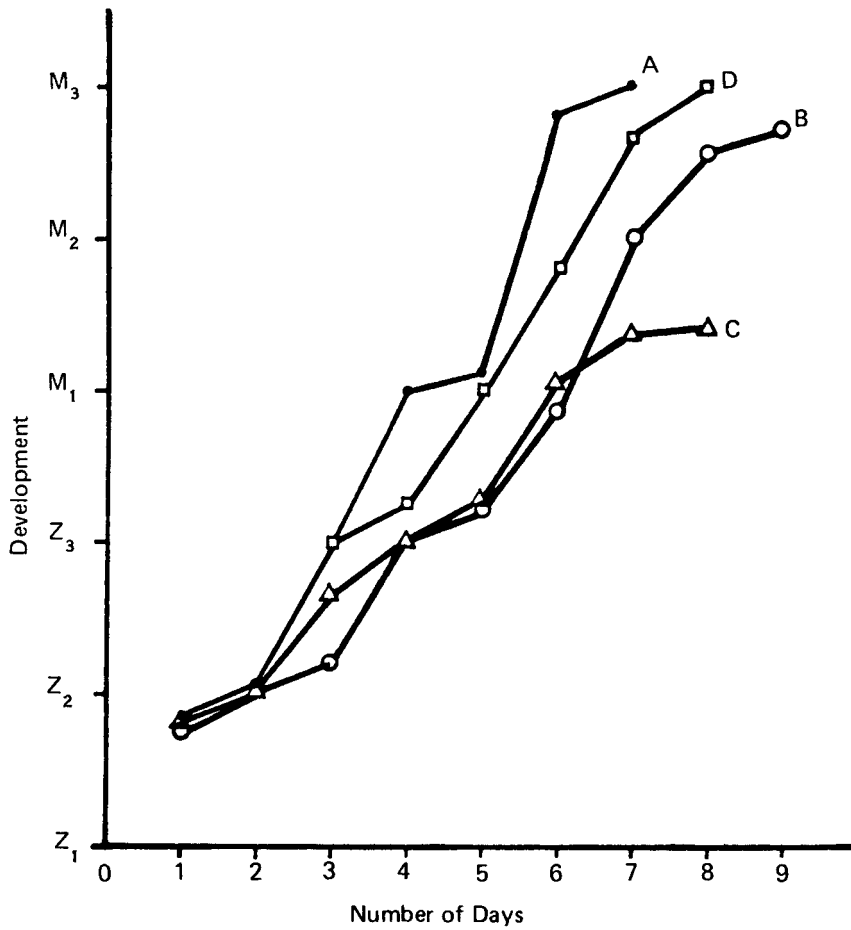


Fig. 1. Growth of *Penaeus japonicus* larvae on different diets: A—*C. gracilis* plus *Artemia* (●—●) B—Tapes meal (○—○), C—Mysid meal (△—△) and D—Diet - B (◻—◻).

**Table 1. Feeds and feeding rates used for rearing of *P. japonicus* from larval stage Z<sub>1</sub> to M<sub>3</sub>.**

Treatment	Feeds	Feeding Rates
1	<i>Chaetoceros gracilis</i> plus <i>Artemia</i> nauplii	50,000-100,000 cells/mL 50 nauplii/larva/day
2	Diet-B	0.16 mg/larva/day
3	<i>Tapes</i> meal	0.16 mg/larva/day
4	Mysid meal	0.16 mg/larva/day

**Table 2. Composition of the artificial diet, Diet-B (Kanazawa et al., 1971).**

Ingredients	% in Dry Diet
Glucose	5.5
Sucrose	10.0
Starch	4.0
Glucosamine	0.8
Casein (Lipid and vitamin free)	50.0
Sodium-citrate	0.3
Sodium-succinate	0.3
Pollack residual oil (powder) <sup>a/</sup>	8.0
Cholesterol	0.5
Mineral mixture <sup>b/</sup>	8.6
Vitamin mixture <sup>c/</sup>	2.7
Cellulose powder	9.3
Agar	3.0
Water	130 – 135 mL

<sup>a/</sup> Residual oil obtained by distilling away Vitamin A from Pollack liver oil.

<sup>b/</sup> K<sub>2</sub>HPO<sub>4</sub> 2.000, Ca<sub>3</sub>(PO<sub>4</sub>)<sub>2</sub> 2.720, MgSO<sub>4</sub> · 7H<sub>2</sub>O 3.041, and NaH<sub>2</sub>PO<sub>4</sub> · 2H<sub>2</sub>O 0.790 g/100 g dry diet.

<sup>c/</sup> p-Aminobenzoic acid 10.00, Biotin 0.40, Inositol 400.00, Nicotinic acid 40.00, Ca-Pantothenate 60.00, Pyridoxine-HCl 12.00, Riboflavin 8.00, Thiamine-HCl 4.00, Menadione 4.00, B-carotene 9.60, — Tocopherol 20.00, Cyanocobalamine 0.08, Calciferol 1.20, Na-ascorbate 2000.00, Folic acid 0.80, and Choline chloride 120.00 mg/100 g of dry diet.

**Table 3. Fatty acid composition (%) of lipids of the different diets.**

Fatty Acid	D I E T S		
	Diet-B	<i>Tapes</i> Meal	Mysid meal
14:0	3.98	5.63	2.01
14:1	2.15	—	—
15:0	0.87	0.90	0.60
15:1	0.08	00.36	—
16:0	15.36	19.81	3.64
16:1w7	11.29	12.48	13.63
17:0	1.20	1.99	2.61
17:1	—	5.62	—
16:2w4	2.53	—	7.71
16:3w3	0.13	—	2.71
18:0	2.19	2.36	6.14
18:1w9	14.91	12.08	26.77
18:2w6	3.86	3.80	6.14
18:1w9	—	0.25	0.90
18:3w3	0.17	0.38	0.87
20:0	—	—	0.68
20:1w9	12.45	1.78	1.37
20:2w6	0.13	0.32	0.27
20:4w6	0.93	3.76	2.84
20:3w9	—	—	0.08
22:1w9	3.68	0.22	0.28
20:5w3	6.65	17.45	13.01
22:2w6	6.35	—	—
22:4w6	0.33	0.34	0.30
22:5w6	0.12	0.02	0.15
22:5w3	0.80	0.34	0.76
22:6w3	9.79	9.85	7.77
Total			
Saturated	23.60	30.69	15.68
Monoenoic acids	44.56	32.54	42.05
Polyenoic acids	31.79	36.51	40.48
w3	17.54	28.02	25.12
w6	10.79	8.24	3.83

**Table 4.** The composition of sterols of the different diets.

Sterol	% Composition		
	Diet-B	<i>Tapes</i> meal	Mysid meal
Cholesterol	94.70	91.33	82.24
Brassicasterol	3.34	6.48	6.07
Desmosterol	1.38	2.08	4.33
24-methylenecholesterol	—	0.86	3.90
Stigmasterol	0.58	0.25	—
B-sistosterol	—	—	1.44
28-isofucosterol	—	—	1.01

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