

INFORMATION OF INTEREST

Southern Thai Shrimp Farming: [synopsis of research results and practical recommendations](#) (Mike Polioudakis, 2000)

The Bass Blogger, the new [online newsletter](#) for the Striped Bass Grower's Association AquaTnet [newsletter](#) : in the AQUA-TNET Newsletter you will find an update of AQUA-TNET and its activities. AQUA-TNET is the European Thematic Network in the field of aquaculture, fisheries and aquatic resource management, funded under the European Commission Socrates Erasmus Programme. If you want to receive the newsletter via email please send request to aquatnet@aquatt.ie

[The role of aquaculture in sustainable development](#): FAO, 2007

Seafood production and international trade: [Global trends \(ppt by FAO Globefish\)](#)

Africa's Fish Industry, including aquaculture: [article](#) in EuroFish Magazine 5/2007

Aquaculture Europe 2007 conference: [summary document](#)

Cultivation of soles: [report](#) of 2006 workshop

ABC of fish reproduction: see [website](#) EU REPROFISH project

[Reports](#) of the November 2007 Conference on European Aquaculture and its Opportunities for Development

MegaPesca FishFiles: [e-Service](#) for decision makers in food and fisheries policy and development

Sam Meyers, pioneer in marine microbiology & aquaculture: [obituary](#)

IIFET 2008 Vietnam conference "ACHIEVING A SUSTAINABLE FUTURE: MANAGING AQUACULTURE, FISHING, TRADE AND DEVELOPMENT" Nha Trang, Vietnam, July 22-25, 2008: [website](#)

8th EIGHTH INTERNATIONAL SYMPOSIUM ON TILAPIA IN AQUACULTURE, Cairo, Egypt, October 12-14, 2008: [website](#)

Oregon State University's Aquaculture Collaborative Research Support Program: [Publications](#) (Aquanews newsletter, different reports, research site descriptions, etc.)

Knud-Hansen, C.F., 1998. Pond Fertilization: Ecological Approach and Practical Applications by PD/A CRSP, Oregon State University, Corvallis, Oregon, USA, 125 pp., now available as [pdf copy](#)

The Asian Fisheries Science E-journal volume 20 number 4 is now available at the AFS website: www.asianfisheriessociety.org ([Table of Contents](#))

3RD INTERNATIONAL SUSTAINABLE MARINE FISH CULTURE CONFERENCE, October 15-17, 2007 Harbor Branch Oceanographic Institution, Fort Pierce, Florida: [programme](#) and [presentations](#)

The rise of seafood awareness campaigns at a time of collapsing fisheries: [interesting article](#)

The 7th Symposium on Diseases in Asian Aquaculture, Taipei-Taiwan, June 22-26, 2008: [website](#)

In China, farming fish in toxic waters, the New York Times December 15, 2007: [article](#), [slide show](#), [video](#)

Ecosystem Approach for Sustainable Aquaculture ECASA project – European Aquaculture Stakeholder Conference (Heraklion, Greece Sept 18-19, 2007): [presentations](#)

Improving *Penaeus monodon* hatchery practices: manual based on experience in India. FAO Fisheries Technical Paper No. 446. Rome, FAO. 2007. 101p. [pdf copy](#)

[PhD course](#) at the University of Portsmouth, UK: the economics of aquaculture

MSc in Fisheries and Aquaculture Management and Economics (FAME) at Nha Trang University in Vietnam: [Program and Scholarship](#)

EXPOSURE TO PROBIOTICS AND β -1,3/1,6-GLUCANS IN LARVICULTURE MODIFIES THE IMMUNE RESPONSE OF *PENAEUS VANNAMEI* JUVENILES AND BOTH THE SURVIVAL TO WHITE SPOT SYNDROME VIRUS CHALLENGE AND POND CULTURE

Jenny Rodríguez, Yuri Espinosa, Fabricio Echeverría, Gabriela Cárdenas, Rubén Román, Samuel Stern-2007

Aquaculture 273(4): 405-415

Abstract:

The effect of the inclusion of probiotics (*Vibrio alginolyticus*) and β -1,3/1,6-glucans in *Penaeus vannamei* larviculture was evaluated by measuring the immune response and survival of shrimp juveniles subjected to white spot syndrome virus (WSSV) challenge tests (per os) and pond culture. Treatments were designed to contrast the probiotic factor (inclusion vs non-inclusion) and β -1,3/1,6-glucans supplementation in various larvae stages; starting from early stage (Zoea II), to middle stage (PL 12), late stage (15 days pre-challenge) or non-supplemented. In larviculture, the highest survival was obtained in animals treated with β -1,3/1,6-glucans from Zoea II. The use of probiotics enhanced survival during the first 0–52 h post-WSSV challenge period. During 56–156 h post-WSSV challenge period, interactions were observed between β -1,3/1,6-glucans \times time and β -1,3/1,6-glucans \times time \times probiotics. Significant differences in final survival rates between treatments were not observed. In the second WSSV challenge, immune parameters were analysed. Significant interaction between probiotics and β -1,3/1,6-glucans was observed for plasmatic protein (PP) concentration, super oxide anion (O₂⁻) generation, antibacterial activity (AA), and total haemocyte count (THC). The use of probiotics in larviculture had a negative effect on the PP, but increased the AA and THC, while β -1,3/1,6-glucans had a negative effect on the O₂⁻ generation. The most relevant results were obtained from treatments T2 (probiotics in larviculture, β -1,3/1,6-glucans from Z II) and T4 (probiotics in larviculture, β -1,3/1,6-glucans 15 days before challenge). Treatment T2 presented the highest survival rate in larviculture. After WSSV infection, the animals of this treatment displayed resistance to the virus, a strong AA and increase of THC. Treatment T4 increased the amount of PP, increased the O₂⁻ generation and THC. Histological analysis showed that the animals of treatment T2 and T4 were able to limit the spread of the virus during the first hour after challenge with WSSV. The survivors from treatments T2 and T4 had a high THC, accompanied by a lack of white spot disease (WSD) injuries. A bioassay was carried out under farm conditions during the warm-rainy season using larvae from treatments T2 and T4. The animals were stocked at 18 animals/m² in earth ponds of 0.20 ha (three ponds/larvae kind). WSD outbreak was not detected, and the survival was significantly higher in ponds stocked with larvae from treatment T4 (70 \pm 3%) than in ponds stocked with larvae from treatment T2 (49 \pm 9%).

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ROTIFER CELLULAR MEMBRANES BIND TO WHITE SPOT SYNDROME VIRUS (WSSV)

Dong-Chun Yan, Shu-Ying Feng, Jie Huang, Shuang-Lin Dong-2007

Aquaculture 273(4): 423-426

Abstract:

Cell membranes from the rotifer, *Brachionus urceus*, were obtained by centrifugation and found to specifically bind white spot syndrome virus (WSSV) in vitro. This finding suggests that there is likely a WSSV receptor on the rotifer cell membrane and provides evidence that rotifers may be a host for WSSV.

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GROWTH PERFORMANCE OF THE ROTIFERS *BRACHIONUS PLICATILIS*, B. 'NEVADA' AND B. 'CAYMAN' UNDER DIFFERENT FOOD CONCENTRATIONS

Venetia Kostopoulou, Olav Vadstein-2007

Aquaculture 273(4): 449-458

Abstract:

Numerical response experiments were conducted using three strains of the *Brachionus plicatilis* species complex. They are commonly used in aquaculture, and could also coexist in nature although this has not been studied yet. *Brachionus plicatilis sensu stricto* (s.s.), B. 'Cayman' and B. 'Nevada' were cultured at different concentrations of *Nannochloropsis oculata* (0–40 mg C l⁻¹). Growth rate, egg female ratio (EF), fecundity and percentage of ovigerous females were determined at each food concentration. From the growth rate and EF, the egg development time and mortality rate were estimated using the Paloheimo equation. Monod curves with a threshold for zero growth described the relationship between growth rate and food concentration. The three strains had different growth rates at low (< 0.04 mg C l⁻¹) and high (> 5.0 mg C l⁻¹) food concentrations, but were similar at intermediate food levels. B. 'Cayman' had the highest maximum growth rate (1.57 ± 0.07 d⁻¹), whereas B. *plicatilis* s.s. had the less negative minimum growth rate and the highest maximum EF (0.96 ± 0.02 eggs ind⁻¹). These differences were attributed to the lowest egg development time of B. 'Cayman' (5.95 ± 0.24 h) and the higher starvation resistance of B. *plicatilis* s.s. (84 ± 12 h), respectively. B. 'Nevada' was the inferior competitor at high and low food concentrations due to the higher investment in body growth rather than reproduction. The outcome of competition in hatcheries is predicted to favor B. 'Cayman' under high food concentrations, whereas the three species may coexist under moderate food limitation.

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A METHOD TO ELIMINATE SELF-FERTILIZATION IN A SIMULTANEOUS HERMAPHRODITE SCALLOP. 1. EFFECTS ON GROWTH AND SURVIVAL OF LARVAE AND JUVENILES

Gloria Martinez, Livia Mettifogo, Miguel A. Perez, Carla Callejas-2007

Aquaculture 273(4): 459-469

Abstract:

Argopecten purpuratus, as several other scallops of commercial importance is a functional hermaphrodite. The usual methods for breeding cause an unavoidable degree of self-

fertilization with the subsequent deleterious effects on survival and growth rates. Some researchers have unsuccessfully attempted to eliminate self-fertilization in these bivalves. Applying our knowledge of the cellular mechanisms of spawning in this species we have developed a method by which self-fertilization was eliminated. By this in vitro fertilization method, oocytes were obtained by scraping the female portion of the gonad, meiosis resumption was induced by serotonin, and then the oocytes were fertilized with sperm from different individuals. The progeny obtained by this method were compared with others obtained by cross-fertilization and self-fertilization. In all these procedures, the oocytes were fertilized at a ratio of 60 sperm per oocyte. The fertilization rates and D larvae survival were determined at 2 and 48 h, respectively. After the D larval stage, the hatchery culture of larvae continued as usual with sampling for survival and growth rates every three days. When larvae looked ready to settle and metamorphose, netlon collectors were introduced into the tanks. After 12 days the collectors were placed in 1 mm mesh collection bags and transferred to the sea. Juveniles were brought back to the hatchery every 40–70 days, to be counted, measured, and placed in mesh pearl nets. The assay of the three procedures for fertilization showed similar fertilization rates but low survival for D larvae obtained from the in vitro method. However, this procedure resulted in the highest size and survival rates of larvae. Survival of juveniles coming from this fertilization procedure was also the highest. The growth of juveniles obtained by in vitro fertilization was also higher than that of those obtained by self-fertilization. We conclude that this in vitro fertilization procedure provides a methodology that results in higher survival and growth rates of juveniles than obtained by procedures involving any degree of inbreeding. This in vitro procedure should be applicable to other simultaneous hermaphroditic scallops.

(Departamento de Biología Marina, Facultad de Ciencias del Mar, Universidad Católica del Norte, Casilla 117, Coquimbo, Chile; email of Gloria Martinez: gmartine@ucn.cl)

TOWARDS DEVELOPMENT OF LARGE-SCALE HATCHERY CULTIVATION OF LARVAE AND SPAT OF THE PEARL OYSTER *PINCTADA MAZATLANICA* IN MEXICO

Pedro E. Saucedo, Pablo Ormart-Castro, Mario Osuna-García-2007

Aquaculture 273(4): 478-486

Abstract:

The results of a series of pilot-scale runs with *P. mazatlanica* larvae from 2004 through 2006 are reported. Preliminary runs in 2004 and 2005 used broodstock collected in summer, when massive spawning of wild populations naturally occurs. However, results of larval development were very poor and failed to produce spat in both years. In 2006, ripe broodstock were still collected in summer, but also in the spring time, based on the hypothesis that the gonads in this season were in better reproductive condition than in summer. Three larval runs were conducted in 2006: two in spring and one in summer. Larvae growth and survival greatly increased in both spring runs, ending with two successful productions of spat (20×10^3 and 100×10^3 juveniles). The summer larval run in 2006 failed again to produce spat. Additionally, the first run of April 2006 refers to an experiment that evaluated two different larval culture conditions: constant temperature (27 °C) and low stocking density (3–4 larvae ml⁻¹) versus variable temperature (24–28 °C) and high stocking density (8–9 larvae ml⁻¹). The first trial significantly increased larval survival and growth, which in turn resulted in greater numbers of settled spat, in comparison of the second trial, where survival, growth, and settlement of spat were significantly lower. Also in 2006, the quality of seawater used at the hatchery was evaluated with microbiological and chemical tests. The implication of these tests, together with results from all experiments are analyzed and discussed in terms of the potential development of large-scale hatchery cultivation of *P. mazatlanica* larvae in Mexico.

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GROWTH, SURVIVAL AND BIOCHEMICAL COMPOSITION OF SPIDER CRAB MAJA BRACHYDACTYLA (BALSS, 1922) (DECAPODA: MAJIDAE) LARVAE REARED UNDER DIFFERENT STOCKING DENSITIES, PREY: LARVA RATIOS AND DIETS

Mireia Andrés, Alicia Estévez, Guiomar Rotllant-2007

Aquaculture 273(4): 494-502

Abstract:

The spider crab *Maja brachydactyla* is overexploited on the NW coast of Spain. Aquaculture of this species can be the solution to the problem, and consequently, several attempts of intensive larval rearing have been conducted. However, most of the studies already published do not provide enough zoo technical data, especially in terms of larval and prey densities or the nutritional quality of diets used for rearing.

Three experiments were carried out to evaluate the conditions for intensive larval rearing of *M. brachydactyla*. Larval stocking density (10, 50 and 100 larvae L⁻¹), prey:larva ratio (15, 30 and 60 enriched *Artemia* larva⁻¹) and diet (enriched *Artemia*, non-enriched *Artemia* and polychaete supplement) effects on growth and survival of this species were studied. For larval culture nine, 35 L, 150 µm mesh-bottomed PVC cylinders (triplicates for each treatment and larval stage) connected to a recirculation unit, were used. Temperature and salinity were kept constant at 18 °C and 36‰ respectively. A 12 to 18 day trial was conducted for each experiment and samples of larvae were collected at each larval stage (zoea I, zoea II, megalopa) in the inter-molt phase and at first juvenile. Survival, carapace length and width, dry weight (DW), and proximate biochemical content (protein, carbohydrates and total lipid) as well as lipid class composition were determined.

Stocking densities of 100 larvae L⁻¹ resulted in higher growth in DW and higher content in lipids and protein for zoea I (ZI) and zoea II (ZII) than 10 larvae L⁻¹. However, survival decreased with increasing stocking density.

The use of 60 preys larva⁻¹ produced larvae with significantly higher DW and protein content, especially at ZII stage, than lower prey densities. Survival rate obtained feeding 60 preys larva⁻¹ up to the megalopa stage was almost two-fold (42.2%) the rate obtained using 15 preys larva⁻¹ (24.8%).

Larvae fed on enriched *Artemia* (EA) showed an increase in weight up to megalopa (518.9 ± 26.5 µg) in contrast to larvae fed on non-enriched prey (A) (467.9 ± 6.9 µg). Variation in DW correlated with the total lipid content (L) of the larvae (LEA = 70.1 ± 37.5 µg ind⁻¹; LA = 28.9 ± 3.2 µg ind⁻¹) especially in terms of neutral lipids. The use of an initial density of at least 50 larvae L⁻¹ and 60 enriched *Artemia* larva⁻¹ can be considered the most adequate rearing parameters in order to obtain good results in growth and survival of *M. brachydactyla* (IRTA. Ctra. Poble Nou, Km 5.5, 43540. Sant Carles de la Ràpita (Tarragona), Spain ; email of Mireia Andrés : mireia.andres@irta.es)

SETTING OF A PROCEDURE FOR EXPERIMENTAL INCUBATION OF PACIFIC OYSTER (*CRASSOSTREA GIGAS*) EMBRYOS

M. Suquet, C. Amourda, C. Mingant, I. Quéau, L. Lebrun, R. Brizard-2007

Aquaculture 273(4): 503-508

Abstract:

Standardized experimental protocols designed to study Pacific oyster (*Crassostrea gigas*) gamete quality have not been previously published. Gamete sampling variations and confounding effect of interacting factors result in large variations between replicates, decreasing the effects of the studied factors. This work aims at defining a standardized procedure for incubation of oyster embryos designed for experimental purposes.

In a first phase, four experiments were developed to improve embryo sampling and handling. They showed that a minimum of 50 embryos must be counted to decrease the variation between counting replicates. For reliable results, sampling must be carried out from 0 to 7 min after a careful agitation of seawater containing embryos (salinity: 35.6‰). Compared to control and a 30 cm one, the D-larval yield of embryos submitted to a 1 m fall was significantly reduced, showing the limited effect of mechanical disturbance on Pacific oyster oocytes survival. Then, maintaining 2.2 million embryos in 250 ml seawater for a two hours period resulted in a decrease of D-larval yield which could not be explained by a decrease of O₂ content and pH of seawater.

The second phase of this work included a set of five experiments, defining experimental incubation conditions. A higher larval yield was observed using 1.8 l beakers and 150 l tanks compared to 0.3 ml microtiter plates and 1 l fish egg incubators. Higher larval yields were recorded when embryo density ranged from 5 to 100 ml⁻¹, compared to values between 500 and 2000 ml⁻¹. Compared to controls (no antibiotic or no presence of light), no changes of D-larval yield were observed by adding 20 ppm chloramphenicol or by maintaining embryos in total darkness. Then, a significant decrease of pH and O₂ content was observed during the incubation period. However, these changes could not be considered as limiting for Pacific oyster embryo development.

In conclusion, experimental incubation conditions have been defined in this study: 30 embryos ml⁻¹ incubated in 1.8 l beakers without antibiotic and regardless of light intensity, when not higher than 500 lux. The mean coefficients of variation observed between tank replicates ranged from 13.1 to 16.5%. The standardized incubation procedure described in this work will help to study quality variations of Pacific oyster gametes.

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EFFECT OF DIETARY ARACHIDONIC ACID, EICOSAPENTAENOIC ACID AND DOCOSAHEXAENOIC ACID ON SURVIVAL, GROWTH AND PIGMENTATION IN LARVAE OF COMMON SOLE (*SOLEA SOLEA* L.)

Ivar Lund, Svend Jørgen Steinfeldt, Benni Winding Hansen-2007

Aquaculture 273(4): 532-544

Abstract:

Evidence confirms that polyunsaturated fatty acids (PUFAs), arachidonic acid (ARA), eicosapentaenoic acid (EPA) and docosahexaenoic acid, DHA are involved in growth as well in pigmentation of marine fish larvae.

In the present study we examined the performance of common sole larvae reared on *Artemia* enriched with 10 formulated emulsions, differing in inclusions of ARA, EPA, and DHA. The specific growth rate of the sole larvae until late metamorphosis, 21 days after hatching (dah) was 20 to 27% d⁻¹. Even though the relative tissue essential fatty acid (EFA) concentrations significantly reflected dietary composition, neither standard growth nor larval survival were significantly related to the absolute concentrations of ARA, EPA and DHA or their ratios. This suggests low requirements for essential polyunsaturated fatty acids (PUFAs) in common sole. Malpigmentation was significantly related to increased dietary ARA content. However, pigmentation was not affected by inclusion levels of EPA or DHA when ARA was high. This, and no relation between DHA: EPA or ARA: EPA ratios and pigmentation and only a weak relation to ARA: DHA ratio, advocate for that it is the absolute concentration of ARA in larval tissues, that is responsible for malpigmentation rather than the relative concentration to other PUFAs.

Within malpigmentation, the trait "albinism" was characterised by an abnormal incomplete eye migration, but this trait is suggested not to be related to dietary ARA. Furthermore, albinism resulted in a lower growth rate, which suggests that visual aberrations affected prey capture.

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EFFECT OF DIETARY SUPPLEMENTATION OF PHOSPHOLIPIDS AND HIGHLY UNSATURATED FATTY ACIDS ON REPRODUCTIVE PERFORMANCE AND OFFSPRING QUALITY OF CHINESE MITTEN CRAB, *ERIOCHEIR SINENSIS* (H. MILNE-EDWARDS), FEMALE BROODSTOCK

Xugan Wu, Yongxu Cheng, Liying Sui, Chaoshu Zeng, Paul C. Southgate, Xiaozhen Yang-2007

Aquaculture 273(4): 602-613

Abstract:

This study was conducted to determine the optimum phospholipids: highly unsaturated fatty acids (PL/HUFA) ratio in maturation diets for female Chinese mitten crab, *Eriocheir sinensis* broodstock. Five isolipidic and isonitrogenous diets were formulated to contain different amounts of pork lard, fish oil and soy lecithin with resulting PL/HUFA levels (%dry weight) of 1.4/0.3 (Diet 1), 1.6/2.5 (Diet 2), 2.3/2.0 (Diet 3), 3.8/1.5 (Diet 4) and 5.1/0.8 (Diet 5). Diet 1 lacked supplemental fish oil and soy lecithin and served as the control. Each of the five formulated diets was fed to a total of 150 female crabs for a period of 7 months. All diet treatments were triplicated with 50 crabs stocked in a pond as a replicate. After 6 months, male crabs were introduced into the ponds where females were kept, mating, spawning and egg hatching (in seawater) occurred in the following month. The nutritional value of various formulated diets was assessed based on survival, gonadosomatic index (GSI), egg production per female, fecundity (eggs/g female weight) of the females fed those diets and egg and larval (newly hatched zoea I larvae) quality.

Females fed Diet 1 had the lowest GSI, egg production per female and fecundity while no significant difference were found for survival, hepatosomatic index (HSI) and the percentage of female spawned among the diet treatments ($P > 0.05$). Although there were no significant differences in egg diameter, egg wet or dry weights among all treatments ($P > 0.05$), the highest and the second highest proportions of essential fatty acids (EFA), i.e. 20:5n-3 (EPA), 22:6n-3 (DHA) and HUFA were found in the eggs produced by the females fed Diet 3 and Diet 2, respectively. Statistical analysis showed that EPA, DHA and HUFA in eggs produced by females fed Diet 3 were significantly higher than those from the other treatments ($P < 0.05$). Meanwhile, zoea I larvae from crabs fed Diet 3 had significantly larger carapace length than those from the other four treatments ($P < 0.05$). The zoea I larvae from crabs fed Diet 2 and Diet 3 also showed generally better tolerance to starvation and osmotic shock.

In conclusion, our results indicated that diet included levels of PL/HUFA around 1.6/2.5 or 2.3/2.0 (% dry weight) fed female *E. sinensis* broodstock supported increased fecundity and elevated level of HUFA in egg, which in turn resulted in improved overall quality of newly hatched larvae.

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DEVELOPMENT OF LIPID MICROBEADS FOR DELIVERY OF LIPID AND WATER-SOLUBLE MATERIALS TO ARTEMIA

A. Nordgreen, K. Hamre, C. Langdon-2007

Aquaculture 273(4): 614-623

Abstract:

Lipid spray beads (LSB) containing high concentrations of phospholipids were produced in order to improve their dispersion in both fresh and saltwater. The beads were developed to deliver both fat-soluble and water-soluble micronutrients to *Artemia* and other suspension feeders. LSB were prepared by spraying molted lipid into a chamber that was cooled with liquid nitrogen in order to solidify the lipid beads. Addition of soy lecithin to LSB did not affect retention of glycine when the beads were suspended in distilled water. There was an initial loss of 80% incorporated glycine after LSB were suspended in water for 20min.

Artemia readily ingested riboflavin-containing LSB and their full guts were evident within 30min of feeding. The riboflavin content of Artemia could be increased from $55 \pm 0.6 \text{ mg kg}^{-1}$ (dw) to $329 \pm 62 \text{ mg kg}^{-1}$ (dw) after 1h enrichment. LSB prepared with phospholipids are promising vehicles for enrichment of suspension-feeding organisms used as feed for larval marine fish and crustaceans as well as other suspension feeders.

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THE EFFECT OF THE ADDITION OF ALGAE FEEDING STIMULANTS TO ARTIFICIAL DIETS FOR THE SEA URCHIN TRIPNEUSTES GRATILLA

Symon A Dworjanyn, Igor Pirozzi, Wenshan Liu-2007

Aquaculture 273(4): 624-633

Abstract:

A key concern when developing artificial aquaculture diets is their palatability. This study investigated whether the palatability of artificial diets could be improved by incorporating a small quantity of highly preferred natural foods as feeding stimulants. The preference of *Tripneustes gratilla* for marine plants with which it co-occurs naturally in New South Wales, Australia, was assessed in a laboratory choice feeding experiment. *T. gratilla* displayed significant preference for the brown alga *Ecklonia radiata* over five other algae and one seagrass when they were offered simultaneously. Total protein or energy in the plants was not found to account for this preference. However, *T. gratilla* showed no preference among *E. radiata*, *Sargassum linearifolium* and *Ulva lactuca* when they were dried. Three artificial diets were made by incorporating one of each of these dried seaweeds at 5% dry weight. Although not statistically significant, *T. gratilla* ate more than twice as much the artificial diet containing *S. linearifolium* compared to the control diet containing no algae in a choice feeding experiment. In a no-choice feeding experiment, *T. gratilla* consumed significantly more of the *Ecklonia* and the *Sargassum* diets than the control diet despite each of the diets containing approximately the same protein and energy levels. *T. gratilla* consumed 49 and 43% more protein, and 37 and 44% more energy, respectively, when fed with the *Ecklonia* and the *Sargassum* diets compared to the control diet. Juvenile *T. gratilla* grew significantly faster on a wet weight basis on the *Sargassum* diet than the control diet at an average increase of 2.4% per day. These results indicate that the small amounts of palatable seaweed added to the artificial diets act as feeding stimulants, increasing the acceptability of artificial sea urchin diets, boosting the protein and energy consumption, and significantly increasing the growth of *T. gratilla*. Moreover, the fast growth of *T. gratilla* achieved in this study also indicates that this species would be a good candidate for commercial aquaculture.

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THE EFFECTS OF ALGAL DIETS ON POPULATION GROWTH AND EGG HATCHING SUCCESS OF THE TROPICAL CALANOID COPEPOD, ACARTIA SINJIENSIS

Michael Milione, Chaoshu Zeng, and Tropical Crustacean Aquaculture Research Group-2007

Aquaculture 273(4): 656-664

Abstract:

As natural diets of fish larvae, a number of calanoid copepod species are being investigated for use as live prey in aquaculture hatcheries. One of these, the tropical calanoid copepod, *Acartia sinjiensis*, has good potential as a live feed for tropical reef fish larvae. However, the rearing techniques for *A. sinjiensis* require further development to improve productivity. This study was carried out to investigate the population growth and egg hatching success of *A. sinjiensis* when fed a range of mono-and binary algal diets, including algae in the form of frozen paste.

For the population growth experiment, the final *A. sinjiensis* population, including eggs, nauplii, copepodites and adults, was determined after feeding eight algal diets (two frozen algae, four live monoalgal and two live binary algal diets) for 8 days at temperature 28 ± 1 °C; salinity 34 ± 1 psu and photoperiod 12 L:12 D. Five replicates, with an initial 12 adult *A. sinjiensis* per replicate, were set up for each treatment. In a separate experiment, effects of diets on egg hatching success were examined after 48 h incubation of eggs produced by *A. sinjiensis* fed the same eight diets.

The results showed that diet significantly affected both population growth and hatching success of *A. sinjiensis*. Of the diets tested, the binary algal diets were more successful than monoalgal diets, while the frozen algae had little dietary value. The highest population growth was recorded on *A. sinjiensis* fed a binary diet of *Tetraselmis chuii* and the Tahitian strain of *Isochrysis* sp. (T-ISO) (final population: 1091 ± 80), which was significantly higher ($P < 0.001$) than all other diets tested except for the other binary diet of *Nannochloropsis* sp. and T-ISO (final population: 897 ± 123). Diet also had a significant effect ($P < 0.001$) on egg hatching rate, though the highest hatch rate was recorded with eggs produced by *A. sinjiensis* fed binary diet *Nannochloropsis* sp. and T-ISO ($88.1 \pm 2.1\%$), this was not significantly different from that of eggs produced by *A. sinjiensis* fed either T-ISO alone ($88.0 \pm 1.7\%$) or the binary algal diet of *T. chuii* and T-ISO ($76.4 \pm 7.1\%$). The results of this study suggest that among the diets tested, a combination of live *T. chuii* and T-ISO was the best for the culture of *A. sinjiensis*.

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DO STRAIN DIFFERENCES IN MICROALGAE ALTER THEIR RELATIVE QUALITY AS A FOOD FOR THE ROTIFER BRACHIONUS PLICATILIS?

Fotoon A.Q. Sayegh, Naseem Radi, David J.S. Montagnes-2007

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Abstract:

Brachionus plicatilis is used in aquaculture to feed larval fish and crustaceans. It is well established that different prey species alter rotifer productivity. *Isochrysis galbana* is one microalgal prey that is commonly fed to rotifers, and there are several strains of this flagellate available to aquaculturists. As microalgae strains may differ in their composition and growth attributes, we rigorously examined if growth and biochemical differences in *I. galbana* strains elicit differences in the growth and biochemical attributes of *B. plicatilis*. Four *I. galbana* strains and one strain of the flagellate *Nannochloropsis* were grown under standard conditions. Growth rate, cell volume, production, and composition (dry weight, carbohydrate, protein, lipid) were measured. Significant differences occurred between strains in all of these attributes (at times 2 to 3 fold), but no clear pattern emerged that one strain was superior. Of note was that for some measurements, strain differences were significantly greater than differences between species. The strains were then fed to rotifers, and a number of parameters were measured: growth rate, reproductive rate, fecundity attributes, a number of developmental rates, and composition (dry weight, carbohydrate, protein, lipid). There were significant effects of prey strain on some of these attributes, but none was dramatic (rarely more than 10% and occasionally up to 30%), suggesting that aquaculturists need not be too concerned regarding which *I. galbana* strain they use. However, we do indicate subtle differences, induced by different prey strains and suggest that for maximum productivity these differences should be considered.

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EFFECTS OF SALINITY AND PH ON ION-TRANSPORT ENZYME ACTIVITIES, SURVIVAL AND GROWTH OF LITOPENAEUS VANNAMEI POSTLARVAE

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Abstract:

Effects of the salinity and pH on ion-transport enzyme activities, survival and growth of *Litopenaeus vannamei* postlarvae were investigated. Shrimp were transferred from salinity 31‰ and pH 8.1 to different salinity levels of 22, 25, 28, 31 (control), and to different pH levels of 7.1, 7.6, 8.1 (control), 8.6 and 9.1. The results showed ion-transport enzyme activities and weight gains of postlarvae were significantly affected by salinity and pH variation, which had no obvious effect on survival rate. The changing salinity affected the activities of total ATPase and Na⁺-K⁺-ATPase notably ($F > F_{0.05}$), meanwhile, non-significantly to the activities of V-ATPase, HCO₃⁻-ATPase. Within 48 h of salinity changing, the activities of ATPase, Na⁺-K⁺-ATPase in each treatment group gradually increased with the sampling time and reached their climax at 48 h, and then stabilized, showing negative correlation with salinity. The changing of pH affected greatly the activities of ATPase, Na⁺-K⁺-ATPase, V-ATPase and HCO₃⁻-ATPase ($F > F_{0.05}$), the activities of ATPase, Na⁺-K⁺-ATPase in each treatment group (pH = 7.1, 7.6, 8.6, 9.1) showed peak change within 72 h and stabilized afterwards, and the Na⁺-K⁺-ATPase activities came back to the level of the control group; Meanwhile the changing extent of V-ATPase and HCO₃⁻-ATPase activity corresponded with the grads of pH, and these ATPase activities showed negative correlation with pH changing, the activities of V-ATPase, HCO₃⁻-ATPase in postlarvae of each treatment group came to stable level after 24 h. The experiment also indicated the strength order of these ion-transport enzyme activities were as follows: Na⁺-K⁺-ATPase > V-ATPase > HCO₃⁻-ATPase. Na⁺-K⁺-ATPase was the chief undertaker of osmoregulation under the salinity effects, while V-ATPase and HCO₃⁻-ATPase were the chief osmoregulation undertakers under pH changing. In different salinity environment, the contributions of Na⁺-K⁺-ATPase, V-ATPase and HCO₃⁻-ATPase of *L. vannamei* postlarvae approximately accounted for 62.0–78.0%, 15.9–29.0% and 2.03–4.12% of ATPase activities in total, respectively. Meanwhile, in different pH medium, the contributions of these ATPases approximately accounted for 50.7–67.4%, 21.3–31.8% and 2.15–7.90% of total ATPase activities, respectively. Weight gain of shrimp transferred to salinity 31 (control) and 28‰ was significantly higher than that of shrimp reared at 25 and 22‰, and weight gain of shrimp transferred to pH 8.1 (control) and 8.6 was significantly higher than that of shrimp transferred to pH 7.1, 7.6 and 9.1. It was suggested that during the process of desalting and culturing of postlarvae, the salinity changing should not exceed 3 and pH variety not more than 0.5.

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