KEMENTERIAN PENDIDIKAN MALAYSIA

UMT

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SEED PRODUCTION OF ORNAMENTAL FISH

Culture Method

- Larvae could be collected from the wild or hatchery production
- Ornamental fish are cultured following common principles:
  - Broodstock husbandry
  - Spawning
  - Larval rearing and weaning
  - Nursery and grow-out
- Fed on formulated diet in order to adapt easily to aquarium condition

- In the hatchery, hatchling is better separated from the parents because many species are cannibalism and may eat their progeny

- Except: mouth-brooders, egg-depositors, bubble-nest builders

Factors Influencing Larval Rearing

- **Factors that critically affect the size of tank used include:**
  - **Species**
  - **Stocking density**
  - **pH**
  - **Food & feeding practices**
  - **Water changing volume and frequency**
  - **Gentle filtration (if applicable)**
  - **Rearing media**

Factors to be Considered for Feeding

- Species
- Water medium
- Phytoplankton
- Zooplankton
- Feed & Feeding
- Light intensity
- Water current/movement
- Water exchange frequency
- Degree of care

Species

- Body sizes
    - Depend on egg size
- Development stages
    - Incubation period
    - Eye pigment
    - Mouth formation
    - Fins development
    - Digestion system
- Yolk-sac volume
- Pigmentation
    - Transparent larvae very sensitive to light

Water Medium

- General term “green water”
- Term as “fresh/salt water added with Chlorella_sp”
- Water greenish depend on species
- Phytoplankton density normal rate of larval rearing (fresh/ saltwater) is $10^{\times 3\text{-}5}$ cells
- Water exchange 7-10 days, depend on larvae density & feeding performance

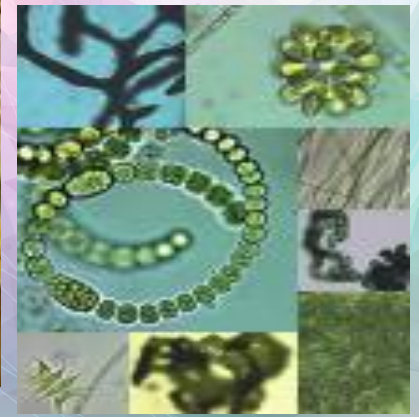




Phytoplankton

- Chlorella sp.
  - General phytoplankton found in Malaysia water
  - Suitable used for larvae rearing
  - Easy culture & maintain

- Spirulina sp.
- Nannochloropsis sp.



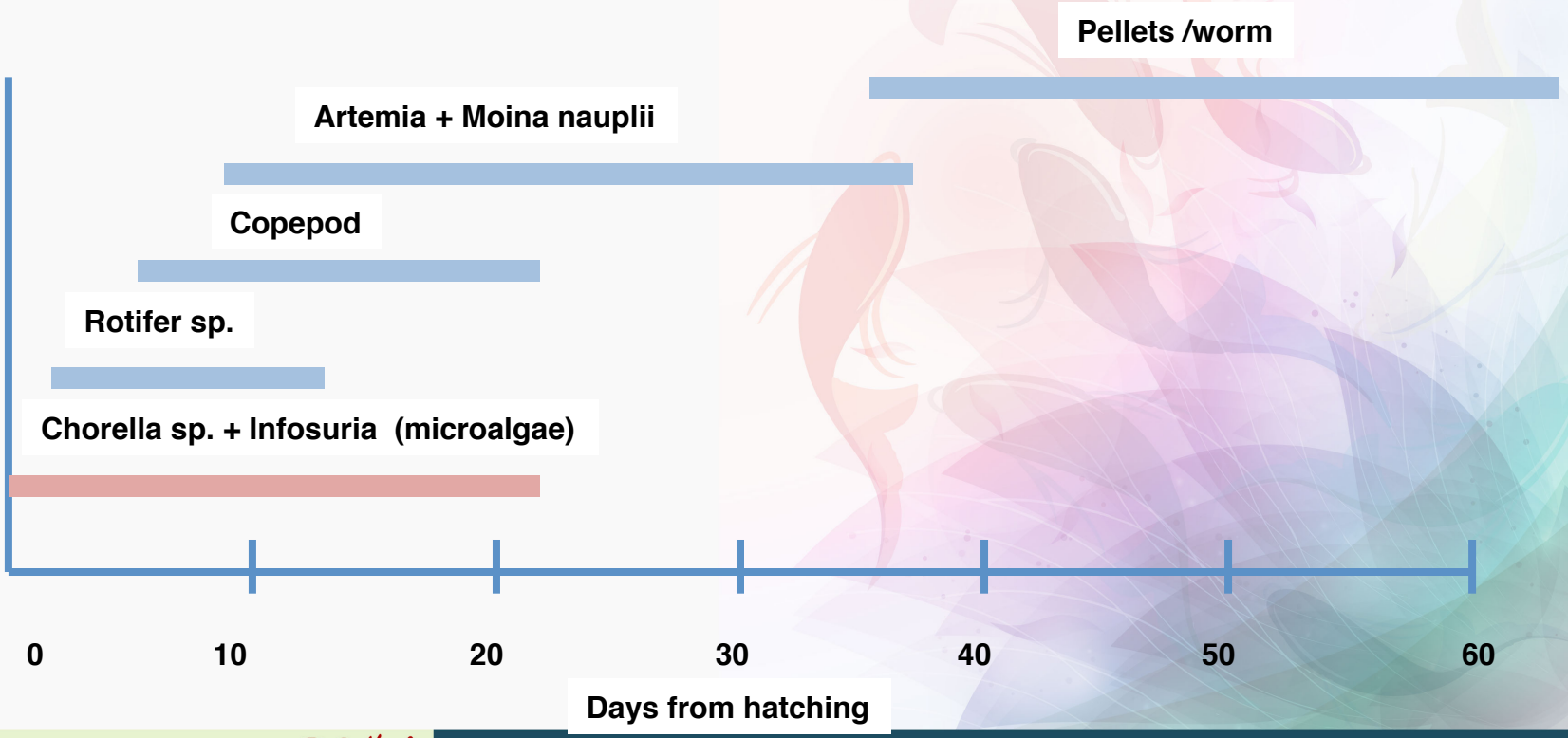
General Types of Live Feed Used

- Phytoplankton
  - Diatoms
    - Skeletonema costatum
    - Thalassiosira sp.
    - Chaetoceros gracilis
    - Chaetoceros calcitrans
  - Chlorococcales
    - Chlorella sp.
    - Most important & widely use in aquaculture industry
- Flagellates
  - Isochrysis galbana
  - Pavlova lutheri
  - Tetraselmis sp.

Selection of Live Feed in Ornamental Fish Culture

- Size
  - 1 – 15μm – filter feeder
  - 15 – 100 μm – other then filter feeder (grazer)
- Digestibility
- Nutritional & enzyme availability
- Easy handling & year round availability
- Life cycle – short & reproducible easily

Common Feeding Schedule for Ornamental Fishes



Advantages of Using Phytoplankton

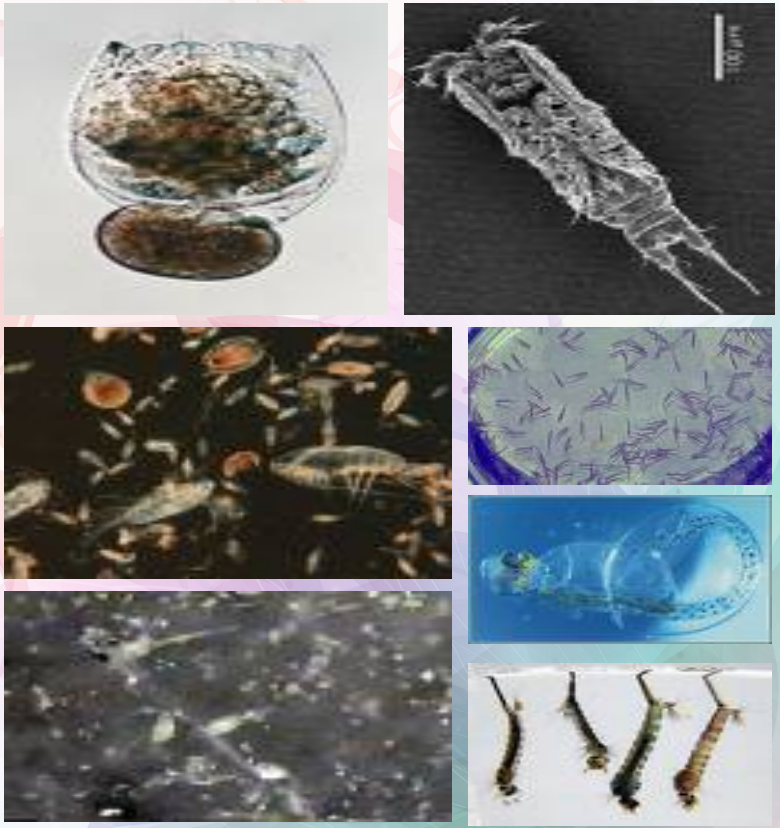
- Phytoplankton is rich with pigmentation
  - Beta carotene
  - Astaxanthin

- Probiotic medium
  - Growth promoting and nutrition stability

- Protection/shading
  - Avoid disturbance
  - Reduce light penetration

Zooplankton

- Infosoria
  - Suitable for transparent larvae / microscopic organism
  - Tetra sp., Rasbora sp.
- Rotifer sp.
  - Suitable for all fish larvae
- Copepod
  - Used for juvenile stage
- Moina sp.
  - Suitable for all larval or juvenile
- Daphnia sp.
  - Juvenile sp.
- Artemia sp.
  - Juvenile sp.



Infosuria

- Infosuria
  - Only apply for those transparent and poor developed larvae

- Application only during early stage
  - Newly hatched to 4 – 5 days

- Always serve as supplemental on day 3 onwards

- A combination of microbe organisms such as protozoa

Rotifer

- Widely use in early life for both marine and freshwater species

- Why???
  - Small in size 90 – 350 μm
  - Slow swimming capacity
  - Fast and stable reproduction
  - Easily digestible by larvae

- **Under hatchery conditions, rotifer populations can reach the following densities:**

  - **In flasks and bags, after 5 to 7 days:**
    - **S-type rotifers, 500 to 700 ind/ml**
    - **L-type rotifers, 150 to 250 ind/ml**

  - **In tanks, after 4 to 6 days:**
    - **S-type rotifers, 1000 and more ind/ml**
    - **L-type rotifers, 400 ind/ml**

Artemia

- **Commonly used in freshwater ornamental fish culture**

- **Serve as intermediate feed (transition feeding period) before fully depending on Moina**

Copepods

- Supplemental intermediate feed (Rotifer & Artemia/Moina) for marine species
- Easy and stable reproduction
- Nutrient availability
  - Promote early larval growth and survival
- Improve pigment development

- **Size of newly hatched nauplii**
  - **150 – 200 *μ*m**

- **Suitable for all types of marine/coral fish species as first feeding feed**

Moina & Daphnia

- Available in most rich natural environment
- Easy and stable reproduce
- Nutrient availability
- Improves growth & survival in all life stages, except Daphnia (juvenile or adults)
- Easy to enrich with all types of nutrient and pigment

Bioencapsulation

- Bioencapsulation
- Enrich live feeds with specific nutrient requirement according to specific need
  - Such as:
    - Vitamin
    - Fatty acids – fish oil
    - Amino acids
    - Colour
    - Mineral
    - Hormones
    - Enzymes

Processed Live Feed

- Shrimp meal
  - Rich in pigmentation

- Frozen enriched Artemia
  - Carotene – pigment development
  - Laxative – digestive system

- Dry form plankton – spirulina
  - Vitamin
  - Beta-carotene
  - Raw protein

Artificial Food

- Milk powder
- Egg yolk
- Fish meal
- Soybean meal
- Bio-encapsulated pellet
- Egg custard

Feed Preparation

- Fish meal + cooked egg yolk (10/20:90/80)
- Soybean meal + cooked egg yolk (10/20:90/80)
- Fish meal + cooked egg yolk + fish oil (30:65:5)
- Fish meal + cooked egg yolk + plant oil (30:65:5)
- Fish meal + algae + fish oil (PUFA/HUFA) (85:10:5)
- Fish meal + algae + fish oil + pigment (80:7:10:3)
- Fish meal + algae + fish oil + digestive bacteria (80:8:10:2)

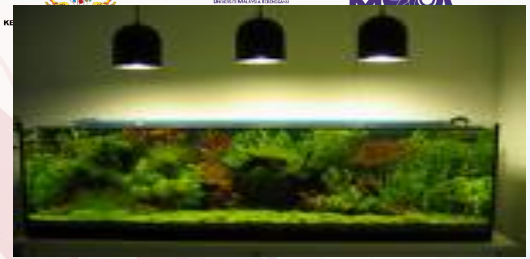
Commercial Artificial Food

- Formulated to meet different nutrient requirement, feeding habits and life stages of fish

- Remember not to over-feed the fish

Light Intensity

- Newly hatch larvae is very sensitive to sunlight
- “Green water” used not only to maintain water quality but also to protect newly hatch larvae from direct light
- Light may increase water temperature
- Recommended artificial light intensity
  - 20 watts for 60 – 80 cm rearing tank with 12L/12D
- Sensitivities cause larvae
  - Head bunting
  - Eye pigment deformation
  - Mortality



Water Current & Exchange Frequency

- Flow through system is **not** recommended for early larval stage
- Early stage (around 7 days) should not change water (depend on density)
- Gentle aeration
- Bubble size should be as smaller as possible
- Recommended water exchange 20-30% by siphon technique per week

Degree of Care - Feeding

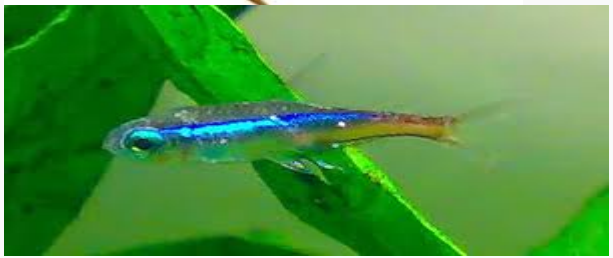
- Feed to satiation
  - Normally for ornamental fish culture
  - Especially for larval rearing
  - Live feed 5-10 individual/ml
- % of body weight
  - Especially for food fish culture
  - Start from juvenile or young stages
  - Koi, giant gourami,
  - 40% - fry/juvenile
  - 20% - fingerling/young
- Feeding frequency
  - Twice per day (8-9 am & 4-5 pm)

Degree of Care - Observation

- Behaviour
  - Mating
  - Pre-spawning
  - Spawning
  - Post-spawning

- Activities
  - Fighting
  - Aggressiveness

Degree of Care - Observation



- **Stress**
  - Outsider disturbance
  - Environment factors
  - Feeding
  - Swimming
  - Isolated
- **Disease symptom**
  - Internal infection
  - Parasites

Degree of care – Siphon and Remove Larvae

- Flow rate – slow
- Do not remove larval out of water
- Do not remove by scope net
- Remove with water
- Conduct under cold at early morning or late evening
- Check water temperature
- Prepare rearing medium

Larval Rearing of Barber Goby Elacatinus figaro

- After hatching, Barber goby larvae may be kept in 20 L glass aquaria
- Cover the tank with black sheet
- Maintain water quality under optimal conditions by daily water renewal at approximately 30% of the total volume of the tank
- Do not change water for the for first 3 days because larvae is fragile

Feed for Barber Goby Larvae

- Larval rearing used Nannochloropsis oculata with rotifers (Brachionus rotundiformis) as first food (day 0-25)
- Nauplii and meta-nauplii of Artemia may be fed from day 18 until metamorphosis.
- After that feed with commercial marine fish diets
- Metamorphosis to juveniles started around the 30th day post hatch
- Juveniles are transferred to nursery tank

Larval Rearing of Goldfish Carrassius auratus

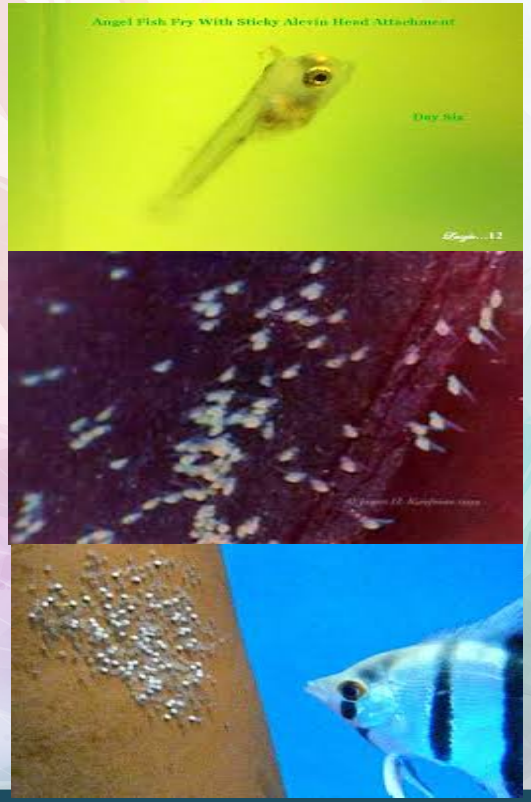
- Goldfish larvae can be fed with brine Shrimp (Artemia)

Feed for Goldfish Larvae

- Feeding should be done with care as they are small & fragile
- A continuous supply of moderate amounts of food is necessary as overfeeding could lead to polluted water and fish death
- Underfeeding leads to starvation and eventually death of fish
- It is better to remove uneaten food from the aquarium in a couple of hours, and then add fresh food when necessary

Larval Rearing of Freshwater Angelfish Pterophyllum scalare

- One to three weeks young fry could be fed yolk of hard boiled eggs squeezed through cheesecloth
- Can also be fed with Artemia in small quantities three to four times daily to prevent overfeeding, ammonia accumulation and disease
- Three to five weeks, fine flakes and/ or Artemia can be fed to the fry
- Dry food can be used twice daily for five to seven week old fry until adult

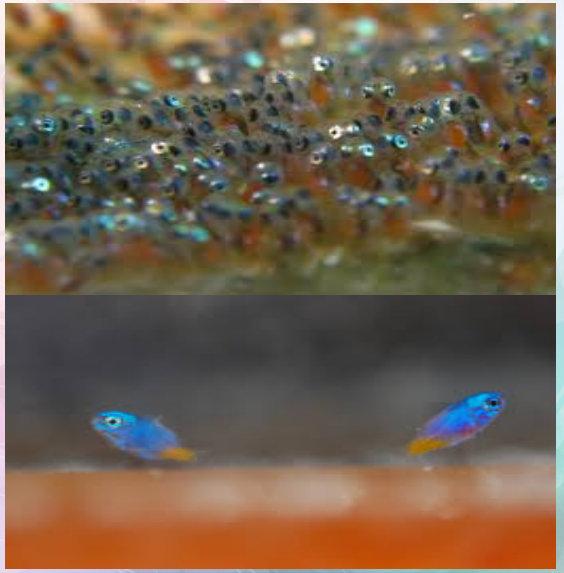


Larval Rearing of Yellow-tailed Damsel Chrysiptera parasema

- Rearing medium should not be filtered or aerated, since larvae of this species are extremely sensitive to any turbulence

- Cover tanks (both side) with panels to reduce the reflection of light

- Provide phytoplankton as culture medium



Larval rearing of Marine Yellow-tailed damsel Chrysiptera parasema

- Chlorella sp. and Isochrysis sp. may be used to “green up” the tanks as culture medium until the bottom of the tank could no longer be seen

- Approximately 15% of the water be replaced each morning, and a few drops (2–3) of a 5% KI solution were added twice a day

Larval Rearing of Marine Yellow-tailed Damsel

- Temperature: 28 ^{o}C
- Salinity : 30 ppt
- Photoperiod: 18L/6D
- First food: 20 rotifers/ml from days 1 to 23
- Second food: Artemia nauplii (25 nauplii/larva) from day 19

(Olivotto et al. 2003)

Clownfish or Anemonefish Pomacentridae

- Clownfish eggs take 6-9 days to hatch, and produce relatively large larvae (>2.0 mm) and have fast development
- Can change sex from male to female (protandry hermaphrodite)
- Generally two to four fish might occupy an anemone, including a large dominant female, a smaller male and one or two non breeders
- If something happens to the female, the male, now dominant, will change into a female and one of the smaller individuals will become a male

- In captivity only one pair is kept in the breeding tank
- Clownfish spawn about twice a month by laying adhesive eggs onto a hard substrate
- Eggs are guarded by the male and hatch after a week

Larval Rearing of Clownfish

- Water Quality;
  - Temp.:26-28 ^{o}C;
  - Salinity: 30-32ppt,
  - pH: 7.5-8.2;
  - DO: >5.5 mg/L

- Stock not more than 5 larvae/l

- Feed newly hatched larvae with rotifers for first ten days, may use micro algae with rotifers, followed by Artemia and small sized artificial diet

- **May feed 3-4 times daily and adjust the feeding schedule**
- **Within one to three weeks the larvae metamorphosis into juveniles**
- **On day 25-30, juveniles may be shifted to grow out or nursery tanks**

Larval Tank Condition for Clownfish

- Tank should be cleaned daily to remove detritus at the bottom
- On a weekly basis, a partial water change, at least 1/3 the tank's volume
- Well-aerated and water circulation