Euryhaline rotifer *Proales similis* as initial live food for rearing fish larvae with small mouth

Atsushi Hagiwara
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A. Hagiwara, S. Wullur
N. Hirai & Y. Sakakura

Proales similis de Beauchamp, 1908
Size of Live food species

Natural zooplankton, Artificial microdiet

Feeding amount

Rotifers

SS  S  L

Artemia

Size (μm)
Proales similis (left)
B. rotundiformis (SS type, right)
References of *Proales similis*

**Culture**

Wullur et al. (2009)

**Larval rearing**

Wullur et al. (2011)  Seven-band grouper
Wullur et al. (2013)  Japanese eel
Hirai et al. (2011, 2013)  Hump head wrasse
Introduction

Taxonomy;
Phylum : Rotifera
Class : Monogononta
Family : Proalidae
Genus : Proales

Culture;
No information in literature
(Except for P. sordida and P. decepiens)

Collection;
Ishigaki island, Okinawa-Japan.
(189th field trip-July 2004)
Morphometry

<table>
<thead>
<tr>
<th>Rotifer</th>
<th>Body dimension (μm)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>length</td>
<td>width</td>
<td></td>
</tr>
<tr>
<td>P. similis</td>
<td>82.7±10.9</td>
<td>40.5±6.4</td>
<td></td>
</tr>
<tr>
<td>SS-type</td>
<td>133.6±13.5</td>
<td>102±11.9</td>
<td></td>
</tr>
<tr>
<td>Body ratio of P. similis</td>
<td>38.1% smaller</td>
<td>60.3% narrower</td>
<td></td>
</tr>
</tbody>
</table>

Values are indicated as mean±standard deviation

- Body size smaller than SS-type
- Soft body without lorica

Can be used as initial food for feeding fish larvae with small mouth (or pharynx) size or less digestive ability?
## Individual culture

Life history parameters (at 25°C)

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Salinity (ppt)</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
<td>15</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Life span (days) 7-10</td>
<td>4.6±1.7</td>
<td>4.0±1.4</td>
<td>4.7±2.0</td>
<td></td>
</tr>
<tr>
<td>Generation time (days) 2</td>
<td>2.5</td>
<td>2.4</td>
<td>2.8</td>
<td></td>
</tr>
<tr>
<td>Reprod. period (days) 5-7</td>
<td>2.9±1.2</td>
<td>3.4±1.1</td>
<td>3.2±1.1</td>
<td></td>
</tr>
<tr>
<td>Fecundity (female⁻¹) 20-30</td>
<td>7.8±3.9ᵃ</td>
<td>4.3±1.4ᵇ</td>
<td>4.3±2.6ᵇ</td>
<td></td>
</tr>
<tr>
<td>r (day⁻¹)</td>
<td>0.4-0.8</td>
<td>0.93</td>
<td>0.70</td>
<td>0.63</td>
</tr>
</tbody>
</table>

Fisher PLSD test, p<0.05. a>b. Values are indicated as mean±standard deviation
Tukey-Kramer test, $p<0.05$, $a>b>c$. Bars are indicated as standard deviation.
Mass culture (2 L)

Salinity: 25 ppt
Temp. : 25°C
Food : *N. oculata*

2,405 ind./ml
\( r = 0.42 \) day\(^{-1} \)

25 ind./ml
HUFA composition

Methods

• Mass cultured in 50 L polycarbonate tanks

• Food source:
  • Nannochloropsis oculata
  • Super fresh Chlorella vulgaris V-12

• HUFA analysis (Chlorella company, Fukuoka-Japan)
### Results

<table>
<thead>
<tr>
<th></th>
<th>N. oculata</th>
<th>Super fresh C. vulgaris®</th>
<th>SS-type</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total lipid</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(% per wet weight)</td>
<td>2.4</td>
<td>2.6</td>
<td>1.5</td>
</tr>
<tr>
<td><strong>HUFA</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(% total lipid)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C20:4n-6 (AA)</td>
<td>5.3</td>
<td>0.5</td>
<td>0.8</td>
</tr>
<tr>
<td>C20:5n-3 (EPA)</td>
<td>23.2</td>
<td>11.0</td>
<td>6.1</td>
</tr>
<tr>
<td>C22:6n-3 (DHA)</td>
<td>0.0</td>
<td>17.5</td>
<td>6.6</td>
</tr>
<tr>
<td><strong>DHA/EPA</strong></td>
<td>0</td>
<td>1.59</td>
<td>1.08</td>
</tr>
</tbody>
</table>
Feeding trials to fish larvae

Seven-band grouper
(Epinephelus septemfasciatus)

Humphead wrasse
Cheilinus undulatus
Feeding trials on seven-band grouper larvae

Methods

• 100 L polycarbonate tanks

• P. similis (20 ind./ml),
  SS-type (20 ind./ml)
  and mix (20 ind./ml)
Results

Survival on 10 DAH

Fisher PLSD test, $p<0.05$. a>b
Tryptic activity

Fisher PLSD test, $p<0.05$. a>b
Humphead wrasse (Napoleon fish)  
*Cheilinus undulatus*
† Study for larval rearing
Food for initial feeding

Boiled chicken egg yolk
↓
Used in Indonesia

Preliminary feeding test in 100L tank

Most feeding
Proales similis

50μm
Proales similis
(Collected from Ishigaki island)

100μm
SS type rotifer
Brachionus rotundiformis
(Thai strain)

2dph
3dph

Proales 200ind./mL
SS-type Rotifer 20ind./mL
Boiled Chicken Egg Yolk
Powdered Milk

Larva of humphead wrasse fed Proales similis (2dph)
Characteristics of larva and juvenile of humphead wrasse

14dph (TL 3.3mm) Preflexion larva
Proales ➔ Start feeding of SS-type rotifer

21dph (TL 4mm) Flexion larva
Increase body height, Form of hypural.

55dph (TL 12mm) juvenile

40dph ~ Pigmentation
Change of behavior
(Pelagic ➔ Settlement ?)

Growth and food type during Early ontogeny

Artemia nauplii

Yolk-sac ➔ Preflexion ➔ Flexion ➔ Postflexion ➔ Juvenile
Conclusion

✓ P. similis can be mass cultured
✓ HUFA composition of P. similis can be manipulated to suit with the HUFA requirement of fish larvae
✓ Fish larvae could ingest P. similis effectively and grow.

*P. similis* can be used as initial food for feeding fish larvae with small mouth size