Effects of strain on growth performances of triploid Thai walking catfish, *Clarias macrocephalus*

Satid Chatchaiphan\(^1\), Prapansak Srisapoome\(^2\) and Uthairat Na-Nakorn\(^2^*\)

\(^1\) Program in Aquaculture, Graduate School, Kasetsart University, Thailand

\(^2\) Department of Aquaculture, Faculty of Fisheries, Kasetsart University
Advantages of triploids

http://www.rivergwashtroturfarm.com/

http://www.coastseafoods.com/

http://www.overtonfisheries.com/
Thai walking catfish
Freshwater aquaculture production by species

- Nile tilapia
- common carp
- silver barb
- snake-skin gouramy
- snake-head
- walking catfish
- striped catfish
- freshwater prawn

Unit = 1,000 tonnes
Previous studies on triploid Thai walking catfish showed different results.

- Na-nakorn & Lakaanantakun (1993) diploids > triploid
- Fast et al. (1995) triploids > diploid

- *Clarius fuscus*: triploids > diploids (Qin et al., 1998)
- *Clarius gariepinus*: triploids = diploids (Henken et al., 1987)
Framework of the project

- Effects of strains on triploid performances
- Mechanisms of the growth differences
- Mechanisms of sterility
Objectives

➢ To study effects of parental strains on performance of triploids
Materials and Methods

<table>
<thead>
<tr>
<th>Strains</th>
<th>KU</th>
<th>UD</th>
</tr>
</thead>
<tbody>
<tr>
<td>KU</td>
<td>KUKU</td>
<td>KUUD</td>
</tr>
<tr>
<td>UD</td>
<td>UDKU</td>
<td>UDUD</td>
</tr>
</tbody>
</table>

**Control**

28±3 °C ambient temperature

**Cold shock**

7 °C, 25 min duration, 0 min AF
Growth trial

30-60 D: 4 replicates in fibre glass tanks (1x1.5 m²) 500 fry/tank

61-240 D: 4 replications in concrete tanks (1x2 m²) at 75 fingerlings/tank

Data collection: BW, BL, AGR, SGR, condition factor

Sterility

Gonadosomatic indices at 240 D
Data analyses

\[ y_{ijk} = \mu + S_i + D_j + T_k + (SxD)_{ij} + (SxT)_{ik} + (DxT)_{jk} + (SxDxT)_{ijk} + e \]

where

- \( y_{ijk} \) = trait, \( \mu \) = constant, \( S_i \) = sire strain, \( D_j \) = dam strain, \( T_k \) = treatments (control or cold-shocked),
- \( SxD \) = interaction between sire and dam,
- \( SxT \) = interaction between sire and treatments,
- \( DxT \) = interaction between dam and treatments,
- \( SxDxT \) = interaction between sire, dam and treatments,
- \( e \) = error

Survival rates are included in the model for the analyses of the traits that may be affected by them.
RESULTS

Hatching rate

Success rate

2n = 54

3n = 81
## Results: 30-60 D

<table>
<thead>
<tr>
<th>Factors/traits</th>
<th>BL</th>
<th>BW</th>
<th>AGR</th>
<th>SGR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sire</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
</tr>
<tr>
<td>Dam</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
</tr>
<tr>
<td>Treatment</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>SirexDam</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
</tr>
<tr>
<td>SirexTreatment</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
</tr>
<tr>
<td>DamxTreatment</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
</tr>
<tr>
<td>SirexDamx Treatment</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
</tr>
</tbody>
</table>
SGR (30-60 D)

- KU x KU
- KU x UD
- UD x KU
- UD x UD

- Control
- Cold shock
Growth Trial 61-240 D: survival

<table>
<thead>
<tr>
<th>Factors/traits</th>
<th>SUR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sire</td>
<td>ns</td>
</tr>
<tr>
<td>Dam</td>
<td>ns</td>
</tr>
<tr>
<td>Treatment</td>
<td>✓</td>
</tr>
<tr>
<td>SirexDam</td>
<td>ns</td>
</tr>
<tr>
<td>SirexShock</td>
<td>ns</td>
</tr>
<tr>
<td>DamxShock</td>
<td>ns</td>
</tr>
<tr>
<td>SirexDamx Treatment</td>
<td>✓</td>
</tr>
</tbody>
</table>

The chart shows survival rates for different sire and dam combinations with and without shock treatment. The bars indicate the percentage of survival, with the control group in blue and the cold shock group in red. The error bars represent the standard error of the mean.
## Effects of Strains on Triploid: 90-240 D

<table>
<thead>
<tr>
<th>Traits/Factors</th>
<th>S</th>
<th>D</th>
<th>T</th>
<th>DxD</th>
<th>SxT</th>
<th>DxD</th>
<th>SxDxD</th>
</tr>
</thead>
<tbody>
<tr>
<td>BL&lt;sub&gt;90D&lt;/sub&gt;</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>ns *</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
</tr>
<tr>
<td>BL&lt;sub&gt;180D&lt;/sub&gt;</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>ns *</td>
<td>ns</td>
<td>*</td>
</tr>
<tr>
<td>BW&lt;sub&gt;90D&lt;/sub&gt;</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>ns *</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
</tr>
<tr>
<td>BW&lt;sub&gt;120D&lt;/sub&gt;</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>ns *</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
</tr>
<tr>
<td>BW&lt;sub&gt;180D&lt;/sub&gt;</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>ns *</td>
<td>*</td>
</tr>
<tr>
<td>AGR&lt;sub&gt;61-90D&lt;/sub&gt;</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>ns *</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
</tr>
<tr>
<td>AGR&lt;sub&gt;121-180D&lt;/sub&gt;</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>ns *</td>
<td>ns</td>
<td>*</td>
</tr>
<tr>
<td>SGR&lt;sub&gt;61-90D&lt;/sub&gt;</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>ns *</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
</tr>
<tr>
<td>SGR&lt;sub&gt;91-120D&lt;/sub&gt;</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>ns *</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
</tr>
<tr>
<td>SGR&lt;sub&gt;180-240D&lt;/sub&gt;</td>
<td>ns</td>
<td>ns</td>
<td>*</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
</tr>
</tbody>
</table>
SGR during 180-240 days old

- KU x KU
- KU x UD
- UD x KU
- UD x UD

Diploid
Triploid
Conclusion

• Neither sire nor dam had significant effects on growth of triploids.

• Only treatments had significant effects on BL, BW, AGR, SGR during 61-90 days old (Triploids<Diploids).

• Treatments had significant effect on survival rate at 240 days old (Triploids<Diploids) and SGR during 180-240 days old (Triploids>Diploids).
On-going work

• The preliminary results showed no differences in IGF-I expression between diploids and triploids. Therefore, transcriptomes are analysed in collaboration with Dr. Robert Devin, Center for aquaculture and environmental Research, Fisheries and Ocean, Canada.

• In collaboration with Dr. Sirawut Klinbugna, BIOTEC Thailand, full length of the Maturation Promoting Factor genes: cyclin B1 and cell division cycle 2 (Cdc2) of C. macrocephalus were characterized.

• Expression patterns of these genes are studied in diploid and triploids. Our preliminary results showed that expressions of cyclin B1 and Cdc2 were completely suppressed in gonad of C. macrocephalus.
Acknowledgements

• Royal Golden Jubilee, Thailand Research Fund
• Kasetsart University Research and Development Institute, Kasetsart University
• Dr. Robert Devlin, Fisheries and Ocean, Canada
• Dr. Sirawut Klinbunga, National Science and Technology Development Agency, Thailand
• Anyaluk Wachirachaikarn, Graduate School, KU