

**EFFECTS OF DIETARY PROBIOTICS  
AND TEMPERATURES STRESS ON  
GROWTH AND IMMUNITY RELATED  
GENES EXPRESSION IN MALAYSIAN  
MAHSEER (*TOR TAMBROIDES*)**

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**School : Fisheries and Aquaculture Science**

*Tor tambroides* is an important cyprinid group with high commercial and aesthetic value as food and ornamental fish. However, overharvesting and habitat degradation have caused the decline of wild *Tor tambroides* population. To restore the population size, *Tor tambroides* have been artificially cultured, but these captive bred individuals tend to have slower growth compared to their wild counterparts. Diet supplemented with probiotics is able to enhance growth and immunity of aquacultured organisms. In this present study, we conducted a 30-day feeding trial using commercial diets supplemented with  $10^8$  CFUg<sup>-1</sup> of *Bacillus subtilis* (*B. subtilis*) strain to study its effects towards their growth rate and temperature stress tolerance. The effects were determined through relative expression levels of GHR1, HSP70 and GPx gene in *T. tambroides* juveniles. Our findings indicated that the weight of *Tor tambroides* increased by 8.77 g/fish in probiotics treated group. In

probiotics treated group, HSP70 gene expression was up-regulated by 6.38-fold in liver at 38°C, whereas GPx gene expression was induced by 1.556-fold in kidney at 11°C. However, the expression of HSP70 and GPx genes were down-regulated in muscle tissue at control temperature by 0.21-fold and 0.247-fold respectively. The expression of GHR1 gene was not significantly different between control group (non-probiotics supplemented) and treated group (probiotics supplemented) in all tissues for all temperature condition, except for liver at 11°C. Overall, commercial diets supplemented with *B. subtilis* at  $10^8$  CFUg<sup>-1</sup> increased the growth rate and up-regulated in both growth immune related genes against temperatures stress in *Tor tambroides*.

Abstrak tesis yang dikemukakan Senat Universiti Malaysia Terengganu sebagai memenuhi keperluan untuk ijazah Sarjana Sains.

**KESAN PEMAKANAN PROBIOTIK DAN TEKAPAN SUHU TERHADAP  
PENGEKSPRESAN GEN BERKAITAN TUMBESARAN DAN IMMUNITI  
PADA MALAYSIAN MAHSEER (*TOR TAMBROIDES*)**

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**September 2015**

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*Tor tambroides* adalah kumpulan cyprinid penting yang mempunyai nilai komersial dan estetik yang tinggi sebagai makanan dan ikan hiasan. Walaubagaimanapun, tangkapan secara berlebihan dan degradasi habitat telah menyebabkan kemerosotan populasi *Tor tambroides* liar. Bagi memulihkan saiz populasi ikan ini, *Tor tambroides* telah dikultur tetapi didapati menunjukkan kadar pertumbuhan yang lebih perlahan berbanding ikan kelah yang hidup liar. Diet yang ditambah dengan probiotik dapat meningkatkan pertumbuhan dan imuniti organisma akuakultur. Dalam kajian ini, kami telah menjalankan kajian percubaan pemberian makanan selama 30 hari dengan menggunakan diet komersial yang ditambah dengan  $10^8$  CFUg<sup>-1</sup> *Bacillus subtilis* untuk mengkaji kesannya ke atas kadar pertumbuhan dan toleransinya terhadap tekanan suhu. Kesannya ditentukan melalui tahap pengekspresan relatif GHR1, HSP70 dan GPx gen pada juvenil *Tor tambroides*. Hasil penemuan kami menunjukkan bahawa berat *Tor tambroides* meningkat

sebanyak 8.77 g/ikan dalam kumpulan ikan yang dirawat dengan probiotik. Dalam kumpulan ikan yang dirawat dengan probiotik, ekspresi gen HSP70 didapati naik sebanyak 6.38 kali ganda dalam hati pada 38°C, manakala ekspresi gen GPx telah dirangsang sebanyak 1.556 kali ganda dalam buah pinggang pada 11°C. Walaubagaimanapun, pengekspresan gen HSP70 dan GPx didapati menurun di tisu otot pada suhu kawalan dengan masing-masing sebanyak 0.21 kali ganda dan 0.247 kali ganda. Pengekspresan gen GHR1 tidak jauh berbeza antara kumpulan kawalan (bukan ditambah dengan probiotik) dan kumpulan rawatan (ditambah dengan probiotik) dalam semua tisu pada semua keadaan suhu kecuali dalam hati pada 11°C. Secara keseluruhan, diet komersial ditambah dengan *Bacillus subtilis* di  $10^8$  CFUg<sup>-1</sup> didapati telah meningkatkan kadar pertumbuhan dan menaikkan pengekspresan kedua-dua gen imun dan pertumbuhan terhadap tekanan suhu pada *Tor tambroides*.