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Genetic Characterization of Two Mahseer Species (*Tor douronensis* and *Tor tambroides*) Using Microsatellite Markers from Other Cyprinids

(Pencirian Genetik dua Spesies Mahseer (*Tor douronensis* dan *Tor tambroides*) Menggunakan Penanda Mikrosatelit daripada Siprinid yang Berbeza)

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ABSTRACT

*This study examined the genetic characteristics of twenty-six microsatellite primers developed from three cyprinid fishes (*Cyprinus carpio *Linnaeus,* Barbus barbus *Linnaeus and* Barbonymus gonionotus *Bleeker) in two indigenous mahseer. The* Tor douronensis *Valenciennes were randomly collected from two locations in Sarawak (N=52), while* Tor tambroides *Bleeker were obtained from Peninsular Malaysia (N=56). A total of ten and twelve primers were successfully amplified producing four and five polymorphic loci in* T. douronensis *and* T. tambroides*, respectively. The number of alleles per locus ranging from 2 to 5 in* T. douronensis *and 2 to 7 in* T. tambroides. *A significant deviation from Hardy-Weinberg equilibrium (HWE) was observed at three loci (Barb37, Barb59 and Barb62) in one or more populations in* T. tambroides *while two loci (Barb37 and Barb62) were deviated in* T. douronensis *population of Batang Ai. Population structure analysis showed low level of inter-population genetic differentiation in both mahseer. Overall, the identified microsatellite loci should be useful in analysing* T. douronensis *and* T. tambroides *natural populations.*

Keywords: Cross-species study; genetic characterization; mahseer; microsatellites

ABSTRAK

*Kajian ini meneliti pencirian genetik dua puluh enam primer mikrosatelit yang dibentuk daripada tiga ikan siprinid (*Cyprinus carpio *Linnaeus,* Barbus barbus *Linnaeus and* Barbonymus gonionotus *Bleeker) ke atas dua ikan kelah indigenus. Ikan kelah* Tor douronensis *Valenciennes telah dipilih secara rawak dari dua tempat yang berbeza di Sarawak (N=52), manakala* Tor tambroides *Bleeker pula telah dikumpul secara rawak dari Semenanjung Malaysia (N=56). Sejumlah sepuluh primer berjaya diamplifikasi menghasilkan empat lokus polimorfik pada* Tor douronensis*; dan dua belas primer pada* Tor tambroides *dengan lima lokasi polimorfik. Nombor alel per lokus berjulat di antara dua hingga lima dalam* Tor douronensis *dan dua hingga tujuh dalam* Tor tambroides. *Penyimpangan daripada keseimbangan Hardy-Weinberg (HWE) yang signifikan telah dijumpai pada tiga lokus (Barb37, Barb59 dan Barb62) di dalam satu atau lebih populasi* T. tambroides *manakala dua lokus (Barb37 dan Barb62) mengalami penyimpangan dalam populasi* T. douronensis *dari Batang Ai. Analisis struktur populasi menunjukkan tahap perbezaan genetik yang rendah di peringkat inter-populasi dalam kedua-dua ikan kelah. Keseluruhannya, lokus mikrosatelit yang dikenalpasti berguna untuk menganalisis secara mendalam populasi semulajadi ikan* T. douronensis *dan* T. tambroides.

Kata kunci: Kajian spesies-silang; kelah; mikrosatelit; pencirian genetik

INTRODUCTION

The mahseer from the genus *Tor* Gray such as *Tor tambroides* Bleeker and *Tor douronensis* Valenciennes, are among the most valuable and highly priced cyprinid fish in Malaysia (Litis et al. 1997). The market price for mahseer is one of the highest due to their great taste, for example, the price of *T. douronensis* can reach above RM100/kg while *T. tambroides* reaches above RM400 (USD100)/ kg in the open market in Kapit, Sarawak (Ingram et al. 2005). Thus, fishes of the genus *Tor* have great potential for freshwater aquaculture industry (Ingram et al. 2005). In addition, the *Tor* fishes are also recognized as an excellent game fish, and have high demand in the ornamental fish industry due to their attractive colourations (Ng 2004).

Therefore, realizing the economic importance of the two mahseer and given their limited distributions and population size, studies on the population structure and level of genetic variations throughout their distribution range are required for effective management and conservation strategy of this important freshwater resource. Populations of these species are declining due to degrading environmental conditions by deforestation, logging and over fishing that may have disturb their natural habitat. In India matured male and female are very difficult to find for several species of mahseer such as *Tor putitora* Hamilton due to over fishing by sport anglers that crave only for large fishes (Patil & Lakra 2005).