



## 转基因鲤的生态安全检测

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### Evaluation of the Ecological Safety of Transgenic Carp by AFLP

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- 摘要
- 参考文献
- 相关文章

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**摘要** 以抚远的野鲤、松花江哈尔滨江段的鲤和养殖鲤作对照,对混有不同比例转大麻哈鱼生长激素基因鲤亲本的子一代的基因组进行扫描,评价其生态安全性.在64对AFLP引物中,选出10对扩增条带清晰的引物对对照组、1%实验组、10%实验组、25%实验组、50%实验组、60%实验组、H组和Y组8个群体的基因组扩增,得到了663个位点,每个群体的多态位点数目均大于50%,且随着转基因鱼亲本比例的上升,子代中多态性位点比例的数目在下降;计算了观测等位基因 $N_a$ 、有效等位基因 $N_e$ 、 $N_e$ 's基因多样指数 $H$ 、Shannon信息 $I$ 、群体内遗传相似度 $S$ 和遗传距离 $D$ 、群体间遗传相似度 $S$ 和遗传距离 $D$ 、群体间遗传分化度 $G_{st}$ 和基因流 $N_m$ ,并对8个群体进行了比较.结果显示:观测等位基因 $N_a$ 、有效等位基因 $N_e$ 、 $N_e$ 's基因多样指数 $H$ 和Shannon信息 $I$ 都是Y组最大,其次是对照组,H组最小,在5组含有不同比例转基因鱼亲本的后代中,随着转基因亲本的比例的上升,这4个指数呈下降趋势.群体间相似性 $S$ 和遗传距离 $D$ 显示:25%、50%和60%实验组在不同程度上与其它群体产生了分化,特别是60%实验组已经明显的超出了同一种群的范围,可见与60%实验组已经与其它实验组间产生了较大的差异.5个转基因实验组与H组和Y组的遗传分化度 $G_{st}$ 和基因流 $N_m$ 比较显示:群体间基因分化较大,基因流较小,随着转基因鱼亲本比例上升,子代群体中的遗传分化度增大,基因流下降.可以看出随着转基因亲本比例的增加,子一代的基因组呈一定的规律在变化,说明转基因对逃逸后对野生种群的影响是随着逃逸数量增大而增大的,应该防止高比例的转基因鱼逃逸到野生群体中,对野生群体的基因组造成污染.

**关键词:** AFLP 鲤 生态安全

**Abstract:** The genome of first filial generation, whose parents were carp with different rate of transferred *Oncorhynchus Suckley* growth hormone gene, were scanned to estimate its eco-security, using the wild carp of Fu-yuan, common carp of Songhua River of Harbin and cultured carp as control. Control group, 1% experimental group, 10% experimental group, 25% experimental group, 50% experimental group, 60% experimental group, H group and Y group were amplified with 10 pairs of AFLP primers. 663 locus were obtained. The numbers of poly-bonds locus were all more than 50% in every population. With the rate of transgenic parents increasing, the numbers of filial generation polymorphism locus descended. Number of alleles ( $N_a$ ), effective number of alleles ( $N_e$ ),  $N_e$ 's gene diversity ( $H$ ), Shannon's Information index ( $I$ ), genetic inter-group similarity ( $S$ ), genetic distance ( $D$ ), the coefficient of gene differentiation among populations within species ( $G_{st}$ ) and gene flow ( $N_m$ ) were calculated with PopGen32 software. Ten groups were compared. The results showed that the largest value of  $N_a$ ,  $N_e$ ,  $N_e$ 's gene diversity index ( $H$ ) and Shannon information index ( $I$ ) were all in Y group, and the second, in the control groups. The minimum were in the H group. In five filial generation experimental groups of transgenic parents of different rate, with the rate of trans-gene parents increasing, all the four indexes tended to descend. Genetic inter-group similarity ( $S$ ) and genetic distance ( $D$ ) showed that 25%, 50% and 60% experimental group were separated from other groups in different degree. Especially, the 60% experimental group was dramatically far away from the same group. It is thus evident that 60% experimental group had great difference with the others. The comparing result of the five trans-gene experimental groups, H group and Y group  $G_{st}$  and gene flow showed that gene differentiation was larger and gene flow was small. With the rate of trans-gene parents increasing, the  $G_{st}$  of filial generation increased and the gene flow descended. From those, it can be seen that the genome of the first filial generation changed in a certain regularity with the increase of parents transgenic rate. All of these

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illuminate that more transgenic fish escape, more influence to the wildlife population. Transgenic fish should be prevented from escaping to reduce the genome pollution of wildlife population.

**Key words:** AFLP *Cyprinus carpio* ecological safety

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