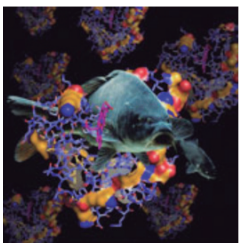

Aquainnova

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EUROCARP

Disease and Stress Resistant Common Carp: Combining Quantitative, Genomic and Proteomic and Immunological marker technologies to identify high performance strains, families and individuals

The Challenge

The common carp is the third most important farmed freshwater fish species in the world. Eastern European carp gene banks have been responsible for the selective improvement of carp for intensive and semi-intensive pond culture in Europe and their dissemination worldwide. Several serious disease problems such as Koi herpesvirus (KHV), and erythrodermatitis (Aeromonas salmonicida and A. hydrophila) threaten carp farming in many countries.

Selection in carp has tended to develop high performing but inbred strains for crossbreeding. The use of marker assisted selection to increase disease resistance is a strategy that has the potential to enhance genetic progress with breeding for increased disease resistance. Numerous studies on genetic variation in immune response in fish suggest that certain immune parameters may have some potential as practical markers for disease resistance. The inclusion of disease and stress resistance as traits within breeding programmes requires the use of modern quantitative and molecular genetic tools.

Specific (humoral antibody and antibody producing cells) and non-specific (lysozyme, macrophage function, blood cell counts) immune parameters may indicate disease resistance to viral or bacterial pathogens can be measured directly. Other genes can be identified using a proteomic approach. Comparison of protein expression in healthy and diseased tissue can pinpoint, which of the thousands of proteins are more or less active at any one time. This will lead to an understanding of the molecular basis of disease. Disease resistance has proved to be a difficult trait to assess and improve in fish – and direct challenges on potential broodstock run the risk of turning such fish into carriers.

Project Objective

The primary aim is to identify strains or families of carp, resistant to two serious pathogens, that can be used in future breeding programmes. The techniques developed by the project can be distributed world-wide where the diseases are endemic as a means of limiting the spread of the diseases.

Key Points

- Heritability estimates for viral and bacterial resistance and genetic correlation to performance traits will be assessed.
- Differences in gene expression within high and low, viral and bacterial, resistance families with and without challenge will be assessed
- Functional genomics, proteomics and gene mapping will identify candidate genes and QTLs (Quantitative Trait Locus) for resistant fish

EATiP *Thematic Area of Relevance*

TA1: Product Quality, Consumer Safety and Health
TA2: Technology and Systems
TA3: Managing the Biological Lifecycle
TA4: Sustainable Feed Production
TA5: Integration with the Environment
TA6: Knowledge Management
TA7: Aquatic Animal Health and Welfare
TA8: Socio-Economics and Management

Key Words

Carp, disease resistance, stress resistance, genomics, fish welfare

Project Information

Contract number:
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- Differences in serum/plasma protein expression and immunological parameters will also be assessed.
- Inclusion of both disease resistance and other major traits (e.g. harvest size) in selection indices will help to develop fish that are both disease resistant and grow well.

Output Highlights

New Stress resistant carp strains
The project developed new special strains of carp with improved disease and stress resistant carp and consumer qualities. This will have a positive impact on fish welfare and reduce the need for antibiotics. Industry will benefit too.

Analytical Methods
New generation of Carp-specific genetic markers and map were developed. This RTD protocol will allow for marker assisted selection and improve carp selection processes. The industry will benefit by a reduced reliance on antibiotic drug treatment.

Breeding Guidelines
A set of guidelines on how to breed carp for commercial production based on new knowledge will lead to improved carp strain selection with a reduced reliance on fidh drug treatment. A statistical method to apply in fish farming, science and selective breeding was also developed.

New knowledge
The project compiled an updated knowledge on the genetic resources of common carp in Europe. This information set will provide a firm basis for further works on carp genetics and breeding. Stocking the natural waters with indigenous carp strains will contribute to the sustainable management of European waters. The genetic diversity of common carp will further prove its importance in European fish farms and waters.

The Full Report:
For a comprehensive description of the research project, visit http://www.haki.hu/

Next Steps – Suggested Actions/Follow On

RTD

- The achieved results should be introduced into practice. The higher resistant families should be introduced into specially designed breeding programs, aiming at distributing resistant carp strains. The impact would be a safer and healthier production of this species with importance in Europe and in the world.

Knowledge transfer

- The published catalogue published during the project was not fully disseminated due to partial copyright problems. There is a need for the information obtained during the project to be fully exploited by the industry.