DISEASE RESISTANCE IN DIFFERENT CARP LINES

W.B. Van Muiswinkel, J. Komen, C.N. Pourreau, G. Houghton and G.F. Wiegertjes
Dept. of Exp. Animal Morphology & Cell Biology, Agricultural University, P.O. Box 338, 6700 AH Wageningen, The Netherlands

SUMMARY

The difference in skin allograft survival among heterozygous and homozygous gynogenetic carp (Cyprinus carpio) lines is supporting the idea that at least one major and several minor histocompatibility loci exist in fish. Moreover, differences in susceptibility to Aeromonas salmonicida infection among conventional and gynogenetic sibling groups were observed. It is suggested that multiple genes are involved in disease resistance of fish.

EXPERIMENTAL SET-UP, RESULTS AND DISCUSSION

The availability of inbred strains of fish is one of the requirements for studies on immunity and disease resistance in fish. For this purpose heterozygous gynogenetic carp were produced by fertilizing eggs with U.V.-irradiated sperm and by treating the resulting zygote with a cold shock as described by Nagy et al. (1978) and Komen et al. (1988). The temperature shock causes retention of the second polar body which allows the eggs to develop into normal diploid fry. Moreover, homozygous gynogenetic offspring were similarly produced by using a heat shock (40°C, 2 min) which suppresses the first mitotic division. Skin allografts exchanged among heterozygous gynogenetic carp exhibited prolonged survival with some allografts surviving for over 28 days. Furthermore a strong histocompatibility locus was seen to seggregate in this group. This observation is in agreement with other studies in gynogenetic carp using allo-antisera (Kaastrup et al., 1989). In contrast, skin allografts exchanged among homozygous gynogenetic siblings were all rejected within 14 days. New homozygous inbred strains were produced by gynogentic reproduction of homozygous female carps. All grafts exchanged among members of the same inbred strain were accepted. These observations provide evidence for the idea that in carp histocompatibility genes exist as at least one major locus and multiple minor loci, which are codominantly expressed.

Infectious diseases may have a devastating effect on fish populations kept in modern aquaculture systems. The impact of these health problems can be reduced by hygiene, medication or vaccination. This approach is successful in many, but not all cases. Another attractive approach is breeding for disease resistance (for review see Chevassus and Dorson, 1990). Most studies known so far are dealing with Salmonid fishes. Much less is known about genetic factors in Cyprinids. We observed a difference in complement activation among 5 carp groups differing in their susceptibility to erythrodermatitis, which is caused by Aeromonas salmonicida. Complement is certainly not the only factor involved in resistance to this bacterium. Unfortunately, it is too early to say which other factors are involved (e.g. regulation by histocompatibility gene products, B or T cell responses, phagocyte activation, antiproteases, transferrins). However, the inbred strains of fish, which are now available, will facilitate further studies in this area.

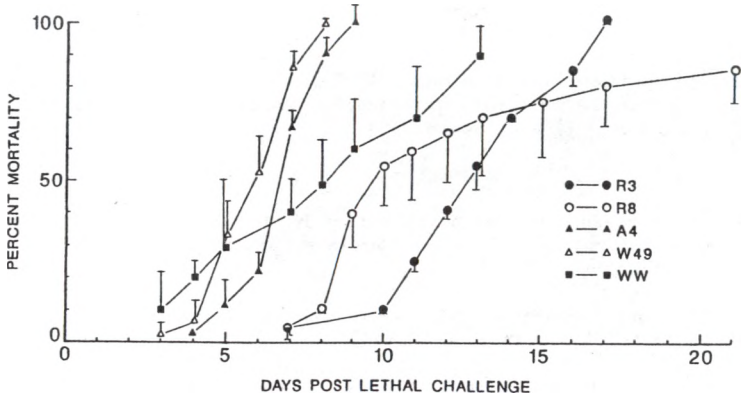

Figure. Cumulative mortality in sibling groups of carp after challenge by intradermal injection with Aeromonas salmonicida. R3= a Polish conventional line; R8= a Hungarian conventional line; A4= an Israeli gynogenetic line; W49 and WW= Dutch gynogenetic lines

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