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The lists of the mutants and strains of the medaka, common gambusia, silver crucian carp, goldfish, and golden venus fish maintained in the Laboratory of Freshwater Fish Stocks, Nagoya University

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The following is the descriptions of the mutants and strains of five species of freshwasher fishes maintained in the Laboratory of Freshwater Fish Stocks, Nagoya University. Detailed accounts for the traits of the Medaka mutants have been given (ref. 1, in Japanese).

The mutants and strains are welcome to the use by researchers outside Nagoya University. Those who wish to have them are requested to visit the Laboratory to carry them back; mailing of living fish is refused (in near future, the mailing system will be established). Only a small number of individuals for each mutant and strain can be supplied.

List 1. Mutants of the medaka, *Oryzias latipes*.

Among the mutants listed below, *Si* and *Va* are dominant to the wild type and *Da* is an incomplete dominant. Others are recessive. The *r* alleles are sex-linked, others are autosomal.

as : fin ray segments deleted here and there.

*B'** : some melanophores colorless.

b : melanophores colorless.

b^d : melanophores colorless at the larval stage and gradually change to black in adults.

b^{dl} : melanophores colorless at the larval stage and gradually change to dilute black in adults.

b^p : melanin formation delayed at the embryonic stage. Melanin in eyes reduced in adults.

b^v : black and dilute black melanophores in adults. ($B > b^v > b^d > B' > b^{dl} > b > b^p$)*

ci : the number of xanthophores decreased. The number of well-developed leucophores increased.

cm : melanin granules in melanophores always concentrated.

co : pigment granules in xanthophores always concentrated. Linked with *dx-2*.

co-2 : phenotype similar to *co* but not linked with *co*.

Da : double anal fins (dorsal fin resembles the anal fin). Caudal fin rhombic. In heterozygotes with wild type, dorsal fin large (the number of fin rays increased).

de : the number of melanophores decreased in adults.

df-1 : fin membrane deformed (fins folded) at the larval stage.

df-2 : phenotype similar to *df-1*.

df-3 : phenotype similar to *df-1*.

df-4 : phenotype similar to *df-1*.

df-5 : phenotype similar to *df-1*.

df-6 : phenotype similar to *df-1*.

di : pigment granules in xanthophores always dispersed. Linked with *wl*.

dl : melanophores dilute black throughout life.

dl-2 : phenotype similar to *dl*.

dm : pigment granules in melanophores and leucophores always dispersed.

dm-2 : phenotype similar to *dm* but not linked with *dm*.

dg : deposition of guanine reduced on the back of body cavity.

dx-1 : xanthophores dilute orange-red.

dx-2 : the same phenotype as *dx-1* but not linked with *dx-1*.

em : median fins (dorsal and anal fins) enlarged posteriorly (the number of fin rays increased).

fl : the number of leucophores decreased at the larval stage.

fl-2 : phenotype similar to *fl*.

fl-3 : phenotype similar to *fl*.

fl-4 : phenotype similar to *fl*.

fm : the number of melanophores decreased throughout life.

fm-2 : the number of melanophores decreased throughout life.

fs : dorsal and anal fins small (interneural and interhemal spins fused at bases).

*Aida (1921, ref. 2) used the gene symbols, *B, B'*, and *R* (*B* > *B'* > *b*, *R* > *r*). *B* and *R* do not imply that they are the dominant mutants but represent the wild type, and therefore *B* > *B'* > *b* and *R* > *r* are equivalent to + > *b'* > *b* and + > *r* according to the current usage of gene symbols, respectively. The symbols *B, B'* and *R* are still being widely used in the field of the Medaka genetics, in memory of the Aida's pioneering contribution to the Medaka genetics.

fu : vertebrae fused to form a short body.

fu-2 : vertebrae fused, short body.

fu-3 : phenotype similar to *fu-2*.

fu-4 : phenotype similar to *fu-2*.

fu-5 : phenotype similar to *fu-2*.

fu-6 : notochord bent wavily at the embryonic stage. Vertebrae fused to form a short body in adults. Inbreeding difficult. Maintenance is done by back-crosses (females often sterile).

fu-7 : phenotype similar to *fu-6*. Inbreeding easy.

gu : deposition of guanine in iridocytes reduced throughout life.

gu-3 : deposition of guanine in eyes reduced at the larval stage.

gu-4 : phenotype similar to *gu-3*.

gu-5, gu-6 : polymeric genes. Phenotype similar to *gu-3*.

gu-7 : deposition of guanine in eyes reduced at the larval stage, forming black-spotted eyes.

ha : auditory vesicle swollen at the larval stage. Inner ear deformed in adults. Swims in circuit.

ha-2, ha-3 : polymeric genes. Phenotypes similar to *ha*.

i : albino. Linked with *ci*.

i^b : melanin formation delayed at the embryonic stage. ($+ > i^b > i$)

i-3 : albino. No linkage with *i*.

if : partial defect of fin rays.

if-2 : phenotype similar to *if*.

il-1, il-2 : polymeric genes. Defect in guanine deposition in iridocytes except in body cavity and eye balls throughout life.

lf : no visible leucophores throughout life.

lf-2 : leucophores small in number and xanthophores partially lacking (sometimes white/orange-red variegated).

ml-3 : the number of leucophores increased at the larval stage.

mm : melanophores and leucophores, dendritic as in normal or non-dendritic.

mo : melanophores dilute brown and no visible leucophores in adults.

pc : polycysts in kidney.

pl : no pectoral fins throughout life.

r : xanthophores colorless.

r^d : xanthophores dilute orange-red. ($R > r^d > r$)*

ro : swims with rolling.

rs : scales deformed.

rs-2 : small scales.

rs-3 : almost no scales, only a few large ones.

Si : a pair of iridocyte spots on brain membrane absent.

sm : physiological color changes of melanophores slow.

Va : melanophores, leucophores and xanthophores sometimes absent. In homozygotes, embryos lethal.

vc : melanophores and leucophores sometimes absent. More dilute black than *Va*.

vl-1 : leucophores disappear 2 weeks after hatching and some leucophores reappear in adults.

vl-2 : leucophores disappear 2 weeks after hatching and a few leucophores in adults.

vl-3 : phenotype similar to *vl-2*.

wl : white leucophores at the larval stage.

wl-2 : phenotype similar to *wl*.

wy : vertebral column bent wavily.

List 2. Mutants in the common gambusia, *Gambusia affinis*.

cm : melanin granules in melanophores always concentrated.

va : melanophores sometimes colorless. Deposition of guanine in iridocytes reduced.

The *cm* and *va* genes are recessive to wild and are autosomal.

List 3. Mutants and strains of the silver crucian carp, *Carassius auratus langsdorfi*.

There are the bisexual type (♀ and ♂, 2n) and the unisexual type (♀, 3n or 4n) in the silver crucian carp. The unisexual type undergoes gynogenetic reproduction, but the strains are usually maintained by mating with gold fish males.

(1) Bisexual type

ne : net-like transparent scales deposition of guanine reduced.

ne^3 : some scales wholly transparent. ($+ > ne^3 > ne$). Autosomal.

(2) Unisexual type (females only)

ne-like strain : *ne*-type scales.

ne^3-like strain : ne^3-type scales.

ne^3-like^2 strain : progenies are mostly of the ne^3 type, but a few ones have only a few metallic scales.

List 4. Mutants and strain of the gold fish, *Carassius auratus*.

m, s : albino. Reside on different loci (dominant epistasis, $M > S$). Derived from thirty albino gold fish transferred to our laboratory from New York in 1965. They are thought to have originally come

*For *R*, see the foot note on page 1.

from Hong Kong. Gene analyses were done by Yamamoto (*m, s*) (3) and Kajishima (*p, c*) (4), independently.

In 1989, one pair of albino gold fish were purchased from a pet shop in Nagoya. They had been imported from China. This albino strain is maintained in this laboratory. The progenies of the crosses between the New York albino and the Nagoya albino were all albino.

List 5. A strain of the golden venus fish, *Aphyocypris (Hemigrammocypris) rasborella.*

Five females and one male having net-like transparent scales were collected in Shippo near Nagoya in 1991–1992. The progenies of the crosses between net-like transparent females and a male were all transparent fish. The F_1 progenies of the crosses between transparent females and normal males were all normal.

References

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