

POECILIID RESEARCH

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Opinion

What we expect from Poeciliids for the future in terms of evolution

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Abstract. This opinion paper discusses on a predictable evolution and diversification of Poeciliid fish. This group of tropical fish must be fully understood. Poeciliids are our wonderful pets, a real challenge for biologists, a good tool to understand sex determination and sex related evolution of animal behavior and traits, and a potential harm to environment. They should not be released in warm waters and hot springs. Return with your Poeciliids to a pet store if you are bored of them.

Key Words: Poeciliid fish, evolution, sex chromosomes, behavior, diversification, adaptative radiation.

Guppies, mollies and platys are among the most popular aquarium fishes. Many Poeciliid breeders and scientists use this group of fish to understand the genetics of color and sex (Petrescu-Mag et al 2008a, 2010; Pășărin 2010; Shaddock 2011).

In the wild, the Poeciliids are known as a group of fish able to conquer a wide range of aquatic environments, from brackish to fresh water, from Mediterranean or thermal temperate springs to hot ecuatorial waters, from stagnant to slow flowing waters at wide range of altitude. This adaptation to various environmental conditions brought to these fishes also a great phenotypic plasticity (Petrescu-Mag et al 2008b). On the other hand, viceversa, the phenotypic plasticity made possible the evolution of an extraordinary ability to adapt to so many types of aquatic environments. The phenotypic plasticity of Poeciliid fish goes hand in hand with their behavioral plasticity as regards forage, sexual selection and antipredator sequences. All these behavioral and morphological traits evolved and continue to evolve together (Lindholm et al 2004). For example, some guppy populations from Trinidad developed a rapid behavioral ability to escape from predators (O'Steen et al 2002). Such mechanisms start at the molecular level and involve sex chromosomes, sex linkage, genetic recombination and supression, mating preferences or strategies, color and morphs (Lindholm & Breden 2002; Petrescu-Mag & Bourne 2008; Petrescu-Mag 2008, 2009).

Each Poeciliid population has its own history and therefore each population has its own ecology, evolving permanently function of changes in its environment. Reproductive isolation of Poeciliid populations due to geographic or behavioral factors mediated diversification and speciation. *Poecilia wingei* Poeser, Kempkes & Isbrücker, 2005, *P. parae* Eigenmann, 1894 and *Micropoecilia picta* (Regan, 1913) are three examples of species or subspecies which undergone a recent process of speciation or morphs' diversification (Breden et al 1999; Breden & Bertrand 1999; Poeser et al 2005). This plasticity of Poeciliids is also illustrated by the huge number of aquarium varieties; they were obtained by selection and crossbreeding. Crossbreeding involves interspecific or intraspecific hybridization while artificial selection is required permanently for maintaining of extreme color and fin traits in aquarium strains.

In both aquarium or in the wild, independent and divergent evolution of Poeciliid populations is illustrated also by the multiple and rather contemporary sex-determination mechanisms and sex chromosomes systems found. For example, in some natural and

polyphyletic populations of platyfishes, *Xiphophorus spp.*, even three sex chromosomes are present: X, Y and W (Kallman 1973, 1984) while in genus *Poecilia* both XX-XY and ZZ-ZW sex-determination mechanisms can be found. That means different sex chromosomes systems emerged independently in the same time in different platyfish subpopulations. Comparatively, while in platyfishes the sex chromosomes are under differentiation, in guppies, *P. reticulata* Peters 1859, the sex chromosomes X and Y are clear differentiated and Y-linked sequences play an important role in the evolution of their behavior and ecology (Traut & Winking 2001).

All these findings among Poeciliid fishes show us they are a group under full process of adaptative radiation (Figure 1). Animal evolution as a whole is an alternance of adaptative radiations and long periods of specialization. Extreme specialization is most often the main cause of animal taxa extinction, while adaptative radiation reflects and/or predicts on a large extent speciation.

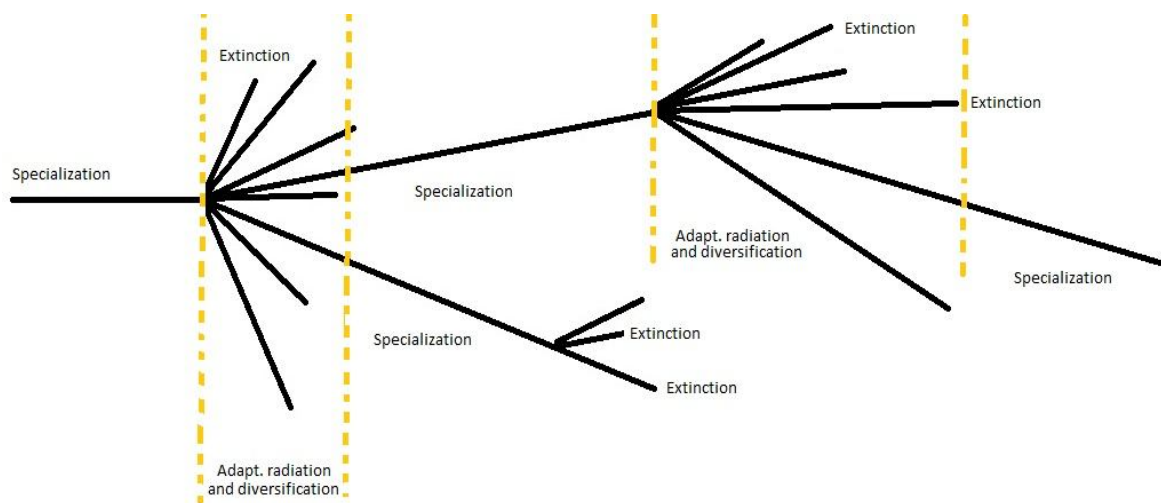


Figure 1. Alternation of adaptative radiation with specialization in evolution of animals (original).

Speciation is often accompanied by invasive potency. This prediction is already on its way to become reality: *Gambusia*, *Poecilia* and *Phalloceros caudimaculatus* (Hensel, 1868) are known as potential threat to many native, phylogenetically old and narrow specialized fish species (Allen 1989; Rowley et al 2005; Pășărin et al 2007; Iacob & Petrescu-Mag 2008).

Conclusion. Poeciliid fish must be fully understood. They are our wonderful pets, a real challenge for biologists, a good tool to understand sex determination and sex related evolution of animal behavior and traits, and a potential harm to environment. They should not be released in warm waters and hot springs. Please send back your Poeciliids to a pet shop if you are bored of them.

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References

- Allen G. R., 1989 Freshwater fishes of Australia. T.F.H. Publications, Inc., Neptune City, New Jersey.
- Breden F., Ptacek M. B., Rashed M., Taphorn D., Figueiredo C. A., 1999 Molecular phylogeny of a live-bearing fish genus *Poecilia* (Poeciliidae: Cyprinodontiformes). *Molecular Phylogenetics and Evolution* 12: 95-104.
- Breden F., Bertrand M., 1999 A test for female attraction to male orange coloration in *Poecilia picta*. *Environmental Biology of Fishes* 55: 449-453.

- Iacob, M., Petrescu-Mag I. V., 2008 [Inventory of non-native species of freshwater fish in Romania]. *Bioflux*, Cluj Napoca, 89 pp. [In Romanian]
- Kallman K. D., 1973 The sex-determining mechanism of the platyfish, *Xiphophorus maculatus*. In: Schröder J. H. (ed.) *Genetics and mutagenesis of fish*. Springer, Berlin Heidelberg New York, pp 19-28.
- Kallman K. D., 1984 A new look at sex-determination in poeciliid fishes. In: Turner B. J., (ed.) *Evolutionary genetics of fishes*. Plenum Press, New York, pp 95-171.
- Lindholm A., Breden F., 2002 Sex chromosomes and sexual selection in poeciliid fishes. *American Naturalist* 160: S214-S224.
- Lindholm A., Brooks R., Breden F., 2004 Extreme polymorphism in a Y-linked, sexually selected trait. *Heredity* 92: 156-162.
- O'Steen S., Cullum A. J., Bennett A. F., 2002 Rapid evolution of escape ability in Trinidadian guppies (*Poecilia reticulata*). *Evolution* 56(4): 776-784.
- Păsărin B., 2010 The Pricopian «gene theory of sexuality» is just a hypothesis, but good enough to explain the sex determination in fish. *AACL Bioflux* 3(2): 141-150.
- Păsărin B., Gorgan L., Bura M., Botha M., Petrescu-Mag I. V., 2007 The invasive potential of the exotic guppyfish (*Poecilia reticulata* Peters 1859) in temperate zone. *Studia Universitatis Babeş-Bolyai - Ambientum* 1-2: 179-187.
- Petrescu-Mag I. V., 2009 Winge's sex-linked color patterns and SDL in the guppy: genes or gene complexes? *AACL Bioflux* 2(1): 71-80.
- Petrescu-Mag I. V., 2008 [Biophysiological characterization of *Poecilia reticulata* and its particularities]. *ABAH Bioflux*, Pilot (b): 1-56. [In Romanian]
- Petrescu-Mag I. V., Boaru M. A., Hărşan R., Petrescu-Mag R. M., 2008a Genetic basis of resistance to stress in fishes. *Molecular and classical investigations in a few model organisms*. *AACL Bioflux* 1(1): 99-110.
- Petrescu-Mag I. V., Bourne G. R., 2008 Crossing-over between Y chromosomes: another possible source of phenotypic variability in the guppy, *Poecilia reticulata* Peters. *AACL Bioflux* 1(1): 1-10.
- Petrescu-Mag I. V., Lozinsky L. R., Csep L., Petrescu-Mag R. M., 2008b Vegetation and predators mediate color pattern frequencies in *Poecilia sphenops* Valenciennes. *AACL Bioflux* 1(1): 51-61.
- Petrescu-Mag I. V., Păsărin B., Todoran C. F., 2010 Metallurgical, agricultural and other industrial related chemical pollutants: biomonitoring and best model organisms used. *Metalurgia International* 15(Sp.iss.9): 38-48.
- Poeser F. N., Kempkes M., Isbrücker I. J. H., 2005 Description of *Poecilia (Acanthocephalus) wingei* sp from the Paría Peninsula, Venezuela, including notes on *Acanthocephalus* Eigenmann, 1907 and other subgenera of *Poecilia* Bloch and Schneider, 1801 (Teleostei, Cyprinodontiformes, Poeciliidae). *Contributions to Zoology* 74(1/2). Available online at: <http://dpc.uba.uva.nl/ctz/vol74/nr01/art07>
- Rowley J. J. L., Rayner T. S., Pyke G. H., 2005 New records and invasive potential of the poeciliid fish *Plalloceros caudimaculatus*. *New Zealand Journal of Marine and Freshwater Research* 39: 1013-1022.
- Shaddock P., 2011 Deciphering the Galaxy Guppy phenotype. *AACL Bioflux* 4(1): 52-71.
- Traut W., Winking H., 2001 Meiotic chromosomes and stages of sex chromosome evolution in fish: zebrafish, platyfish and guppy. *Chromosome Research* 9: 659-72.

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