

Genetic basis of females preference for male color patterns that are specific to their own population

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Abstract. Studies performed to guppy fish, *Poecilia reticulata* Peters, 1859 have succeeded in explaining why females often prefer the male which has a color pattern that is typical to the population they belong to, when they have more options in mate choice. In the region where the sex-determining locus is located, where genetic recombination is restricted, sexually antagonistic genes tend to accumulate. If the attractive male traits are linked to Y chromosome in the guppy, the female preference (which is a behavioral trait) is linked to X chromosome. Subsequent, but seldom, recombination events of attractive male characters from Y to the X would create physical linkage between attractive male trait and female preference. Such a linkage of attractive male traits and female preference explain why females express very often a marked preference for males with a color pattern specific to their own population.

Key Words: mate choice, mate preference, sexual selection, sex-chromosomes.

In the case of many tropical fish species, a sexual preference of individuals for a partner of the same variety or population can be observed on one side (*Symphysodon discus* Heckel, 1840; *Pterophyllum scalare* (Schultze, 1823); findings based on direct observation). On the other side, in the guppy, *Poecilia reticulata* Peters, 1859 (Figure 1), there was observed both a sexual preference for conspicuous color patterns (in some populations) (Mag & Bud 2006) and a sexual preference for less conspicuous color patterns (in other populations) (Houde 1997), as well as a pronounced preference for very rare or variable color patterns (Brooks & Endler 2001). The individual's preference for the mating partner appears to be, in many cases, genetically encoded and correlated with predation risk in the ecosystem (Petrescu-Mag et al 2008).

Therefore, mating partners will adopt physical (color pattern, shape and size of the fins) and behavioral tactics (courtship behavior; mating strategies) to suit the preference criteria (Petrescu-Mag 2007a, b).

Studies performed to guppy fish have succeeded in explaining why females often prefer the male which has a color pattern that is typical to the population they belong to (when they have more options in mate choice).

Guppy fish has a sex-determination mechanism of *Drosophylla* type, with heterogametic male (XY) and homogametic female (XX). Their sex chromosomes are genetically and cytogenetically differentiated (Nanda et al 1990, 1992; Traut & Winking 2001; Oroian 2015; Kottler & Schartl 2018).



Figure 1. Experimental tank with guppy females (*P. reticulata*).

In the region where the sex-determining locus is located and where genetic recombination is restricted, sexually antagonistic genes (i.e., genes that are beneficial to one sex but detrimental to the other sex) tend to accumulate (Lindholm & Breden 2002). The recombination frequencies of genes on sex-chromosomes increase with the increased distance of a gene from the sex-determining locus (Lindholm & Breden 2002).

In the guppy case, sexually antagonistic genes are genes encoding conspicuous color patterns, specific to guppy males. Conspicuous color patterns would be detrimental to females in high predation risk guppy populations, because such patterns make the females more visible and expose them to predation risk. Due to restricted rate of recombination between X and Y close to the region of sex-determining locus, genes that are detrimental to females cannot be expressed in female individuals, which are homogametic, having no Y chromosome (Rice 1987).

If the attractive male traits are linked to Y chromosome in the guppy, the female preference (which is a behavioral trait) is linked to X chromosome (Lindholm & Breden 2002). Subsequent, but seldom, recombination events of attractive male characters from Y to the X would create physical linkage between attractive male trait and female preference.

Such a linkage of the attractive male trait and female preference explain why females express very often a marked preference for males with a color pattern specific to their own population.

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