Histology and genetic determination of sex-inversion in *Coris julis (L.)*

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Résumé: Chez *Coris julis*, le changement du sexe des femelles en mâles secondaires confirmé par l'analyse histologique des gonades en transition doit être déterminé par un mécanisme chromosomal puisque les mâles primaires sont hétérogomes. Cependant, la fonction biologique des mâles primaires n'est pas connue actuellement: Quoique leur testicules soient plus grandes que celle des mâles secondaires et montrent une spermatogénèse active, aucune copulation avec des femelles ni aucun comportement particulier correspondant ne fût observé sous l'eau.

Zusammenfassung: Der Geschlechtswechsel von Weibchen zu sekundären Männchen bei *Coris julis* wird durch die histologische Analyse der Gonaden in der Umwandlung bestätigt. Diese muss chromosomal determiniert sein, weil primäre Männchen heterogametisch sind. Die biologische Funktion der primären Männchen ist noch unklar: obwohl ihre Hoden deutlich grösser sind als diejenigen von Sekundärmännchen und eine aktive Spermatogenese zeigen, wurde weder eine Kopulation mit Weibchen noch Kopulationsverhalten unter Wasser beobachtet.

The development of the sex-linked morphological features in *Coris julis* by sex-inversion is an important factor in its territorial behaviour and therefore in its relation to the substrate. Is sex-inversion induced by environmental factors stimulating a sexually mature female to change its sex? Is sex-inversion genetically determined?

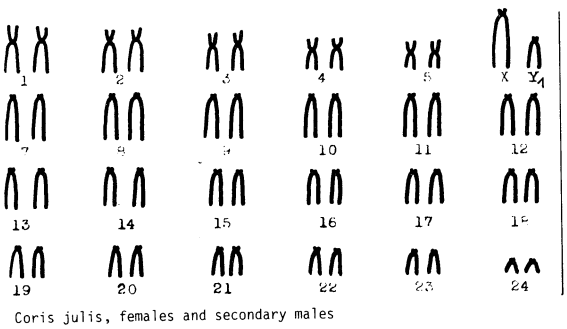
Protogynous sex-inversion among *Perciformes* is a common phenomenon. The histological study of the gonads during sex-inversion in *Coris julis* has corroborated the basic concept that *Coris julis* is a diandric species with primary and secondary males. The sex-inversion from female to secondary male is correlated to some extent only with a change of colour pattern. Specimens with an intermediate coloration (transition from the "giofredi-risso (brown-white)" to the "julis (turquoise)"-livery) have gonads which are in a transitional stage. In such gonads the ovarian tissue undergoes degeneration to varying degrees. During the same time period testicular tissue starts its development from a region of germinal cell clusters adjacent to the former ovarian wall. Sex-inversion of females to secondary males occurs at the end of the propagation period, i.e. middle of September to October. However, some animals have been observed undergoing sex-inversion in July.

The presence of deutogonian cells in all females indicates that every female possesses the potential to undergo sex-inversion. Maybe all females having grown to a certain size change their sex.

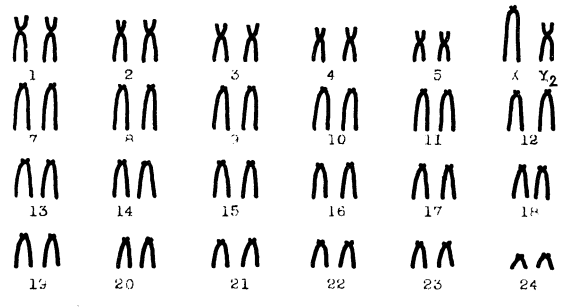
According to Reinboth (1961), the testes of both primary and secondary males seem to be active as established by artificial insemination experiments. But testes in primary males are significantly larger than in secondary ones and show active intact spermatogenesis. The size of the testes within different secondary males however varies greatly what could represent different developmental stages. However, the biologic function of the primary males is not understood at present: No mating behaviour in primary males nor mating between primary males and females was observed under water.

In order to study the genetic determination of sex-inversion, cytogenetic preparations from somatic cells of female *Coris julis* as well as from primary and secondary males were made. The modal chromosome number was 48 in all individuals. Karyotype analyses revealed that females and secondary males have 10 metacentric and 38 acrocentric chromosomes while primary males possess 11 metacentric and 37 acrocentric chromosomes. Thus, primary males are heterogametic. For technical reasons it cannot yet be confirmed that the females and secondary males were homogametic; they might also be heterogametic. This needs further investigation.

Reference: Reinboth, R., 1961, Natürliche Geschlechtsumwandlung bei aktiven Teleostiern, Zool. Anz. Suppl. 24, 259-262.



Coris julis, females and secondary males



Coris julis, primary males