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ATTI ACCADEMIA NAZIONALE DEI LINCEI  
CLASSE SCIENZE FISICHE MATEMATICHE NATURALI  
**RENDICONTI**

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**Karyological and genetic data on the planarian  
*Dugesia sanchezi* from Chile**

*Atti della Accademia Nazionale dei Lincei. Classe di Scienze Fisiche,  
Matematiche e Naturali. Rendiconti, Serie 8, Vol. 64 (1978), n.3, p. 299–301.*

Accademia Nazionale dei Lincei

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### SEZIONE III

(Botanica, zoologia, fisiologia e patologia)

**Zoologia.** — *Karyological and genetic data on the planarian Dugesia sanchezi from Chile* (\*). Nota (\*\*) del Socio MARIO BENAZZI.

RIASSUNTO. — *Dugesia sanchezi* si riproduce sia per via sessuata, sia per scissione. Viene determinato il corredo cromosomico della specie ( $2n = 16$ ,  $n = 8$ ) e dimostrato mediante analisi del comportamento riproduttivo dei nati da uova che la scissiparità è controllata da fattori genetici.

The aim of the present paper is to give a preliminary account of investigations carried out on *Dugesia sanchezi* Hyman, 1959, a fresh-water planarian belonging to the subgenus *Girardia* Ball, 1974, which comprises numerous species distributed in North, Central and South America. *D. sanchezi* was first collected by Dr. P. Sanchez in coastal hillside streams and brooks of Central Chile; he considers that the Rio Mapocho, in the Province of Santiago, might be designated the type locality (cf. Hyman, 1959). This planarian reproduces sexually and the stalked capsules are readily found in nature and also readily laid in laboratory cultures; however, Dr. Sanchez observed that the worms may undergo the usual transverse fission behind the pharynx, and both fragments regenerate (cf. Hyman, *loc. cit.*, p. 7).

In April 1976, Prof. Ivonne Hermosilla Bonvallet of the University of Concepcion and Dr. Tomás Cekalovic, Curator of the Museum, sent me living specimens and cocoons of a planarian that I was able to identify as *D. sanchezi*; after a period of laboratory culture I could also confirm Sanchez's observations on the reproductive modalities.

Fissioning in planarians is a topic to which I have paid attention since the beginning of my studies and in recent years I have investigated the genetical bases of the phenomenon, particularly in the species group *Dugesia gonocephala* s.l. An analysis of fissioning in *D. Sanchezi* therefore appeared desirable and the first results have confirmed that genetic factors are involved also in this species.

However, before any genetical research a karyological investigation was necessary, because in the species of the subgenus *Girardia* different chromosome complements have been found, some of which are in apparent connection with the reproductive behaviour. I summarize the data now available (for references see Benazzi and Benazzi Lentati, 1976).

(\*) Istituto di Zoologia e Anatomia comparata dell'Università di Pisa. Ricerche finanziate dal Consiglio Nazionale delle Ricerche.

(\*\*) Presentata nella seduta dell'11 marzo 1978.

*D. tigrina* (Girard), the most widespread planarian in America, also migrated to Europe, possesses a complement of  $2n = 16$ ,  $n = 8$ , but the somatic cells of fissiparous populations include diploid and triploid (24 chromosomes) sets which are present in the same individual. *D. dorotocephala* (Woodworth), common in the U.S.A. has  $2n = 16$ ,  $n = 8$ ; the diploid set occurs also in most fissiparous populations, two of them, however, being triploid. On the other hand, a *dorotocephala*-like planarian from Sabino (Arizona), which multiplies exclusively by fission, has a complement of 8 chromosomes, and two sexual species: *D. arizonensis* Kenk, 1975 and *D. jenkinsae* Benazzi and Gourbault, 1977, which are closely related to *dorotocephala*, have  $2n = 8$ ,  $n = 4$ . This complement is also shared by *Neppia shubarti* (Marcus), a South American species attributed by Marcus to the genus *Cura*, then transferred by Ball (1974a) to the genus *Dugesia* subg. *Girardia* and successively (Ball 1974b) to the new genus *Neppia*. Finally I mention *D. anceps* Kenk (*nom. nov.* of *Planaria dubia* Borelli, 1895), a species from Argentina reproducing only sexually, which has  $2n = 16$ ,  $n = 8$ .

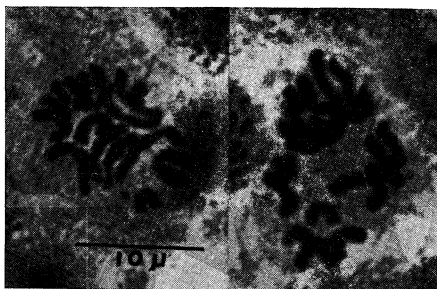


Fig. 1. - *Dugesia sanchezi*: metaphase chromosomes of two somatic cells.

In *D. sanchezi* I have found  $2n = 16$ ,  $n = 8$  with a karyotype containing meta- and submetacentric chromosomes (Fig. 1); in sexual specimens gametogenesis is normal and in the fissiparous individuals the diploid complement of 16 chromosomes appears to be constant: no heteroploid variations seem to arise in correlation with asexual reproduction.

However, the genetic control of fissioning has been proved by its transmission through sexual reproduction. In fact, most of the offspring born from the cocoons become sexual, but a few undergo transverse fission and give rise to asexual strains. This behaviour corresponds to that found in the planarians of the *gonocephala* group and demonstrates that the reproductive modalities are not determined by external factors: effectively, offspring reared in identical laboratory conditions become either sexual or fissiparous, this in all probability depending on their genetic constitution.

In my research on the *gonocephala* group (Benazzi, 1974) I have attempted an analysis of the fission-controlling factors, reaching the conclusion that these factors are located in the chromosomes and presumably correspond to Mendelian genes. Great differences exist, among the various populations,

in the ratio between sexual and asexual specimens, as well as in the fertility of the specimens which become sexual after a phase of asexual reproduction (ex-fissiparous specimens); these differences may be tentatively attributed to variations in the number or in the penetrance of the fission-controlling factors. A population from Castello Pino (Corsica) that I have been working on for many years has given the best results: on crossing sexual specimens chosen at random from the laboratory culture I obtained offspring in a ratio of fissiparous to sexual (110:98) of 1.1:1 which is near to 1:1 (the chi square test shows that the difference is not significant). This segregation suggests that Mendelian genes are involved in establishing sexual vs. asexual reproduction, although the data till now obtained do not permit a reliable factorial analysis.

A segregation occurs also in *D. sanchezi*, but the ratio between sexual and asexual descendents is very different. In the past year I have reared in separate vials all cocoons laid by the sexual specimens and checked the behaviour of the offspring: about 105 of them have reached sexuality while only 5 have undergone fission.

I am not able to offer an explanation for this result, which requires more extensive data. It is worth noting that the asexual specimens divide frequently so that their number increases rapidly. A few of them, however, attain the sexual state and the reproductive behaviour of their offspring will be very useful to my research.

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