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Biologia. — *Different relationship between egg and sperm in the pseudogamy of planarians according to the type of oogenesis, synaptic or asynaptic* (*). Nota (**) di GIUSEPPINA BENAZZI LENTATI, presentata dal Socio M. BENAZZI.

RIASSUNTO. — I biotipi poliploidi pseudogamici della planaria *Dugesia lugubris* s.l. presentano un diverso modello di pseudogamia (degenerazione dello spermio entro l'uovo oppure sua eliminazione con un polocita) a seconda che l'ovogenesi è asinaptica o sinaptica. I discendenti poliploidi dell'incrocio fra il biotipo diploide, che è sempre meiotico ed anfimittico, ed il biotipo poliploide ad ovogenesi asinaptica presentano ovogenesi asinaptica oppure sinaptica. Anche fra i discendenti dell'incrocio fra il biotipo diploide ed il biotipo poliploide ad ovogenesi sinaptica compaiono individui poliploidi ad ovogenesi sia sinaptica che asinaptica. In alcuni di questi ibridi viene pure trasmesso dallo spermio dell'individuo pseudogamico il carattere pseudogamia, ma la modalità con cui questa si realizza non corrisponde a quella propria del biotipo paterno, poiché si ha sempre la degenerazione dello spermio in tutti gli ovociti asinaptici e la sua eliminazione in tutti gli ovociti sinaptici.

Esiste quindi una peculiare interazione fra i fattori della pseudogamia e quelli che controllano il tipo di ovogenesi.

The pseudogamic polyploid planarians of the "*Dugesia lugubris* group" and "*D. gonocephala* group" present a different mode of pseudogamy according to the type of oogenesis, meiotic or ameiotic. This is particularly evident in the planarians of the first group, and various observations have already been made in this respect. In the two natural biotypes (1) with asynaptic and ameiotic oogenesis (biotypes C and D) the sperm, after penetrating the oocyte, does not transform into pronucleus; it approaches the female spindle and builds its own spindle which seems to join that of the female, but then it slowly degenerates. On the contrary, in the natural biotype with synaptic and meiotic oogenesis (biotype B) the sperm seems to initiate evolution in the pronucleus, since it swells and turns into distinct filaments; it builds its own spindle, but it has not yet been possible to ascertain whether this spindle joins the female one; however the sperm enters into contact with the cytoplasmic zone which will form the polocyte; its filaments seem to stretch in the same direction as the fibres of the spindle, just as if the centromeres were attracted towards the external pole of the latter. Finally it is expelled with the polocyte (in most cases with the first polycite) (fig. 1 *a*). The sperm behaves actively in this expulsion process, as shown by experiments effected with strongly irradiated

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(1) For further explanations regarding the various biotypes of these planarians and previous research on the oogenesis of hybrids, see: Benazzi, 1957; Benazzi Lentati, 1970.

sperms (15,000–20,000 r) which are not expelled, but degenerate in the egg (fig. 1 *b*). It is therefore evident that the relationships between egg and sperm are different in synaptic oocytes and asynaptic ones.

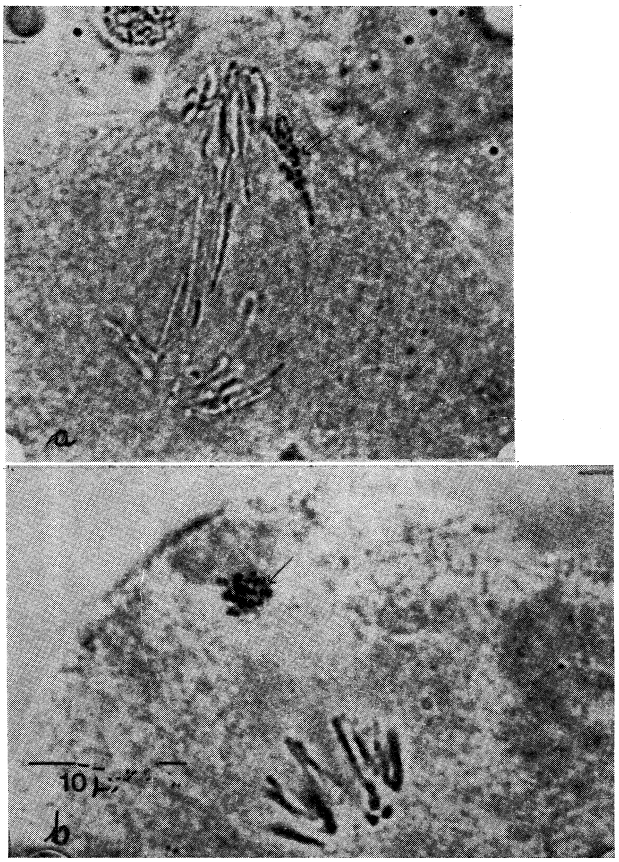

Fig. 1. – Two oocytes of the polyploid synaptic biotype: *a*) egg activated by a normal sperm, which is expelled with the polocyte (arrow). *b*) egg activated by an irradiated sperm which degenerates in the cytoplasm (arrow). Both oocytes are examined in a hanging-drop, a method which permits to observe the exact position of the sperm chromosomes.

Research effected on hybrids of the various biotypes of *D. lugubris* s.l., has emphasized this relationship between type of maturation and pattern of oogenesis. In fact, from the cross between the amphimictic diploid synaptic biotype (biotype A) acting as female and the two pseudogamic asynaptic polyploid biotypes, it is possible to obtain pseudogamic polyploid offspring which are synaptic; however pseudogamy manifests itself with sperm expulsion and not with sperm degeneration as on the contrary occurs in the biotypes which acted as male in the initial cross. On the basis of these results I have

proposed the hypothesis of an interaction between the factors which control the mode of pseudogamy (sperm expulsion or sperm degeneration) and those which regulate the type of maturation of the egg (with synapsis and meiosis or with asynapsis and ameiosis) (Benazzi Lentati, 1965; 1966).

The observations reported in this paper represent the verification of this fact. The hybrids which gave these new data come from the cross between biotype A, amphimictic diploid synaptic, acting as female, and biotype B also synaptic, but triploid in the soma and hexaploid in the oocytes and pseudogamic. The F_1 consisted of amphimictic diploid individuals, most of which with synaptic oocytes (four bivalents) and a small proportion (about 5 %) with partially asynaptic oocytes (with bivalents and univalents) (2).

From crosses between these individuals with partially asynaptic oocytes, we have obtained individuals, tetraploid in the soma and in the oocytes, which are completely asynaptic. The appearance of polyploid individuals is due to the presence " of chromosome set doubling factors " transmitted from the triplo-hexaploid biotype which acted as male in the initial cross (Benazzi Lentati and Mezzani, 1974). The latter biotype, as we have already mentioned, is pseudogamic and has also transmitted to the offspring of an amphimictic mother the factors which control this type of development. However, pseudogamy appeared only in the subsequent polyploid generations with asynaptic oocytes and in a way which deserves to be emphasized. In fact, it does not manifest itself with the expulsion of the sperm (as in the triplo-hexaploid synaptic biotype which acted as father in the initial cross), but with the degeneration of the sperm, as occurs in the asynaptic oocytes of the natural biotypes.

I think therefore that from these results the peculiarity of the pseudogamy character clearly emerges; it manifests itself in the offspring in a mode which may differ from that of the parent which has transmitted it, appearing to be controlled also by the type of oogenesis, synaptic or asynaptic, and therefore by the different relationship between egg and sperm.

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(2) I attributed this unexpected appearance of asynapsis to the presence in both biotypes of factors for female asynapsis, which however does not appear in the cross *inter se*, but which becomes manifest only after the union of the genomes of the two biotypes (Benazzi Lentati, 1968).