Atti Accademia Nazionale dei Lincei

Classe Scienze Fisiche Matematiche Naturali

Rendiconti

Mario Benazzi, Jaime Baguñá, Rafael Ballester

First report on an asexual form of the planarian Dugesia lugubris s.l.

Atti della Accademia Nazionale dei Lincei. Classe di Scienze Fisiche, Matematiche e Naturali. Rendiconti, Serie 8, Vol. **48** (1970), n.2, p. 282–284.

Accademia Nazionale dei Lincei

<http://www.bdim.eu/item?id=RLINA_1970_8_48_2_282_0>

Zoologia. — *First report on an asexual form of the planarian* Dugesia lugubris *s. l.* Nota di MARIO BENAZZI (*), JAIME BAGUÑÁ (**) e RAFAEL BALLESTER (**), presentata (***) dal Corrisp. M. BENAZZI.

RIASSUNTO. — Viene per la prima volta segnalata una forma scissipara di *Dugesia lugubris* s.l. Il reperto appare interessante poiché questa planaria, pur essendo dotata di alta capacità rigenerativa, era stata fino ad ora ritenuta incapace di moltiplicazione agamica.

We refer to a finding that, in the reproductive biology of fresh water Triclads, is new and unexpected, i.e. the existence of a fissiparous form of *Dugesia lugubris* (1).

Asexual reproduction is a well-known phenomenon in various planarians and, except in very few species, consists in an architomic mechanism: the animal splits transversely into pieces in which the new organs regenerate only after fission is completed. It is, therefore, clear that fissioning can occur only in planarians which have a high regenerative power. This condition, if necessary, is not however sufficient, and in fact, there are some species, e.g. *Dugesia lugubris*, which although they may regenerate rapidly, never show asexual reproduction.

The inability to propagate by fission of this planarian is well known and has recently been emphasized by Brøndsted [1]: " ...there remains the curious fact that several species with high regenerative power and rich in neoblasts, e. g. *Dugesia lugubris*, do not propagate by fission " (pag. 167). Benazzi, who for more than 30 years has been studying specimens of *D. lugubris* from many different European localities, has never found, either in field or in laboratory cultures, even one case of asexual reproduction.

It is, therefore, very interesting to be able to refer to a race, ascribable to this species, which reproduces exclusively by fission. It was found in Barcelona (Spain) in an artificial pond rich in organic material; the summer temperature of the water is 25–28° C and the winter one 10–12° C.

Baguñá and Ballester, who have been working on this planarian for two years, have never found sexuated specimens; on the contrary, very frequently they have observed fissioning. This has been also confirmed in

(*) Istituto di Zoologia dell'Università di Pisa.
(**) Departamento de Genetica, Facultad de Ciencias de Barcelona (España).
(***) Nella seduta del 14 febbraio 1970.

(1) We use the specific name *lugubris* in *sensu lato*, also including *polychroa*; we don't think it is necessary here to discuss this taxonomic problem.

the specimens they sent to Pisa. The ability for fission of this planarian is really accentuated; very often pieces from a previous fission divide again before regenerating the new organs; the site of fission, which is usually post-pharyngeal, may therefore occur prepharyngeally.

On the basis of the external morphology, we have reached the conclusion that it is a fissiparous form of the "*D. lugubris—polychroa* group" (2). The lack of the copulatory apparatus (on which Triclad systematics is based) could suggest some doubt on the exactness of the diagnosis; but all the external characters and in particular the shape of the head, the position of the eyes and the appearance of the unpigmented periocular area, the shape and position of the auricular grooves, correspond exactly with those of *D. lugubris s.l.* (fig. 1).

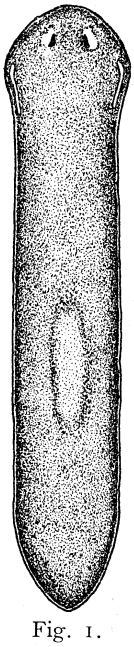

Fig. 1.

The existence of a fissiparous race in a species which was previously believed to reproduce exclusively sexually suggests the problem of its origin. In this respect it is necessary to remember that Benazzi's research on the asexual races of the "*D. gonocephala* group" [3–4] have shown how fission, although it is influenced in its rate by environmental conditions, depends primarily on genetic factors. These factors not only induce the division but their first action is to inhibit sexual evolution. In fact the individuals which will divide remain asexual (showing at most, traces of gonads) even if, due to a temporary stoppage of the divisions, they reach a remarkable size. This shows that fission is a reproductive mechanism genetically controlled, and very different from accidental autotomy which, in sexual specimens, is always followed by the regeneration of the reproductive system. By studying ex-fissiparous specimens (i. e. individuals from fissiparous strains which have reached sexuality) Benazzi has also shown the gametic transmission of fission-determining factors.

Fissioning in planarians may be considered a phenomenon of mutational origin, and it seems likely to think that in the *D. lugubris* from Barcelona a similar event has taken place. We hope that further research will shown the reliability of this interpretation. However it would be necessary to obtain some ex-fissiparous specimens, to be able to accomplish crosses with specimens of the sexual strains and thus face the problem with genetic methods. It will be opportune to examine other Spanish localities in order to establish whether the fissiparous form is more widely diffused, and whether there are populations which propagate both sexually and by fission.

(2) The lack of germ cells, in particular of oocytes, does not allow us to establish whether this form belongs to one of the 7 karyological biotypes found by Benazzi [2].

REFERENCES.

[1] BRØNDSTED H. V., *Planarian Regeneration.* Pergamon Press (1969).

[2] BENAZZI M., *Evoluzione cromosomica e differenziamento razziale e specifico nei Tricladi,* « Acc. Naz. Lincei », Quad. N. 47 (1960).

[3] BENAZZI M., *Considerazioni sui rapporti tra moltiplicazione agamica e sessualità,* « Rend. Acc. Naz. Lincei », Ser. VIII, *42* (1967).

[4] BENAZZI M., *Régénération et fonctionnalité de l'appareil génital chez les planaires scissipares,* « Ann. d'Embryol. et de Morphogenèse », Suppl. 1 (1969).