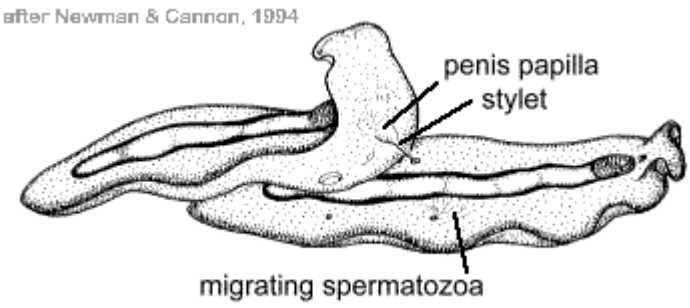
Mating and Reproduction

Since the visual sense of polyclads is quite primitive, chemical compounds are thought to play a key role for finding food and mating partners. The elaboration of the anterior margin into large pseudotentacles is one evidence that these worms rely substantially on a chemosensory instrumentarium to perceive the reef environment and to determine their behavior.



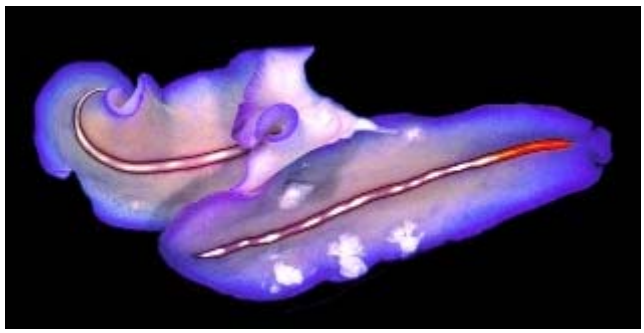


PHOTO © Leslie Newman

In general, polyclads are hermaphroditic having male and female reproductory organs. They copulate to engage in mutual cross-fertilization. Once, two adult worms of the same species meet a quite crude copulation act, which can be described as hypodermic insemination, is performed (upper images, *Pseudoceros bifurcus*). During copulation worms were observed to move towards each other, touch, then roll around together (left image below, *Pseudoceros gravieri*), simultaneously everting their penis papillae and stylets outward (both images on the right below, *Pseudobiceros bedfordi*). They then try to stab each other anywhere, sometimes causing considerable damage to their partner. Worms with wounds were able to heal within 24 hours. When one animal is successful in penetrating the other, it holds on with its stylet embedded in the epidermis of its partner for several minutes. During that time, spermatozoa are injected into the partner (upper image, right) .

PHOTO © Theresa Zuberbühler

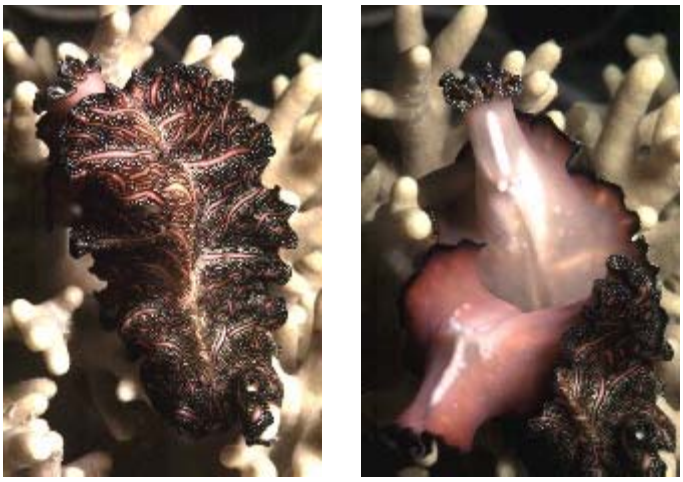


PHOTO © Michael D. Miller

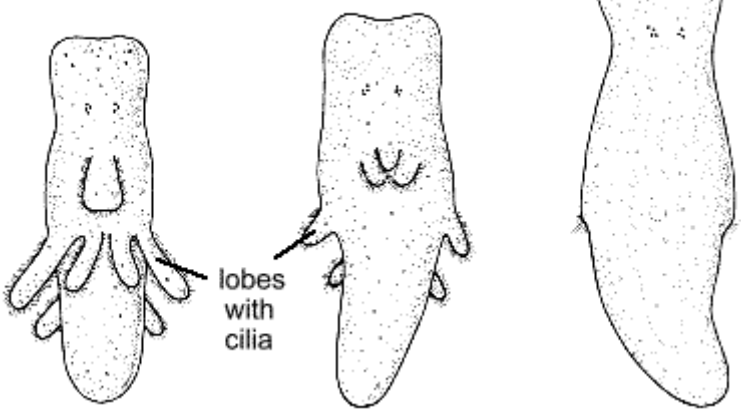
Recently, observations on the mating behaviour of *Pseudoceros bifurcus* (Michiels & Newman, Nature, Vol. 391: 647), show that polyclad individuals seem to increase sperm donation over sperm receipt. For males, injecting sperm offers direct access to eggs, whereas females bear the costs of wound healing and lose control over fertilization. Therefore, a strong selection on females to avoid these costs is observed. This is achieved by "rearing up", a mating behaviour that is effective for both "striking and parrying". Individuals try to stab one another, but show strong avoidance behaviour when struck by their partner. In terms of evolution, this attempt to increase the benefit of sperm donation over the cost of sperm receipt, means that avoidance of insemination might not only cut costs but also offer the benefit of being inseminated by better "stabbers", resulting in more successful offspring.

Two individuals of *Pseudoceros bifurcus* rearing up with everted penises, attempt to inseminate the opponent while avoiding being inseminated.

Insemination by one partner: Sperm is transferred for the duration of penis insertion, resulting in a sperm droplet under the partner's skin (arrow).

Sperm moving through the body after several inseminations. Holes were caused by ventral and dorsal inseminations in the same place.

After hypodermic insemination sperm actively move into the parenchyma towards the oviducts. They are probably attracted by a gradient of molecules released by oocytes or other cells of the female reproductory tract. Fertilized eggs are then deposited as an irregular shaped eggmass containing a few hundred eggs which are tightly packed in a single layer. Often, they can be found underneath boulders nearby colonial ascidians, one of their preferred prey. After about ten days of development free swimming, transparent larvae hatch (=Müller's larvae).



As depicted on the scheme where three consecutive stages of development are shown, Müller's larvae are characterized by eight lobes. Lobes carry beating cilia which allow a ciliate-like swimming (very left photo: larval stage under dark field microscope). Larvae enter the planktonic phase and swim around for a few days prior to settling and metamorphosing. During development, larval lobes continue to be absorbed whereas the digestive glands grow. Metamorphosis is completed when miniature adult worms, only a few millimeters in length, enter the benthic phase of life. As known from developmental studies on nudibranchs metamorphosis of larvae can be triggered by chemical compounds produced by the favorite food of the species. This mechanism makes sure that the place of settling provides enough food for the juvenile organism to grow and, therefore, it has a much better chance of survival. Since polyclad larvae under lab conditions only survived for two weeks after hatching without settling in this time, it is not known if an external trigger is necessary for polyclads to enter the benthic life phase.

| main | back | photo galleries! |

© Marine Flatworms of the World, Wolfgang Seifarth 1997-2002, All Rights Reserved!
Last update: *April 26, 2002*