

## First record of a free-living dalyellioid turbellarian from the Pacific: *Balgetia pacifica* nov. spec.

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ABSTRACT: *Balgetia pacifica* nov. spec. from coarse sand beaches along the west coast of San Juan Island (Washington) is described and its taxonomy discussed. The species is characterized by its large bursal apparatus with a strengthened copulatory bursa. *B. pacifica* is the first free-living species of the Turbellaria Dalyellioida recorded from the Pacific Ocean.

### INTRODUCTION

The Dalyellioida, a suborder of the Turbellaria Rhabdocoela, are well represented by numerous marine species described from beaches along the coasts of the Atlantic and its adjacent seas.

On the other hand, literature concerning the presence of free-living Dalyellioida in the Pacific is lacking. The few dalyellioid species found along the Pacific coast of North America are indicated as endocommensals of echinoderms (e.g. Holt & Mettrick, 1975; Hyman, 1960; Mettrick & Jennings, 1969; Smith, 1973; Stunkard & Corliss, 1951).

With the new species *Balgetia pacifica* from sand beaches of the San Juan Archipelago (Washington) the existence of interstitial Dalyellioida in the Pacific is documented for the first time. Together with the species described here another dalyellioid turbellarian, *Bresslauilla relicta* Reisinger, was collected within the archipelago at Brown Island.

### LOCALITIES AND MATERIAL

Samples with *B. pacifica* were collected intertidally and in the upper sublittoral from coarse sand beaches along the west coast of San Juan Island (48.5 °N, 123 °W).

Type locality: False Bay, August 17th and 19th, 1965, several specimens.

Further localities: Northern part of Smallpox Bay (San Juan Park), August 30th, 1965, several specimens. Andrews Bay, Sept. 1st, 1965, one specimen.

A detailed characterization of the beaches investigated was given by Ax & Ax (1967).

Material: Observations on living material, including drawings; nine sectioned specimens, one animal sectioned sagittally = holotype (Nr. P 761, Zoological Museum of the University of Göttingen).

## SPECIES DESCRIPTION

Living specimens attain a total length of up to 0.7–0.8 mm when swimming slowly. The front end tapers slightly; several tactile hairs are present on the blunted anterior tip of the animal. In unsqueezeed and uncontracted animals the posterior end of the body also tapers (Fig. 1 B). The body colour is translucent to slightly opaque due to the gut content. Pigmented eyespots are lacking.

The thickness of the epidermis is striking; the cells possess vacuoles. This vacuolation can be interpreted as an adaption to the interstitial living space.

In live material rhabdites seem to be lacking; in histological material, however, one can find small rhabdite-like inclusions near the distal surface of the specimens.

The pharynx *doliiformis*, containing strong muscles, agrees well with the scheme of organization known from other dalyellioids. Small papillae and cilia are situated at the distal opening of the pharynx. Secretory cells are present in the pharynx and empty their fine, eosinophileous granules along the pharynx lumen. Well developed granular clubs surround the intestinal mouth.

Male organs: The paired testes are situated in the middle of the body. In addition to the differentiated spermatozoa, large refractive inclusions are to be seen in live material (Fig. 1 A); it is assumed that these inclusions correspond to early stages of spermatogenesis observed in histological material. The vasa deferentia extend to the elongated, semicircular male copulatory organ which is surrounded by a strong layer of mainly spiral muscles. This muscular sheath encloses the ejaculatory duct which is widened to a seminal vesicle. The spermatozoa lie close to the muscular wall, being separated from the muscle cells by thin epithelial cells. Prostatic glands and a prostatic vesicle are lacking.

More distally the muscular bulb is provided with a 15  $\mu\text{m}$  long, slightly strengthened stylet tapering posteriorly and lying free in the male genital canal. Adjacent to the lateral sides of the stylet are short disc-like structures (Fig. 1 C). The wall of the male genital canal is a thickened secretory epithelium enclosed by muscle fibres; the canal opens into a small atrium near the common gonopore.

Female organs: Female gonads are an unpaired germarium and an unpaired vitellarium. The yolk gland extends caudally and dorsally from the pharynx to the germarium lying posterior to the genital pore. The younger oocytes are found in the caudal end of the germarium. Progressively more mature stages are found as one proceeds anteriorly (Fig. 1 A). The mature vitellocytes adjoin the most mature oocyte directly (Fig. 2), a vitelline duct is missing.

The most prominent genital organ of the species is the large bursal apparatus (Figs. 1 A and 1 D). It is connected with the atrium by a female genital canal. The wall of this canal is a thick secretory epithelium, the inner membrane of which is slightly strengthened (a thickened basement lamina?). Several glands with eosinophileous secretion granules empty into the proximal part of the canal (Fig. 1 E).

The bursa consists of three different parts: (1) caudally an elongated (in squeeze preparation 85  $\mu\text{m}$  long) and extremely muscular piece (Figs. 1 D and 1 E), internally lined with a broad basement lamina. The nuclei of the inner epithelia cells lie more distally within smaller lobes outside the sheath (Fig. 2). (2) Cranially to the entrance of the female genital canal the middle part of the bursa widens to a large hollow space; the lumen

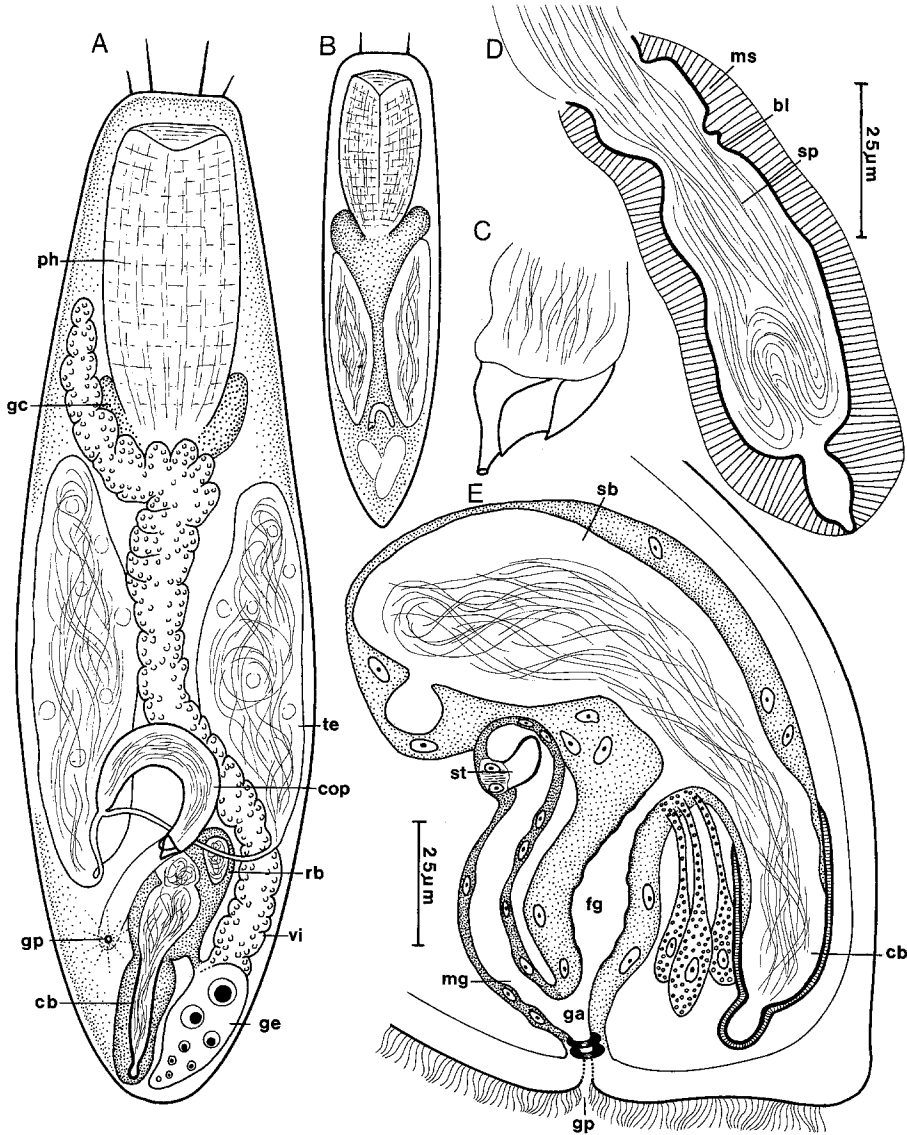


Fig. 1: *Balgetia pacifica*. (A) Organization from squeezed live specimen (dorsal view). (B) Free-swimming specimen. (C) Penis stylet. (D) Copulatory bursa from squeezed live specimen. (E) Atrial organs (lateral view from the left side, based on reconstructions from histological sections)

contains many spermatozoa which are mainly orientated parallel to each other. (3) The anterior part of the bursa consists of voluminous secretory epithelia – apparently forming a syncytium. It contains a variable number of spaces filled with sperm (Figs. 1 A and 2). The three parts of the bursal apparatus act as a copulatory bursa (1), a seminal bursa (2), and a resorbing bursa (3).

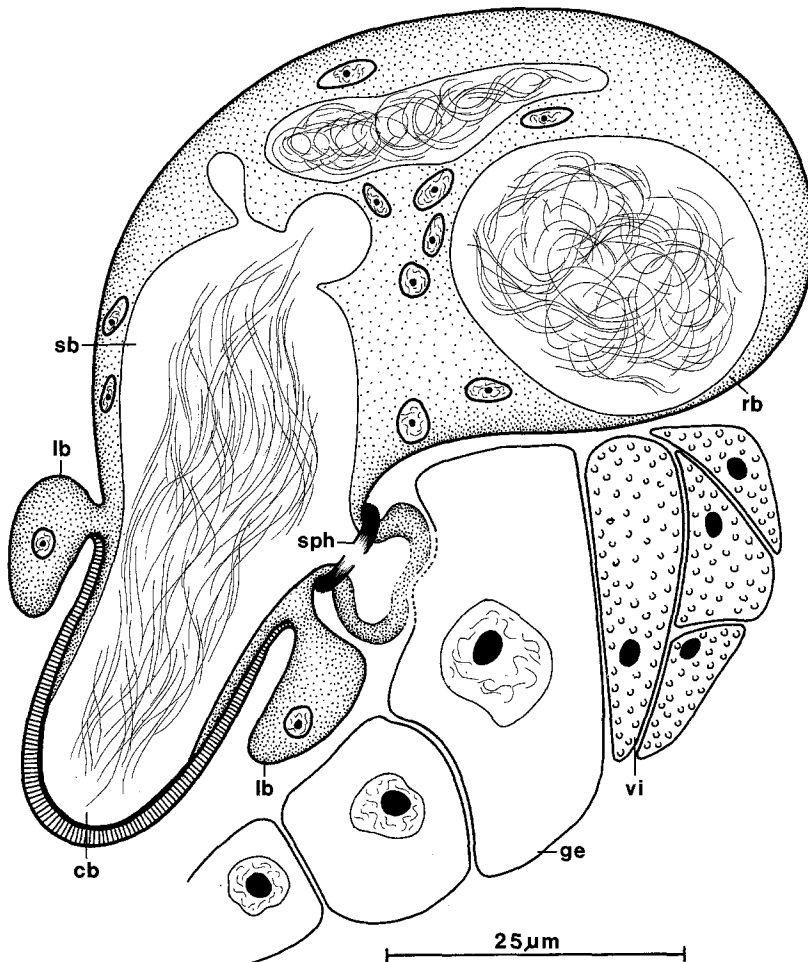


Fig. 2: *Balgetia pacifica*. Horizontal section of the bursal apparatus and the female gonads

Sperm moves from the seminal bursa to the germarium through a weakly differentiated glandular lobe with a strong sphincter (Fig. 2). This lobe also acts as a duct for transporting the oocytes and vitellocytes to the female genital canal which may also serve as a uterus.

#### DISCUSSION

One has considerable difficulty in classifying the species because of the as yet unsatisfactory system of the marine Dalyellioida – which does not conform to the principles of phylogenetic systematics (Karling, 1956; Ehlers, 1979).

In the actual system the pacific species shows some relationships to the family Provorticidae Beklemishev *sensu* Marcus (1954) according to two morphological features:

(1) lack of adenal rhabdites, (2) existence of granular clubs surrounding the intestinal mouth.

Other taxonomically important features, as for example the male and female organs, bring the species in a close relationship to the genus *Balgetia* Luther: (1) paired testes, (2) unpaired germarium and unpaired vitellarium, (3) male copulatory organ elongated, surrounded by a strong layer of helical muscles, and provided with a stylet, (4) proximal part of the female genital canal strengthened by a thick basement lamina. The characteristics (2) and (4) are of more value than the features (1) and (3) which seem to be relatively primitive (plesiomorph) within the family Provorticidae and thus having a restricted systematic value.

The genus *Balgetia* contains three species: *B. semicirculifera* Karling in Luther, *B. hyalina* Karling in Luther, and *B. papii* Kolasa. Our knowledge of the anatomy in the genus is based on Karling's description (in Luther, 1962) of *B. semicirculifera*. In this species the dorsal part of the large genital atrium has a thick basement lamina acting as a copulatory bursa. Karling named the proximally situated part of the female genital canal, which is provided with a thickened basement lamina, as an ootype. Yet one can not exclude the possibility that this strengthened part of the female canal in *B. semicirculifera* also acts as a copulatory bursa, corresponding with the situation in *B. pacifica*.

The structure of the stylets in *B. hyalina* and *B. pacifica* shows additional relationships. In the European species the stylet has the same configuration and is also only slightly strengthened, but it is twice as long (30  $\mu$ m) as in *B. pacifica*. The other two species, *B. semicirculifera* and *B. papii*, have stylets of a different type.

The new species obviously differs from all known species of the genus *Balgetia* and moreover from all taxa of the family Provorticidae in lacking prostatic glands and a prostatic vesicle. We interpret this lack as the result of a reduction; therefore this feature is to be regarded as an autapomorphy of the Pacific species. Due to this situation and the above mentioned differences in the genital tract of *B. semicirculifera* and *B. pacifica*, the last-mentioned species is included with reservations in the genus *Balgetia*.

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#### Abbreviations in the figures

bl	basement lamina	ms	muscle sheath
cb	copulatory bursa	ph	pharynx
cop	copulatory organ	rb	resorbing bursa
fg	female genital canal	sb	seminal bursa
ga	genital atrium	sp	sperm
gc	granular clubs	sph	sphincter
ge	germarium	st	stylet
gp	gonopore	te	testis
lb	lobe with nucleus	vi	vitellarium
mg	male genital canal		

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