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The Enteropneusta from the Palau Islands¹⁾

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(With 11 Text-figures)

Ptychodera flava is the only species hitherto described from the South Sea Islands. The species, the first Enteropneust ever to be mentioned in literature, was obtained from Otdia in the Marshall Islands, one of the South Sea Islands, and described by Eschscholtz in 1825. During his short stay in the Palau or Pelew Islands, the most western group of the Carolines, in 1934, the present writer collected two species of the Enteropneust, *Glossobalanus ruficollis* and *Balanoglossus carnosus*, at Marukyoku located on the eastern coast of Baberudaabu. Both species were found living in company in a muddy bottom of low tide marks. The presence of their burrows was indicated by a coiled mass of sand, though it can not be ascertained to which species this casting really belongs. The larger species, *Balanoglossus carnosus* was recently recorded from Misaki by van der Horst (1930) and *Glossobalanus ruficollis* has been formerly collected from New Britain (Willey, 1899) and Amboina (van der Horst, 1930).

The writer wishes here to extend his hearty thanks to Prof. Tohru Uchida for his kind guidance.

Glossobalanus ruficollis (WILLEY)

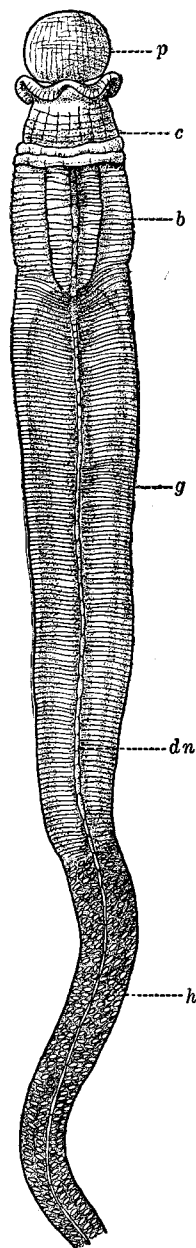
(Figs. 1-10)

Ptychodera ruficollis: WILLEY, 1899, pp. 257-267; pl. 27, fig. 7; pl. 28, fig. 1 c; pl. 30, figs. 24-35.

Glossobalanus ruficollis: VAN DER HORST, 1930, pp. 165-173, figs. 34-40.

1) Contribution No. 135 from the Zoological Institute, Faculty of Science, Hokkaido Imperial University.

External characters



The proboscis is more or less spherical in shape. Its epidermis is marked with fine irregular longitudinal and transverse striae. The collar is longer than the proboscis. Surrounding the proboscis stalk the anterior portion of the collar forms a frill with an undulated margin. The five epidermal zones are distinguishable. The third and fifth zones form distinct foldings near the posterior end of the collar. The branchial region is short. At the posterior end of the branchial region there are deep depressions of branchial grooves which are found on either side of the dorso-median groove. They are deep and narrow along their whole length and so no gill pore is visible externally. The branchial region is traversed by cross striations. The genital region of the writer's specimens is rather short comparing with the former descriptions. According to Willey the genital region is about 10 times the length of the branchial region, while in the present specimens it is about 5-6 times the branchial region. As to the length of the genital region relative to the branchial region the present specimens recall *Glossobalanus sarniensis*. The epidermis of the branchial region shows cross-ridges and furrows encircling the body. These ridges and furrows are especially well marked between the longitudinal grooves. They are also present in the genital region. The hepatic region is fragile and easily broken off. The specimens examined were all incomplete at the posterior end of this region. There are no external evidences of liver sacculations. As Willey stated, the dermal annulations of the hepatic region are broken up into numerous sacculations. The dimensions of the body are as follows: length of proboscis 3.5-3.9 mm; maximum breadth of proboscis, 5-6 mm; length of collar, 4-6 mm; maximum breadth of collar 4.3-5.3 mm; length of branchial region, 5-6.5 mm; length of genital region, 27-38 mm.

Fig. 1. External appearance of *Glossobalanus ruficollis* (WILLEY). $\times 3$. b. Branchial region; c. Collar; dn. Dorsal nerve cord; g. Genital region; h. Hepatic region; p. Proboscis.

Internal anatomy

Proboscis: In cross section the epidermis shows narrow furrows which correspond to the fine longitudinal striae seen externally. The nuclei of the epidermal cells are arranged in two rows, one in the middle of the layer of cells, the other nearer the base of these cells. A fair number of glandular cells are scattered. The circular and longitudinal muscle layers are well developed. The coelomic cavity is rather wide, extending beyond the anterior limit of the proboscis organs. The basement membrane is well marked. The pericardium of the

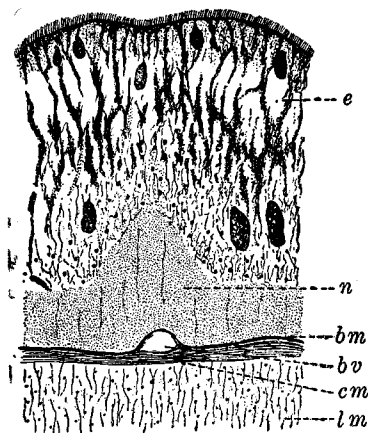


Fig. 2. Cross section of a part of proboscis showing nervous thickening. $\times 220$. *bm*. Basement membrane; *bv*. Blood-vessel; *cm*. Circular muscle layer; *e*. Epidermis; *lm*. Longitudinal muscle layer; *n*. Nervous layer.

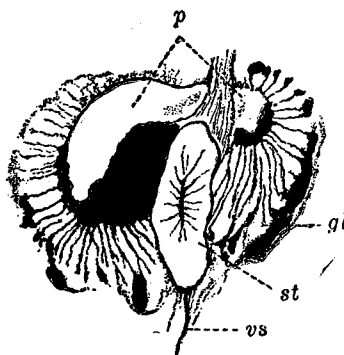


Fig. 3. Cross section of frontal part of proboscis organs. $\times 65$. *gl*. Glomerulus; *p*. Pericardium; *st*. Stomochord; *vs*. Ventral proboscis septum.

present specimens is characteristically consistent with Willey's description. The anterior part of the pericardium is divided into two small pouches extending through two or three sections. Each of these two blind pouches is accompanied by the corresponding half of a glomerulus. According to van der Horst, however, the glomerulus is not divided into two parts corresponding to the two blind pouches of the pericardium. As to such different condition of the glomerulus van der Horst is of the opinion that frontal extension of the stomochord may be variable in specimens. The greater part of the glomerulus stretches over the stomochord and nearly reaches the median line at the ventral side of the stomochord. The anterior limit of the stomochord extends just behind the level of the anterior limit of the glomerulus. There is no ventral caecum,

but two lateral pouches are projected as often occurs in other species. In cross section the mid-dorsal nervous layer of the epidermis has a triangular thickening with numerous small oval nuclei as already pointed by van der Horst, but the writer failed to find larger round nuclei slightly stained, which were described to occur in more peripheral region of this nervous thickening. The ventral septum

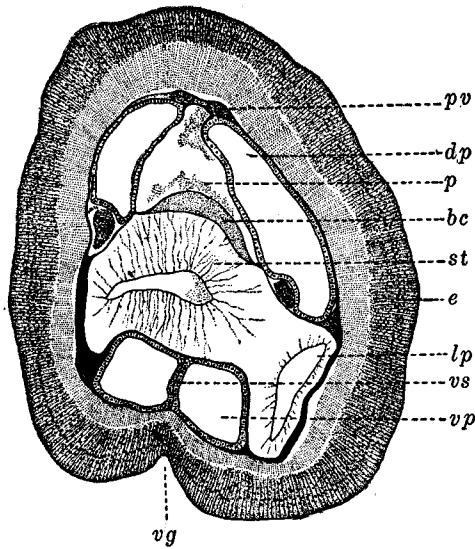


Fig. 4. Cross section of proboscis organs. $\times 50$. *bc*. Central blood sinus; *dp*. Dorsal coelomic pouch; *e*. Epidermis; *lp*. Lateral pouch of stomochord; *p*. Pericardium; *pv*. Proboscis vein; *st*. Stomochord; *vg*. Ventral groove; *vp*. Ventral coelomic pouch; *vs*. Ventral proboscis septum.

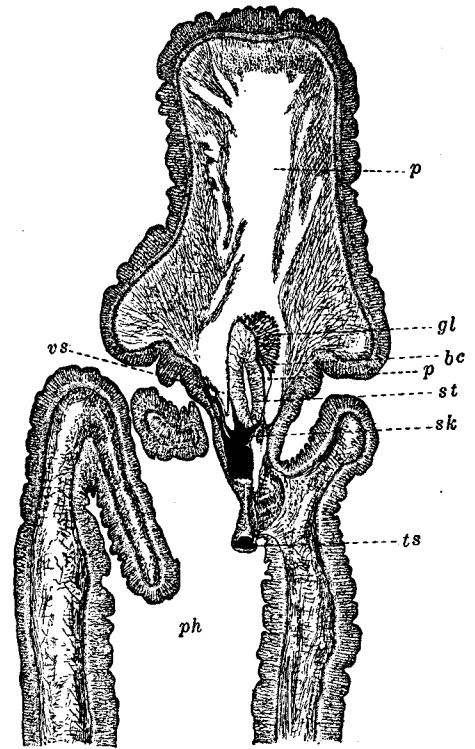


Fig. 5. Longitudinal section of proboscis. $\times 9$. *bc*. Central blood sinus; *gl*. Glomerulus; *p*. Pericardium; *pc*. Proboscis coelom; *ph*. Pharynx; *sk*. Skeleton; *st*. Stomochord; *ts*. Terminal portion of skeleton; *vs*. Ventral proboscis septum.

is rather long, and the anterior free edge of the septum is found a little in front of the stomochord. The ventral caecum of the proboscis extends for a considerable distance beyond the ventral septum. The single proboscis pore opens on the left side. There is no caecal extension of the end-vesicle behind the pore. The

nuchal skeleton consists for the greater part of a blunt keel. The chondroid tissue is exceedingly scanty.

Collar: The dorsal mesentery is complete from the first dorsal root to the end of the collar. As in *Glossobalanus mortenseni* there exists an incomplete mesentery in front of the first root which is attached to the medullary cord only. The medullary cord has a continuous central canal. The external aperture of the collar canal opens to the first gill-pouch. The dorsal nerve roots are more than 13 in number in the present specimens. Willey reported 17 in one of his specimens and 12 in the other. The larger number of nerve roots is characteristic of the species. The perihæmal cavities, well developed, are separated from each other along the ventral side of the blood vessel for nearly their entire length, but communicate at their posterior end. The nerve cord is surrounded by this large hæmal cavity. As in the stomochord there are no glandular cells in the

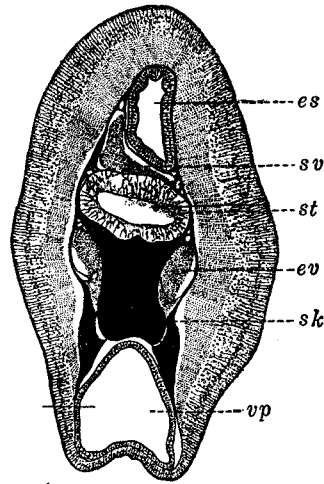


Fig. 6. Cross section of proboscis neck. $\times 50$. *es.* End-sac; *ev.* Efferent proboscis vessel; *sk.* Skeleton; *st.* Stomochord; *sv.* Sinus venosus; *vp.* Ventral coelomic pouch.

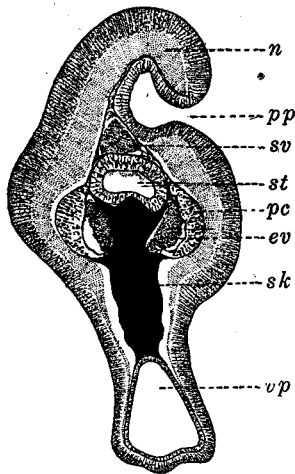


Fig. 7. Cross section of proboscis at a more caudal region than that of Fig. 6. $\times 50$. *ev.* Efferent proboscis vessel; *n.* Nervous layer; *pc.* Perihæmal cavity; *pp.* Proboscis pore; *sk.* Skeleton; *st.* Stomochord; *sv.* Sinus venosus; *vp.* Ventral coelomic pouch.

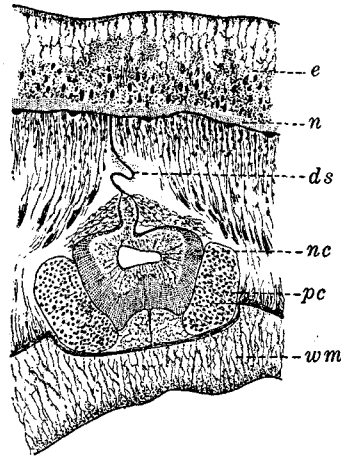


Fig. 8. Cross section of mid-dorsal part of collar. $\times 50$. *e.* Epidermis; *ds.* Dorsal septum; *n.* Nervous layer; *nc.* Nerve cord; *pc.* Perihæmal cavity; *wm.* Wall of mouth cavity.

epithelium of the mouth cavity. The external aperture of the collar canal opens into the first gill-pouch. The posterior horns of the skeleton extend just before the union of the right and left crests of the nerve cord with the epidermis. At the posterior end of the collar the canal becomes fused with the epidermis, whence it projects into the wide, first branchial pore surrounded by the epidermis. As van der Horst mentioned the canal does not communicate with the branchial pore, but opens directly to the exterior. The collar coelom is entirely filled with longitudinal muscle fibres and connective tissue, leaving a small space round the opening of each of the collar funnels. The right and left peripharyngeal spaces are separate except at the hind end of the collar, where they meet ventrally.

Trunk: The branchial region of this species is remarkably short. In cross section it is nearly circular. Along the dorsal side there are three deep longitudinal grooves. One is situated in the mid-dorsal line and on its bottom lies the dorsal nerve cord. This groove does not extend over the entire length of

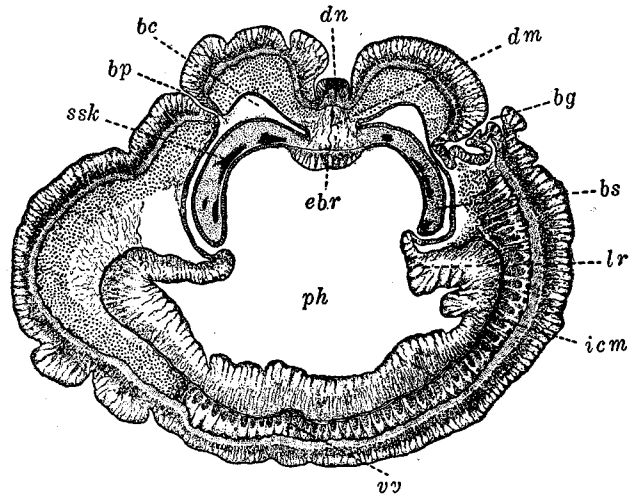


Fig. 9. Cross section of branchial ridge. $\times 9$. *bc*. Branchial cavity; *bg*. Branchial groove; *bp*. Branchial pore; *bs*. Branchial septum; *dm*. Dorsal mesentery; *dn*. Dorsal nerve cord; *ebr*. Epibranchial ridge; *icm*. Inner circular musculature; *lr*. Limiting ridge; *ph*. Pharynx; *ssk*. Septal skeletal bar; *vv*. Ventral blood vessel.

the branchial region. The posterior portion of this groove is replaced by a prominent ridge. The branchial grooves which are found on either side of the dorso-median groove end abruptly and are deeply depressed at the posterior end of the branchial region. The epidermis contains rather few glandular cells, and

only in the peripheral part of these cells is the excretory substance found. Only along the two sides of the nerve cord and in the branchial grooves deeply stained glandular cells are found. The external circular muscle layer is absent. The longitudinal musculature has nearly similar thickness to that of the epidermis. At the end of this region the longitudinal muscle layer becomes thick on the ventral side of the body. There is an inner muscular layer in the branchial region. This is a well-defined layer lying against the ventral part of the pharynx, and it ends at the limiting ridge, but extends more dorsally along the branchial septa as a bundle of fibres. The dorsal mesentery is complete over its entire length. The limiting ridges between the upper and lower parts of the pharynx are rather well developed and there is a constriction between these two parts of the pharynx. The dorsal part is narrower than the ventral part, but longer. The epithelium of the ventral pharynx has the same character as that of the mouth cavity, but is lower in height. The epibranchial ridge shows no differentiation in its cells. Over the whole breadth they are of the same kind, with nuclei near the free end and a few glandular cells between them. The number of synapticula is about 10. There are about 30 gill pores. The postbranchial canal starting

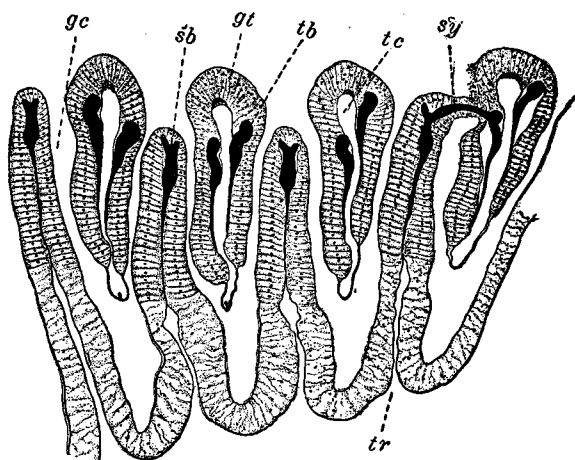


Fig. 10. Cross section of gill. $\times 110$. *gc*. Gill chamber; *gt*. Gill tongue; *sb*. Septal bar of branchial skeleton; *sy*. Synapticulum; *tb*. Tongue bar of branchial skeleton; *tc*. Tongue coelom; *tr*. Trunk coelom.

at the last gill slit, is rather simple in form and has a wall of a high epithelium. The canal becomes gradually lower posteriorly and is gradually replaced by a solid mass of tissues with densely packed nuclei. The canal projects forwards for some distance beyond the region of its communication with the gut. Its communication with the gut extends over a comparatively short distance. The species is remarkable for showing such a great length in the postbranchial

genital region. Though the opening of the first genital pore could not be observed exactly the position of it seems more or less variable in different specimens. There are no genital pleurae though the median dorsal region is somewhat depressed. The intestinal walls of the hepatic region are divided into numerous sacculations. On account of the imperfect condition of the caudal region no mention can be made as to the pygochord.

In general the present specimens are in close accordance with the former descriptions given for the species. The present species is an interesting form in having transitional characteristics between the genera *Ptychodera* and *Glossobalanus*.

Balanoglossus carnosus (WILLEY)

(fig. 11)

Ptychodera carnosus: WILLEY, 1899, pp. 248-256, pl. 27, fig. 6; pl. 28, fig. 1 b; pl. 29, figs. 16-19.

Balanoglossus carnosus; VAN DER HORST, 1930, pp. 187-190, figs. 56-59.

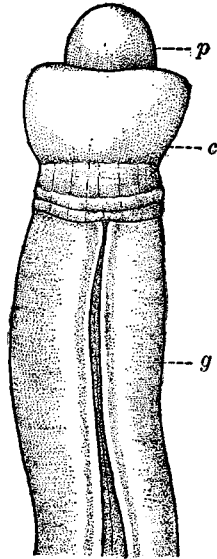


Fig. 11.

Anterior end of
Balanoglossus carnosus
WILLEY. $\times 2$.

- p. Proboscis;
- c. Collar;
- b. Branchial region.

The species has already been thoroughly treated by Willey (1899), Maser (1913) and van der Horst (1930). A single anterior body devoid of hepatic region was collected from a burrow which *Glossobalanus ruficollis* also inhabited. At the base of the burrow a cylindrical casting was found. The species is characterised externally by a remarkable short, contracted proboscis, by a long capacious collar and by abrupt ending of genital pleurae. The species is one of giant Enteropneusts as *Balanoglossus gigas* and *B. misakiensis*. In the present specimen the proboscis attains 4 mm long and is bluntly elliptical in shape. The main portion of the proboscis is concealed within the collar. A maximum length of the collar was 9 mm. The upper portion of the collar is cup-shaped. The branchial region measures 22 mm and the genital region 70 mm. The intimate association of two different species of Enteropneusta as described above has been also recorded among such species as

Ptychodera flava and *Glossobalanus hedleyi* or *Ptychodera flava* and *Spengelia porosa*.

The present species was formerly recorded from New Britain (Willey, 1899); Minikoi and Hulule (Punnett, 1903); New Caledonia (Maser, 1913) and Kei-Islands, Amboina and Misaki (van der Horst, 1930).

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