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*BASSIANOBELLA VICTORIAE* gen. et sp. nov. (HIRUDINOIDEA:  
RICHARDSONIANIDAE)<sup>1</sup>

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### Abstract

Somites ix to xxiv, 5-annulate (total 16); xxv, 4-annulate; no salivary gland papillae; median regions, bimyomeric, mesomorphic; vagina caecate, U-form with a duct; common oviduct, short, not associated with the duct, a median black and 3 pairs of paler dark dorsal bands. Bassian sub-region.

### Introduction

All previous records of aquatic jawed sanguivorous leeches from Victoria have been referred to *Limnobdella australis*, a species described very briefly in the classical manner by Bosisto in 1859 from specimens from the Murray as being 'Hirudo'-like in general appearance with a median and two pairs of dark longitudinal bands, figured as such by Becker (1859), and as I now find, not recognizably described again since then.

A small leech taken by Dr W. D. Williams of Monash University at Cranbourne, an outer Melbourne suburb, has seven longitudinal dark bands, enabling me to recognize this as the pattern faintly indicated in faded specimens taken in 1904 at Thornton on the Goulburn River, and housed in the collections of the National Museum of Victoria. Dr Williams's specimen is somewhat strongly contracted; the Thornton specimens are extended and more suitable for most description.

The indications are that this may be found a common and widespread species in Victoria. It might possibly be the 'horse-leech' of Bosisto, figured by Becker as having an obvious median dorsal band, and noted by Becker as having 'a central line of jet black colour and three faint brown parallel lines on either side', a species not reported since. Both go grey in alcohol.

A current study of the nature of speciation in aquatic jawed sanguivorous leeches of E. Australia has provided further refinement in the understanding of the nature of the hirudiniform genus, leading to the recognition of this 7-banded species from Victoria as being generically distinct from but having relationship only with two Torresian 7-banded species to be described in the study on speciation, where a new genus will be provided for them.

The two new genera are members of the family Richardsonianidae. In both there is marked elongation of the ejaculatory bulbs and vagina to a cylindroid form, and the vagina U-shaped with two subequal limbs. This parallelism in the form of two different organs on two different regions of the reproductive system, regions which elaborate in two separate processes of morphological differentiation (Richardson 1969), sharply sets apart the two new genera from the other five genera in this family. In these five, the bulbs and vagina remain short, fusiform to sub-ovoid. With this there begins to appear a separation which is more than simply generic in nature.

The former systematic framework for the hirudiniform leeches was a single cosmopolitan family Hirudidae, with all aquatic monostichodonts in a subfamily

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Hirudinae and the distichodonts and agnatha in a subfamily Haemopinae (Caballero 1959). The demonstration (Richardson 1969) of hirudiniform families of a regional nature made the above untenable. The need for new sub-familial ranks emerged in that study which was initially concerned with establishing the nature of the hirudiniform genus, but the order for sub-familial differentiation could not then be assessed.

This is the first experience of differences of a sub-familial level inside the new systematic framework. Their nature is shown in the brief summary given below to distinguish the new genus for the Victorian leech. It is sufficient at this time to draw attention to the matter, and to postpone nominating groups at this level until our hirudiniform fauna is more fully explored.

With the exception of the genus *Hirudobdella* Goddard 1910, which stands apart from the following (Richardson 1969), the known hirudiniform leeches of the Australian region are divided between two families. Both are sanguivorous, monostichodont, with a hirudoid pharynx and crop.

#### F. ORNITHOBDELLIDAE Richardson, 1969

Median reproductive regions, amyomeric, micromorphic; epididymis and ejaculatory bulb (or sperm duct) differentiated on a primary loop on the anterior region of the paired male ducts, the relationship subparallel; genital pores, xi  $b_5/b_6$  and xii/xiii (xiii  $b_1/b_2$ ). Pattern, reticulate, lacking, or a single median dorsal dark band. Amphibious (? aquatic). Australian region. gg. *Ornithobdella* Benham 1909, 15 5-annulate somites, etc., 1 species, Snares Islands, New Zealand; *Aetheobdella* Moore 1935, 17 5-annulate somites, etc., E. coastal Australia.

#### F. RICHARDSONIANIDAE Richardson, 1969

Median reproductive regions, myomeric; no primary loop on the anterior region of the paired male duct, the epididymis posterior to the ejaculatory bulb, the relationship linear; vagina, caecate; genital pores xi and xii  $b_5/b_6$ . Pattern striped, aquatic. Australian region.

The genera in this family separate as follows:

- 1 (10) Vagina and ejaculatory bulbs fusiform to sub-ovoid, the vagina not U-form with subequal limbs when functionally differentiated.
- 2 ( 9) ix to xxiv, 5-annulate (16 complete somites); no salivary gland papillae on the jaws ('*australis*' complex).
- 3 ( 8) Median regions, bimyomeric, the male a muscular penis-sheath.
- 4 ( 7) Male median region, mesomorphic; vaginal duct long, equal to or longer than the vagina; xxv, 4-annulate; a median and two pairs of dark dorsal longitudinal bands.
- 5 ( 6) Pharynx terminates in ix.  
g. *Richardsonianus* Soos 1968, four species. Bassian, Eyrean, and New Zealand.
- 6 ( 5) Pharynx terminates at viii/ix.  
g. *Quantenobdella* Richardson 1969, one species. Lord Howe Island.
- 7 ( 4) Male median region, micromorphic; no vaginal duct; xxv, 3-annulate; a median and two pairs of orange-red (preserved, pale) dorsal bands. Pharynx ends, viii/ix.  
g. *Eunomobdella* Richardson 1969, one species. Torresian.
- 8 ( 3) Median regions, hemimyomeric, the male, micromorphic, an elongate thin-walled atrium. Vaginal duct, short, less than half the length of the vagina. Pharynx ends in ix; xxv, 4-annulate; a median dark, and two pairs of orange-red dorsal bands (preserved, fade completely).  
g. *Euranophila* Richardson 1969, one species. Torresian.

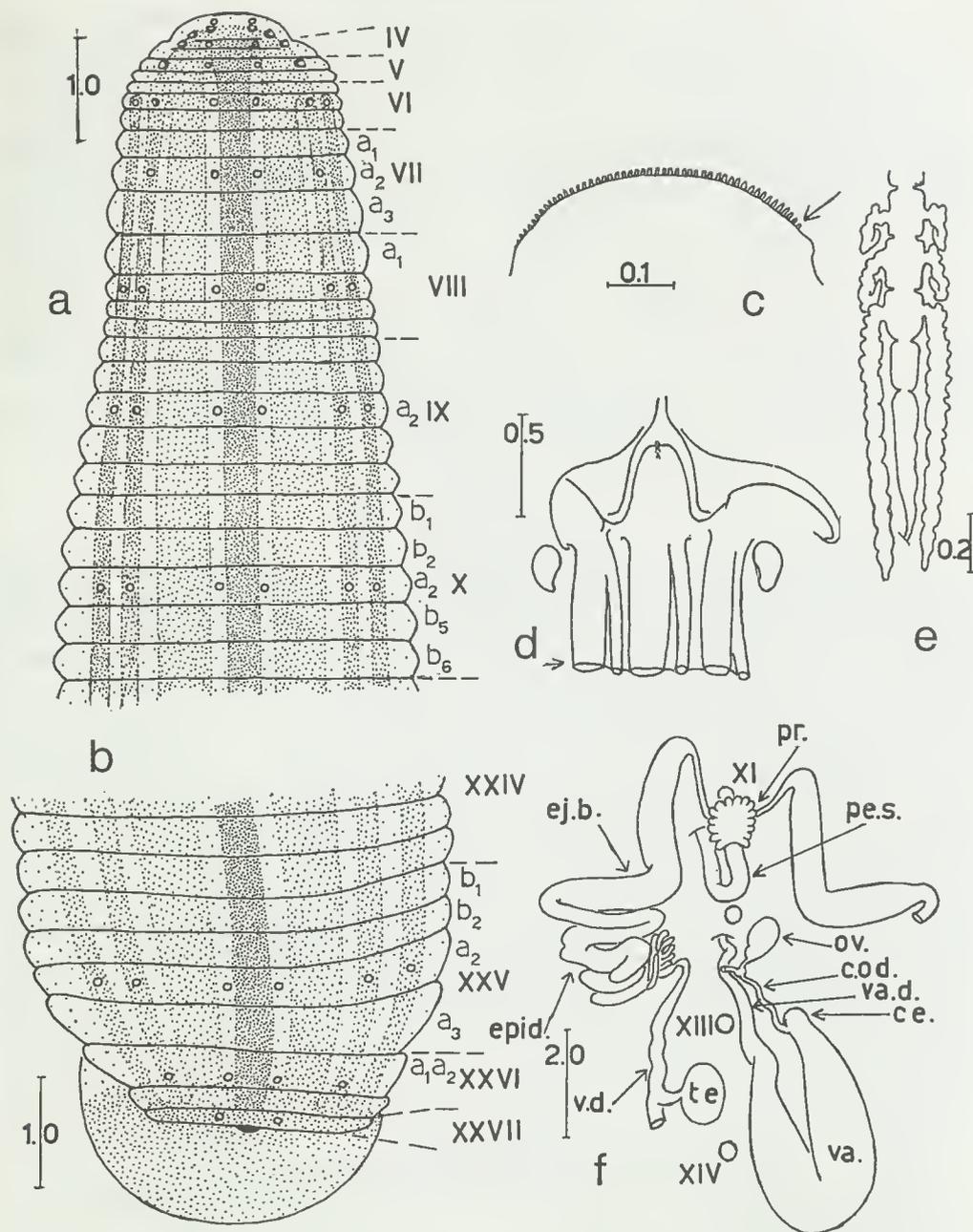


FIG. 1—*Bassianobdella victoriae* gen. et sp. nov. a. Dorsal aspect, somites i to x, and b. somites xxiv a<sub>2</sub> to xxvii and sucker, to show topography of the pattern. c. Jaw and dental ridge (arrow indicates medial end). d. Jaws, and pharynx opened along mid-ventral line to show internal muscular ridges (arrow indicates mid-point in length of pharynx). e. Crop, somites xvii to xix, caecation, and intestine. f. Anterior region of male paired duct (medial aspect shown, dorsal aspect is lateral in the figure); male median region; and female reproductive system.

Somites and somital ganglia indicated by Roman figures; annuli, 'a<sub>2</sub>' etc. Abbreviations: c.od. common oviduct, ce. vaginal caecum, ej.b. ejaculatory bulb, epid. epididymus, od. oviduct, ov. ovary, pe.s. penis sheath, pr. prostate, te. testis, va. vagina, va.d. vaginal duct, v.d. vas deferens.

All scales in millimetres. All drawings are from the holotype.

bands along the dorsum; the margins, light, continuous with the immaculate venter.

The length is 45.0 mm; 2.0 mm wide at iv/v; 2.0 mm wide and deep at vii/viii, widening gradually behind this and the depth increasing, to be 3.0 mm wide and deep at x/xi, 6.0 mm from the velum, so that the pregenital region is tapering cylindrical; behind this increasing more in width and depth to be 4.5 mm wide and 3.5 mm deep at xiv, 12.0 mm from the velum; continuing this suboval cross-section back to 40.0 mm with a maximum width of 5.0 mm, then reducing gradually to 2.2 mm at xxvii which forms the base of the deeply cupped sucker which is 2.5 mm in both diameters. The margins are keeled along the posterior quarter of the body.

### Colour

Faded; but possibly dark brownish above in life and lighter below. Preserved, only the narrow median black band and the very light margins are obvious; between these pale greyish brown; the three pairs of narrow light stripes, very faint. The posterior half of the dorsum of the sucker is pale grey, darker than the anterior half which is much of the colour of the venter.

### Pattern

(Fig. 1a-b)

Preserved, faded, vague, but definitely: the median black band almost filling the median field; the inner pair of narrow light stripes extend along the paramedian line and include these sense organs; a wide pale brownish band fills most of the paramedian field, excepting for the narrow light stripe which completes the lateral part of this field; the inner and outer narrow dark paired bands extend along the intermediate and supramarginal lines of sense organs, include these organs, and are separated by the outer paired narrow light stripe which fills most of the intermediate field.

The margin of the velum is light in colour, continuous with the marginal field (supramarginal + submarginal fields) and the venter. The interocular area on the velum is pale brown, excepting for faint indications of the median black band in iv; behind iv/v, the median black band is well-defined back to xxvi/xxvii, without any indications of this on xxvii and the dorsum of the sucker which are both uniformly dark greyish. The paired narrow light paramedian stripes commence on v a<sub>2</sub>, include the paramedians of this annulus, and are continuous of almost uniform width back to xxvi a<sub>1</sub>a<sub>2</sub>/a<sub>3</sub>, and include the paramedians of this somite. The narrow light stripe lateral in the paramedian field commences medial to the 5th eye in vi a<sub>2</sub>, is continuous back to xxv/xxvi, vaguely indicated on xxvi, and back to xxvi/xxvii which is probably the actual termination of this stripe which is a little wider along the greater part of the body than at the ends. The two stripes, the paramedian line and lateral in the paramedian field, define the dark band of the paramedian field between the above levels, this band increasing markedly in width along the body as the paramedian field widens, in contrast to the other bands and stripes which are more uniform in width along their length. The narrow paired light stripes of the intermediate fields are faintly indicated at vi/vii, appear to be continuous with the margin of the velum at vi a<sub>2</sub> lateral to the 5th eye, and extend back to xxv/xxvi with indications of them on xxvi back to xxvi/xxvii, but not on xxvii. The lateral light stripe of the paramedian field, the light stripe of the intermediate field, and the light margin define the dark narrow bands along the intermediate and supramarginal lines between the above levels. The termination of the supramarginal band on vi a<sub>2</sub> where it includes the supramarginal sense organ, and the separation of the band at this end from the interocular dark area of the velum, is most unusual.

- 9 (2) ix to xxiii, 5-annulate (15 complete somites); xxv, 3-annulate; salivary gland papillae on jaws. Pharynx ends at viii/ix; median regions bimyo-meric, mesomorphic; no vaginal duct; a median light and two pairs of dark dorsal bands.  
g. *Goddardobdella* Richardson 1969, one species. Torresian, Papuan.
- 10 (1) Vagina and ejaculatory bulbs elongate, cylindroid, the vagina folded lengthwise, U-form with subequal recurrent and procurrent limbs. Somites ix to xxiv, 5-annulate (16 complete somites); xxv, 4-annulate; no salivary gland papillae; a median black and three pairs of dark (preserved, pale) dorsal bands.
- 11 (12) Common oviduct, long, equal to or longer than the procurrent limb of the vagina; common oviduct closely associated with and extends along the surface of the vaginal duct; pharynx ends in ix. (gen. nov. Two species under description elsewhere. Torresian).
- 12 (11) Common oviduct, short, about  $\frac{1}{2}$  length of procurrent limb of vagina, and not associated with the vaginal duct; pharynx ends viii/ix. gen. nov. *Bassianobdella*, as follows.

Gen. nov. **Bassianobdella**

Derivation: Bassian = zoogeographic name; bdellos = a leech, f.

Monostichodont; 16 5-annulate somites; xxv, 4-annulate; somital sense organs small; jaws, small; teeth, minute, about 50; no salivary gland papillae; dorsal salivary glands, spaced, sparse, right and left loose clusters, no large columns of aggregated ducts; radial muscles, an obvious extrinsic system; mouth and lumen of pharynx, narrow, the lumen, tubular, tapering; pharynx with six internal muscular ridges, joining as dorsomedian and ventrolateral pairs to enter the jaws, none ending independently between the bases of the jaws; pharynx terminating viii/ix; compartment ix, acaecate, x to xviii each with a single pair of simple caeca median on the compartment and those in xix forming postcaeca extending to xxvi; the compartment on xix fully formed behind the caeca; intestine with a section in xx divided off from the tapering intestine; genital pores, xi  $b_5/b_6$  and xii  $b_5/b_6$ ; testes, normally 10 pairs; anterior region of male paired duct without a primary loop, epididymis in contiguous halves of xii and xiii and posterior to the elongate cylindrical ejaculatory bulb folding on itself in the contiguous halves of xi and xii; bulbs without cornua; median regions, bimyo-meric, mesomorphic; penis, sheath, cylindrical, reflected; oviducts, short; common oviduct longer than oviducts but much shorter than the recurrent limb of the U-form vagina; vaginal duct of the length of the procurrent limb; common oviduct not associated with the vaginal duct.

Size medium, pattern striped, aquatic, sanguivorous. Australian region (Bassian).

Type species: *Bassianobdella victoriae* sp. nov.

Type specimens in National Museum of Victoria, Melbourne.

Holotype G839 45.0 mm long from Thornton, Goulburn Valley, Victoria, 12 April 1904. Donated G. E. Nichols.

Paratype G1510 34.0 mm long, same locality and donor.

**Bassianobdella victoriae** sp. nov.

(Fig. 1a-f)

A leech of medium size; the dorsum with a narrow median black band, wider than the three pairs of light stripes which divide the dorsum into a wider pair of inner dark longitudinal bands, and narrow intermediate and lateral paired dark bands which are of the width of the light stripes, so that there are seven dark

### Annulation

(Fig. 1a-b)

The intersomital and interannular furrows are well-defined, equivalent, and without regular indications of division of the body into true somites; in the genital and post-genital regions,  $a_2$  is occasionally dorsally, commonly ventrally, distinctly longer, giving the appearance of longer singles dividing off shorter annuli as quadruplets. Somital sense organs, small, mostly detectable, often with some difficulty, and commonly the full series cannot be detected across the annulus. Somital sensillae, minute, pointed, obscure. Nephropores small, ventral.

The margin of the velum shows a distinct pair of paramedians anterior to the 1st eyes. The first furrow, iii/iv, extends across the velum between the 2nd and 3rd pair of eyes, but not onto the margin of the velum; iv, 2-annulate,  $a_1a_2$  (with the 3rd pair of eyes and obvious paramedians)— $a_3$ , the furrow  $a_1a_2/a_3$  ending in the intermediate line, and the dorsolateral lobe of the margin of the sucker is not strongly defined anteriorly; v, 2-annulate above, the 4th eyes and the paramedians in  $a_1a_2 > a_3$ , the furrow  $a_1a_2/a_3$  extending into the submarginal field so that  $a_1a_2$  forms the lateral margin of the sucker and uniannulate v, the ventral margin; vi, 3-annulate above  $a_1 < a_2 < a_3$ , the 5th pair of eyes, paramedians and supramarginals in  $a_2$ , the furrow  $a_1/a_2$  reaching into the submarginal field, and vi, 2-annulate ventrally; vii, 3-annulate above and below,  $a_1 < a_2 < a_3$  ( $a_3 = \text{viii } a_1$ ); viii, 4-annulate,  $a_1 > a_2 > b_5 = b_6$ , the first nephropores on  $a_1$ ; ix, 5-annulate,  $b_1 < b_2 < a_2 < b_5 > b_6$ ; ix to xxiv, 5-annulate, complete (total, 16); x,  $b_1 < b_2 = a_2 > b_5 = b_6$ ; the relative lengths of the annuli in the somites behind x are variable, some all subequal, in others  $a_2$  distinctly longer and in these  $b_1 = b_2 < a_2 > b_5 = b_6$ ; xxiv, 5-annulate,  $b_1 = b_2 > a_2 > b_5 = b_6$ , the last nephropore on  $b_2$  just medial to the intermediate line; xxv, 4-annulate,  $b_1 = b_2 < a_2 < a_3$ , and  $a_3$  the last annulus complete on the venter; xxvi, 2-annulate,  $a_1a_2 > a_3$ , the somital sense organs posterior in  $a_1a_2$ ; the furrow xxvi/xxvii, weaker but complete in the median field; xxvii, uniannulate; the anus at the posterior border of xxvii.

No annulation or somital sense organs are detectable on the dorsum of the sucker which is slightly eroded as though the animal had been killed in hot water.

### Alimentary Tract

(Fig. 1c-e)

Jaws, small, compressed, slightly taller (0.4 mm) than wide (0.3 mm) across the base; housed in deep grooves with poorly defined margins; the dental ridge, low convex; the teeth, about 50, minute, at the median end 30 microns high, the row diminishing very gradually in height so that the teeth in the middle of the row are about 22.0 microns high, reducing from about the thirtieth tooth to be 15 microns or less at the outer end. No salivary gland papillae.

The mouth and lumen of the pharynx, narrow, the mouth little wider than the base of the dorsomedian jaw, the lumen tubular, tapering; internal muscular ridges, 6, alternating wide and narrow, one of each joining close to and entering the base of the jaw; none ending independently between the bases of the jaws.

Salivary glands, sparse, poorly defined right and left dorsal masses; no obvious thick cords of aggregated ducts. Radial muscles, an obvious extrinsic system extending back into the anterior part of x.

The pharynx, short, commencing at vii/viii and terminating at viii/ix. (In the type, the crop is narrowly tubular from ix to xii, without compartmentation or caecation, an artefact condition found in leeches killed in hot water, v. Richardson, 1969. The Cranbourne specimen shows a full compartment in ix; x to xii, each with a single pair of simple caeca median on the compartment, the caeca progressively longer and folding on themselves in xiii and xiv.) In the type, a simple

pair of median primary caeca on xiv, each folded on itself in the paramedian chamber; the caeca progressively longer in xv to xviii, extending into the following somite, folded; the compartment in xix, complete anterior and posterior to the median caeca which form postcaeca extending into xxvi. The intestine commences with a defined chamber in xx, followed by the tapering intestine. Dissection was not taken to the level of the rectum.

### Reproductive System

(Fig. 1f)

The indications are that the specimen is fully male mature.

The genital pores are at xi  $b_5/b_6$  and xii  $b_5/b_6$ . The tip of the penis shows as very narrow, cylindrical. The testes, simple, saccular, the first at xiii/xiv, the last at xxii/xxiii, total 10 pairs (11 in the Cranbourne specimen). The vasa deferentia run in the paramedian longitudinal chambers of the body cavity, each tapering in xiii, folding tortuously as the wider epididymis in the contiguous halves of xiii and xii, expanding into a much wider portion folding on itself in xii and xiii, this connecting by a thin-walled narrower short portion to the dorsal end of the elongate cylindrical ejaculatory bulb which has a descending vertical limb in xii and a sub-horizontal limb in xi; the bulbs taper very briefly at each end and are without distinct cornua. Accordingly, there is no primary loop on the anterior region of the paired male ducts; the epididymis, essentially posterior to the ejaculatory bulb; the two in a linear relationship.

A short thin-walled ejaculatory duct connects the anterior end of the bulb to the muscular atrium which is close behind g. ix, continuous with a narrower cylindrical elongate penis sheath reflecting on itself just anterior to g. xii, terminating at the genital pore. The male median region is myomeric, mesomorphic.

The saccular ovaries are in the posterior annuli of xii, connected by thin-walled oviducts, shorter than the ovaries, to the small atrium at xii/xiii; the common oviduct, slightly thicker-walled, weakly muscular, with a relatively large lumen, is much longer than the oviducts, but no more than half the length of the recurrent limb of the vagina, and extends loosely folded between the atrium and the caecate end of the vagina, independently, without association with either the vagina or the vaginal duct. The common oviduct joins the vagina subterminally lateral to g. xiii; the vagina caecate, the caecum, small, the whole muscular, elongate, cylindroid, folded on itself in the contiguous halves of xiv and xv, into subequal recurrent and procurrent limbs, the procurrent limb tapering in the posterior half of xiii to merge gradually into the more muscular folded vaginal duct which is a relatively short, not as strongly muscular as a typical duct, thinner-walled and with a relatively larger lumen than usual. The female median region is myomeric, mesomorphic, caecate with a duct, and the whole system ventral to the crop.

The prostate glands are a large mass covering the atrium and extending along the ejaculatory ducts. The albumin glands invest and conceal the atrium and the full length of the common oviduct.

*Other material:* One specimen, 22.0 mm long, Cranbourne. Victoria, coll. W. D. Williams, no date. Deposited Australian Museum, Sydney, Coll. No. W4196.

### Comparative Morphology of the Female Median Region

This region is well-advanced in functional differentiation in the type of *B. victoriae*; somewhat more so in the paratype where the vagina is markedly increased in diameter and the wall relatively thinned. In both, there is not the usual abrupt transition from vagina to vaginal duct as seen in *leches* having a fusiform to sub-ovoid vagina: the wall of the vagina relatively thin but muscular, the lumen, large; the vaginal duct, thick-walled, strongly muscularized, the lumen greatly

reduced; and the vagina and duct sharply distinct morphologically. Instead, in *B. victoricae*, the procurrent limb of the vagina tapers, reducing rather gradually in diameter, the wall remaining thin, the lumen reducing proportionately; so that the terminal portion which has the appearance of a duct, still has the wall thinner and the lumen larger, than is usual. In the two Torresian species with the U-form vagina, the terminal portion is more strongly muscularized, quite readily recognized as a vaginal duct, the division between vagina and duct quite sharply defined in the fully differentiated region, and the common oviduct is elongated and extends along the face of the vaginal duct; but in the Victorian leech, the common oviduct lies loosely tortuous between the atrium and the caecate end of the vagina, and is remote from and shorter than the duct.

In myomeric leeches with a caecate vagina, the female median region differentiates morphologically as a posteriorly directed primary loop; the recurrent limb forming the non-muscularized common oviduct, elongating in morphological differentiation to fold loosely between the atrium and the caecate end of the muscularized portion of the vagina which forms on the posterior part of the recurrent limb, the procurrent limb forming the vaginal duct; or in those without a vaginal duct, the vagina extends along the procurrent limb, so that at this stage it is folded on itself as two subequal limbs, the whole ventral to the crop (e.g. *H. medicinalis* v. Richardson 1969, Fig. 1A). In those without a duct, the vagina straightens during early functional differentiation to become subfusiform and stand more or less erect lateral to the crop (v. *Goddardobdella*, Fig. 2D; *Eunomobdella*, 2E), or extends posteriorly lateral to the crop (v. *Haemopsis* s.s., 3C; *Bdellarogatis*, 4A); but in all without a duct, the common oviduct elongates with the vagina, runs closely adherent to the wall of the simple vagina, and is of the length of the vagina.

In those with a caecate vagina and a vaginal duct, on the evidence of the Australian leeches, the condition towards the end of morphological differentiation is much as in those without a duct, the common oviduct loosely folded between the atrium and the caecate end of the vagina, and without association with either the vagina or the duct (v. *Richardsonianus*, Fig. 2A); the whole ventral to the crop. Growth in early functional differentiation is greater on the vaginal duct than on the vagina, the duct extending lengthwise and carrying the end of the vagina posteriorly, the body of the vagina becoming sub-erect lateral to the crop in mesomorphic forms (v. *Quantenobdella*, 2B; *Luranophila*, 2C); or elongate lateral to the crop in the macromorphic form (v. *Mollibdella*, 3D); or both the duct and vagina lateral to the crop in the megamorphic form (v. *Percymoorensis*, 4B); but in all with a duct, the common oviduct elongates and extends along the face of the vaginal duct and has no relationship with the wall of the vagina.

In the Torresian genus, the common oviduct is nearly equal in length or longer than the recurrent limb of the vagina and much of the length of the vaginal duct. It extends along the face of the duct to reach the caecate end of the vagina. The regional relationships of the common oviduct are those typical of leeches having a caecate vagina and a vaginal duct.

In *B. victoricae*, the common oviduct remains relatively short without elongation in functional differentiation although the duct elongates to become folded on itself. The common oviduct does not become closely associated with the vaginal duct; but retains the relationships achieved at the end of morphological differentiation unaltered in functional differentiation.

The persistence of the relationships of the common oviduct as achieved in morphological differentiation, the lack of the usual strongly muscularized wall and the presence of a relatively large lumen in the duct with the associated lack of sharp morphological distinction between the vagina and the duct, together indicate

some measure of failure in the usual organogenic processes elaborating these structures on the primary loop. With only the facilities of hand dissection, the evidence is that the 'duct' has more the nature of a 'vestigial' structure or 'pseudo-duct', and might more correctly be referred to in some such term rather than as a vaginal duct; but this can be decided only from the study of sections.

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