

TWO NEW SPECIES OF CESTODES FROM INDIAN LIZARDS.

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On several occasions I examined the intestines of the common garden lizard, *Calotes versicolor* Daud. and found them to be always infected by a cestode of the genus *Oochoristica*. The intestines of *Varanus bengalensis* Daud. another lizard which I have examined was always infected by *Duthiersia expansa* Perrier (1873), but on one occasion I also got a large number of a Proteocephalid worm associated with *Duthiersia expansa*.

Oochoristica sigmoides, sp. nov.

The species of the genus *Oochoristica* have been recently catalogued by Meggitt (1924) and since then, so far as I am aware, one more species, *O. theileri*, has been described by Fuhrmann (1924) from a lizard. These worms inhabit both mammals and reptiles and those from the latter occur in Lacertilia and Ophidia.

The worm is approximately 28-88 mm. in length with a maximum width of 0.9 mm. (1.4 mm. in the flattened specimen). The width increases as the mature proglottids are reached near the middle of the worm. The head (Fig. 1) is rounded and narrow and not definitely set off from the unsegmented portion of the strobila behind it. There is a slight protuberance which suggests a rudimentary rostellum. It has a width of 0.21 mm. (0.34 mm. in the flattened specimen). The unarmed suckers are oval, their antero-posterior diameter being 114 μ and transverse diameter 90 μ . The unsegmented region behind the head is 0.17 mm. in length though the beginning of segmentation is very faintly indicated. The most anterior segments are considerably broader than long and do not show any genital organs. The cirrus-sac and vagina are the first to appear. The ovary appears later and lastly the testes. The immature segments (Fig. 2) measure 0.32 mm. in length and 0.9 mm. in width in unflattened specimens. The gravid segments (Fig. 3), which are more or less quadrate, measure 0.87 mm. to 1 mm. in length and 0.9 mm. in width.

There are 15-20 segments in which well developed genital organs can be made out. The ovary disappears somewhat abruptly, being clearly visible up to a certain segment and then, in the following segment, being apparently absent; the testes, on the other hand, persist through two or three segments more.

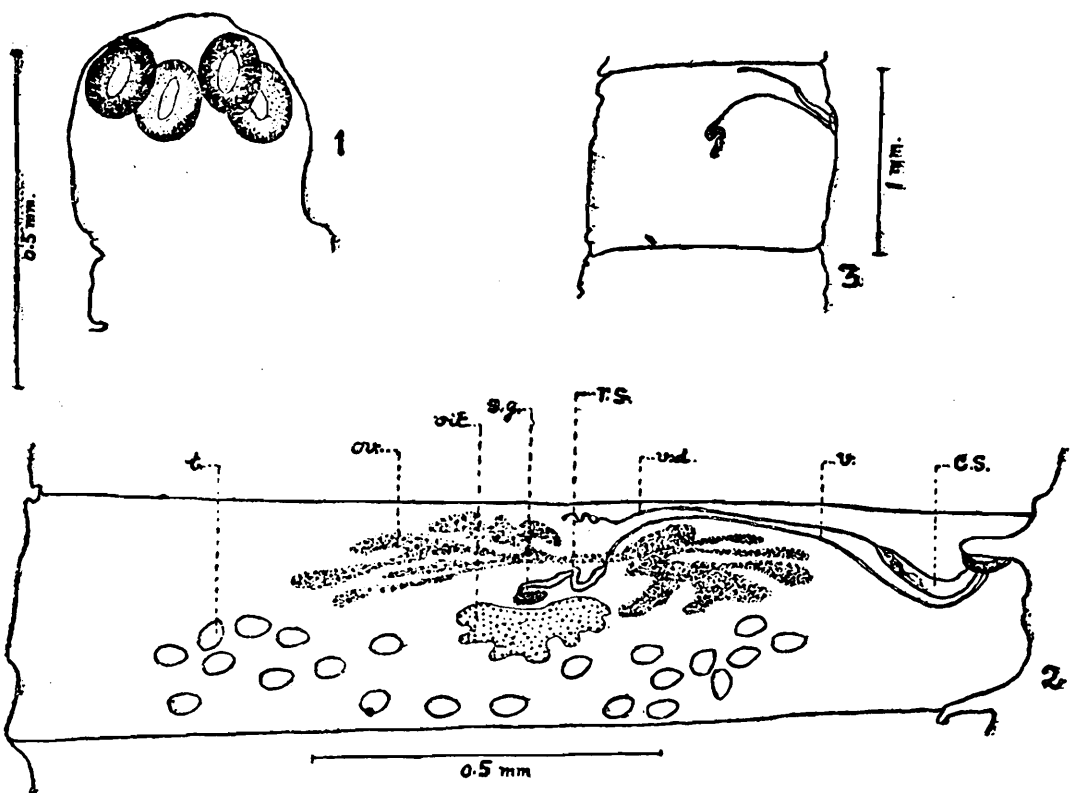
The cuticle is very thick. The musculature is weak and consists of an outermost layer of a few scattered longitudinal fibres, an inner layer of longitudinal bundles and an innermost layer of transverse fibres.

There are four longitudinal excretory vessels in each proglottid, of these the dorsal pair are wide and thin-walled and the ventral pair are

narrow and thick-walled. The latter are situated vertically below the dorsal ones and laterally give off irregular branches. The excretory vessels disappear in the posterior gravid segments.

The genital pores are irregularly alternate and are situated near the anterior corner of the lateral margin of the proglottid. The genital atrium has thick muscular walls and does not extend beyond the longitudinal excretory vessels. The genital ducts pass between the dorsal and ventral excretory vessels and dorsal to the nerve.

The testes (Fig. 2, *t.*), 22-24 in number, are disposed in two main groups one on each side of the corresponding lobe of the ovary. These two groups are connected by a row of 2-4 testes posterior to the vitelline gland. They do not extend in front of or lateral to the ovary



FIGS. 1-3.—*Oochoristica sigmoides*, sp. nov.

(From a flattened specimen.)

1. Scoles $\times 68$. 2. A mature proglottid $\times 68$. 3. A gravid segment. (Eggs are not drawn) $\times 19$.

c. s. cirrus-sac; *ov.*, ovary; *r.*, receptaculum seminis; *s. g.*, shell-gland; *t.*, testes; *v.*, vagina; *v. d.*, vas deferens; *vit.*, vitelline gland.

but extend beyond the aporal excretory vessel. The testes measure $48-52\mu \times 29-32\mu$.

The cirrus-sac (Fig. 2, *c. s.*), $154-167\mu$ in length and $20-25\mu$ in width, is a long thin sac containing a coiled portion of the vas deferens near the medial end. It passes beyond the excretory vessels. The vas deferens (*v. d.*), before it reaches the cirrus pouch, is a narrow straight tube as far as the point between the level of the bridge of the ovary, where it is disposed in one or two simple coils. The cirrus-sac opens into the genital atrium.

The ovary (*ov.*) is bilobed, each mass divided into finger-like lobes arising from a transverse stalk. It is situated in the anterior region of

the proglottid and is a large structure extending across more than one-half the width of the segment. The aporal lobe is slightly larger.

The vagina (*v*) is a straight and narrow tube running parallel and posterior to the cirrus-sac and vas deferens. It opens into the genital atrium just posterior to the opening of the cirrus-sac. It turns posteriorly and crosses the bridge of the ovary towards the poral side and then enlarges into a S-shaped narrow receptaculum seminis; at the other end of the latter structure it runs into the shell-gland (*s. g.*). The receptaculum seminis (*r. s.*) measures 79μ in length and 18μ in width. The large lobed vitelline gland (*vit.*) is slightly aporal.

The development of the uterus and the precise position it occupies could not be made out except that in gravid segments a very large number of parenchymatous capsules are seen, each capsule containing a single egg. These capsules fill nearly the whole of the gravid segment. The eggs are spherical in shape and measure 27μ in diameter, the diameter of the contained embryo being 15μ .

The possession of unarmed suckers, a single set of reproductive organs in each segment, genital pores irregularly alternating, the position of the testes and the eggs becoming enclosed singly in capsules places this worm in the genus *Oochoristica*. Referring to Meggitt's key to the species of this genus (1920) it comes very close to *O. truncata* Krabbe (1879) in the following particulars:—Egg-capsules contain only one egg, vagina opens posteriorly to the cirrus, testes 20-30, posterior to ovary; eggs present in the centre of the proglottid. It, however, differs from *O. truncata* Krabbe as described by Rudin (1916) in the following particulars:—Posterior segments becoming quadrate, position of the genital openings, longer cirrus-sac, the position of the testes and the smaller size of the eggs. I, therefore, consider it to be a new species. The following is the specific characterization:—

Length 28-88 mm., maximum width 0.9 mm.; segments broader than long, only a few at the posterior end nearly quadrate; scolex 0.21 mm. wide (0.34 mm. in flattened specimen), narrow and rounded, suckers oval, 114μ by 90μ ; genital ducts pass between longitudinal excretory vessels and dorsal to the nerve; testes 22-24, oval, posterior to the ovary, posterior and lateral to the vitelline gland, $48-52\mu$ by $29-32\mu$, cirrus-sac narrow, 154μ to 167μ long and $20-25\mu$ wide; ovary bilobed, extending across more than half the width of the segment, aporal lobe slightly larger and vagina straight and narrow posterior to the cirrus; uterus breaks into egg-capsules, each containing a single egg; embryo 27 and onchosphere 15μ in diameter.

Habitat.—Intestine of *Calotes versicolor* Daud.

Locality.—Nagpur, C. P., India.

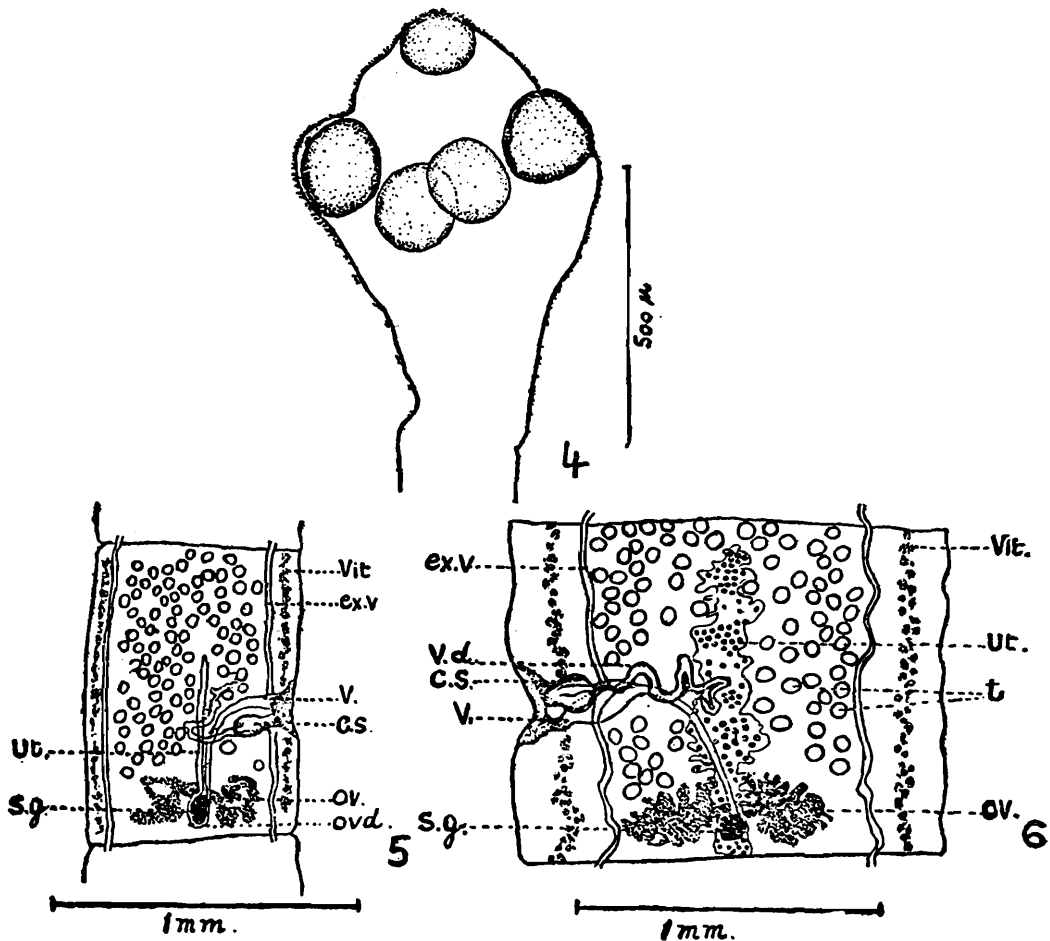
The type slide is deposited in the collection of the Zoological Survey of India.

***Proteocephalus woodlandi*, sp. nov.**

Many pieces of different lengths were found associated with *Duthiersia expansa* Perrier (1873). I obtained only two scolices: one was mounted when fresh in lactophenol but the other was lost during the process of fixing and washing. It is quite possible, as Woodland (1925, p. 374)

suggests, that many pieces remain attached to the intestinal mucosa. The three largest pieces measured 31 mm., 28 mm., and 24 mm. respectively. The total length of the pieces collected was 140 mm.

The scolex is situated on a uniformly wide neck, gradually widening at the level of the suckers and gradually tapering anteriorly. It is 525μ in maximum width, which is at the level of the suckers. It bears four rounded suckers, their diameter being 140μ by 148μ . On the conical apex of the scolex a fifth sucker is borne. The width of the worm behind the scolex is 205μ and increases in posterior proglottids to 1.4 mm. Young mature proglottids (Fig. 5) measure 1 mm. in length and



FIGS. 4-6.—*Proteocephalus woodlandi*, sp. nov.

(From an unflattened specimen.)

4. Scolex $\times 56$. 5. A young mature proglottid $\times 30$. 6. An older mature proglottid $\times 30$.
s., cirrus-sac; *ex. v.*, excretory vessel; *ov.*, ovary; *ovd.*, oviduct; *s.g.*, shell-gland; *t.*, testes; *ut.*, uterus; *v.*, vagina; *v.d.*, vas deferens; *vit.*, vitellaria.

694μ in width. Fully mature proglottids (Fig. 6), *i.e.*, the ones in which the uterus is well developed and nearly fills the whole segment, measure from 0.9 mm. to 1.66 mm. in length and 1.16 mm. to 1.4 mm. in maximum width. The proglottids do not overlap each other.

The cuticle of the scolex and the anterior end of the strobilus is covered with minute spines, which are closely set on the scolex but less dense behind.

The genital openings are irregularly alternating and are situated posterior to the middle of the proglottid margin. The opening of the

vagina is sometimes anterior and sometimes posterior to the opening of the cirrus. There is a well developed genital atrium.

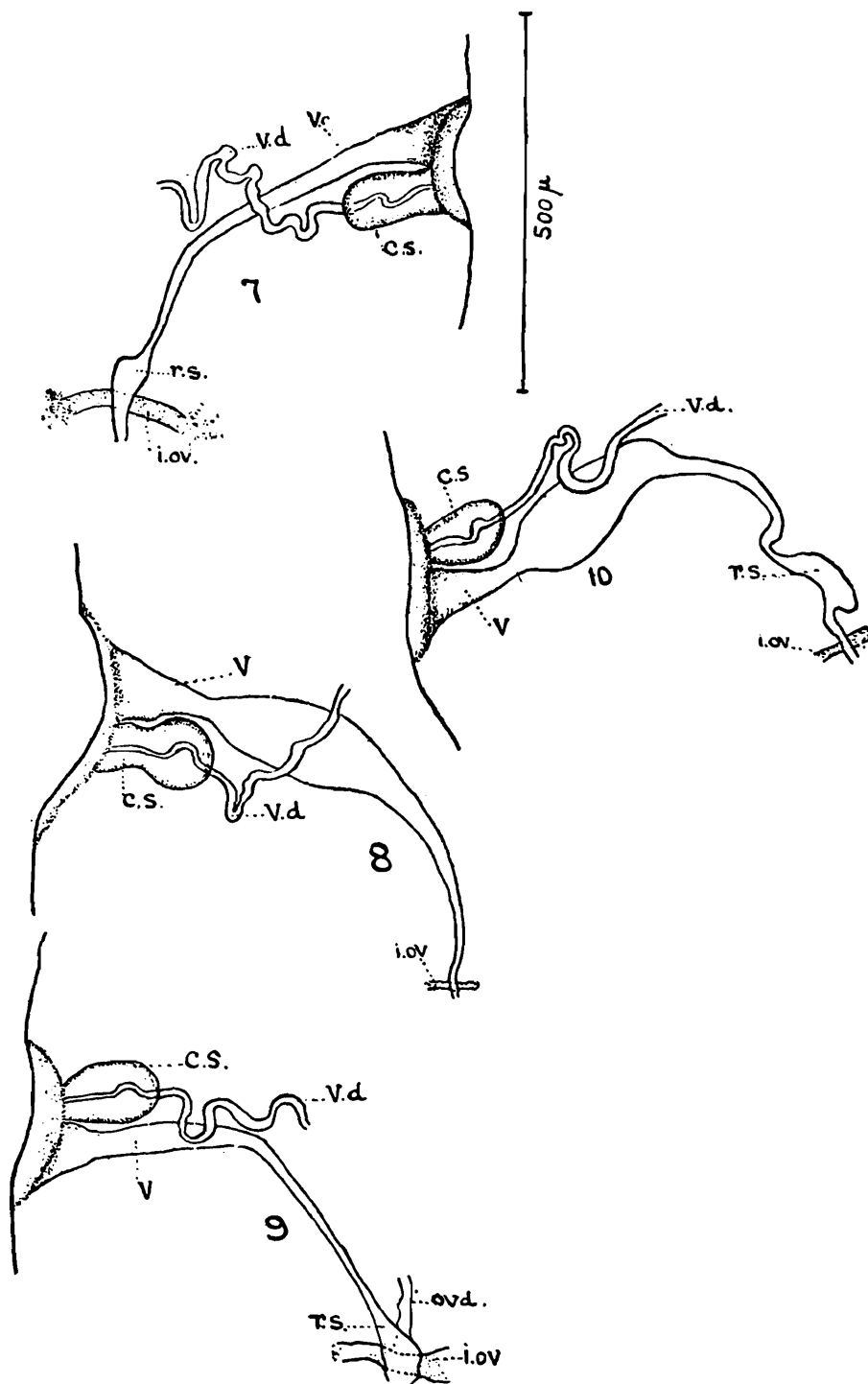
The testes (Fig. 6, *t.*), 90 to 130 in number, occupy in young segments the whole of the space between the longitudinal excretory vessels, but in more mature segments there is a considerable free space in the middle of the proglottid which, however, is not entirely free from testes. In distribution, therefore, the testes, as in *P. beddardi* Woodland (1925, p. 377), exhibit neither a strictly *Proteocephalus* nor a strictly *Ophiotaenia* condition. The testes in none of the older segments that I have examined have a one-field arrangement and yet in young mature segments (Fig. 5) there is a distinct one-field arrangement. There are no testes posterior to the ovary. They are vesicled and oval and measure 44-55 μ by 61-68 μ . The cirrus-sac (*c. s.*) in well developed segments is 156-176 μ long and 115-130 μ in maximum width. It is conical, unarmed and muscular, containing a rod-like portion of the vas deferens. It is sometimes anterior and sometimes posterior to the vagina and does not extend beyond the longitudinal excretory vessel. The vas deferens (*v. d.*) is a stout and a very loosely coiled tube dorsal to the excretory vessel. Some of these coils cross the broad vagina.

The ovary (*ov.*) is situated at the posterior extremity of the proglottid and consists of two branching masses connected together by a narrow bridge. It occupies nearly half the width of the proglottid. The poral lobe is slightly larger. The vagina differs considerably in different segments. Generally the vagina in *Acanthotaenia* is divisible into the following four parts:—(i) The initial part reaching from the genital atrium nearly to the middle of the proglottid; it is sometimes broadened out and muscular; (ii) the tube extending back to the interovarian space where its structure changes to (iii) the receptaculum seminis; and (iv) the lower vagina extending from the receptaculum seminis to the oviduct (La Rue, 1914, p. 29).

The initial part of the vagina in *P. woodlandi*, sp. nov. is broadened out and muscular (Figs. 7-10) and the tube, extending back to the interovarian space, commences in some segments with a thin-walled dilatation. This dilatation has the shape of a small spindle, but in some segments it may be very large and possibly corresponds to the "spindleformige Anschwellung" described by Ratz (1900, p. 659) in *I. saccifera*. It measures 250 μ in length and 100 μ in maximum width. Near the ovarian bridge in some segments but not in all the vagina enlarges into a small curved receptaculum seminis, which narrows posteriorly and passes into the shell-gland to join the oviduct. The oviduct (Fig. 5, *ovd.*) surrounds the shell-gland and continues anteriorly to the ovary into the uterus, which in young mature segments is a small narrow tube lying in the middle of the proglottid but not reaching to its anterior transverse margin. In older mature segments the uterus (Fig. 6, *ut.*) is a broad irregular thin-walled sac with 10-12 outpocketings on each side. As in *P. beddardi* Woodland (1925) the uterus extends to the hind limit of the proglottid, *i. e.*, below the ovary. The vitellaria have the normal *Proteocephalid* distribution. The eggs in the uterus measure 16 by 20 μ .

The possession of cuticular spines on the scolex and the anterior part of the body, the presence of the fifth sucker on the conical apex of the

rostellum and the fact that the vagina opens either anterior or posterior to the cirrus-sac place this worm in the genus *Acanthotaenia* v. Linstow (1903) as subsequently emended by Johnston (1909). La Rue (1911) suggests that to this genus should belong species of *Ichthyotaenia* from



FIGS. 7-10.—*Proteocephalus woodlandi*, sp. nov.

Various positions of the cirrus-sac and the vagina and the shapes of the vagina.

c. s., cirrus-sac ; i. ov., interovarian bridge ; ovd., oviduct ; r. s., receptaculum seminis ; v., vagina ; v. d., vas deferens.

the Varanidae and Johnston (1909) and La Rue (1911 and 1914) included in the genus *Acanthotaenia* species of *Ichthyotaenia* from the Varanidae previously described by Beddard (1913) and Ratz (1900). Later Hall

(1911) and La Rue (1914) maintain that *Ichthyotaenia* Lonnberg (1896) is synonymous with *Proteocephalus* Weinland (1856). Woodland (1924, p. 448) doubts the taxonomic value of characters such as the presence of cuticular spines and maintains that the creation of genera based on such characters is extremely objectionable. In a recent paper, he (Woodland, 1925) has pointed out that the other "non-scolex" characters associated with the spiny scolex in *Acanthotaenia* are also found "singly and probably to a large extent in other Proteocephalids altogether devoid of spiny scolices" (p. 387). He, therefore, considers it necessary that this genus should lapse along with several others of the family Proteocephalidae in the genus *Proteocephalus*. Acting on this I have labelled my worm *Proteocephalus*.

Of the species possessing cuticular spines on the scolex which have been included by Woodland in the genus *Proteocephalus* (1925, p. 379), both *Ichthyotaenia nilotica* Beddard (1913) and *Proteocephalus beddardi* Woodland (1925) have spines on the cirrus and can thus be distinguished from *P. woodlandi*, sp. nov. Besides, in *I. nilotica* the genital pores are slightly in front of the middle point of the proglottid margin, the ovary is solid and the eggs are aggregated in masses. In *P. beddardi* there are only 60-80 testes (90-130 in *P. woodlandi*) and each measures 55×30 microns ($44-55 \times 61-68$ microns in *P. woodlandi*). *Ichthyotaenia boroi* Ratz (1900), *I. varia* Beddard (1913) and *Acanthotaenia shipleyi* v. Linstow (1903) can also be distinguished from the species described in this paper by the position of the cirrus-sac, which always opens in these species behind the vagina. The reverse is the case in *Ichthyotaenia saccifera* v. Ratz (1900), *I. gracilis* Beddard (1913) and *Acanthotaenia tidswellia* Johnston (1910), in which the vagina always opens behind the cirrus-sac. Of the remaining species, *A. striata* Johnston (1914) is an extremely narrow worm being only 0.12 mm. in maximum width and has the testes disposed in "two rather narrow fields" (Johnston, 1914, p. 108). The description of *A. varia* Nybelin (1917), which is probably specifically distinct from Beddard's *I. varia* (Woodland, 1925, p. 379), is not available to me in India.

I consider *Proteocephalus woodlandi* to be a new species and I have named it in honour of Dr. Woodland, who has recently contributed so much to our knowledge of this family. The following is the specific characterization of *P. woodlandi*, sp. nov. :—

Maximum width 1.4 mm. ; maximum width of scolex 525μ , diameter of suckers 140μ by 148μ ; proglottids do not overlap each other; vitelline follicles scattered and confined to the cortical region; genital openings posterior to the middle of the proglottid margin, irregularly alternating; vagina sometimes anterior and sometimes posterior to the cirrus-sac; 90-130 testes, $44-55\mu$ by $61-68\mu$; cirrus-sac conical, $156-176\mu$ by 115 to 130μ ; vagina very variable in shape; in some segments the distal part at first widened out and muscular and a receptaculum seminis present in some segments; uterus at first a small thin-walled median tube but later filling nearly the whole medullary space with 10-12 small and irregular outpocketings on each side; eggs singly scattered in the uterus and its pockets, measuring 16×20 microns.

The type slide is deposited in the collection of the Zoological Survey of India.

In conclusion I desire to express my gratitude to Dr. Asa C. Chandler for giving me very valuable guidance in the compilation of this paper.

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