

ON FOUR TREMATODES OF THE GENUS DIPLOSTOMUM FROM BIRDS IN INDIA

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Abstract. Four species of the genus *Diplostomum* Nordmann, 1832 are reported from birds in India: *Diplostomum spathaceum* (Rudolphi, 1819), *D. butei* Vidyarthi, 1937, *D. odeningi* sp. n. and *D. vidyarthii* sp. n. Keys to the species of the subgenera *Adenodiplostomum* and *Glossodiplostomoides* have been proposed. *D. spathaceum* has been reported for the first time from India. Some variations have been noted in respect of *D. butei*.

Family Diplostomatidae Poirier, 1886

Diplostomum (*Diplostomum*) *spathaceum* (Rudolphi, 1819)

Fig. 1A

Material examined: 7 specimens from the small intestine of the Yellow-legged Herring Gull, *Larus argentatus cachinnans* Pallas and one specimen from that of the Dark-backed Herring Gull, *Larus fuscus taimyrensis* Buturlin at Pamban Island (Tamil Nadu), South India.

Shape and size: body 2.54—3.09 mm long, divided into two segments; anterior segment foliiform, 1.25—1.44 × 0.66—0.79 mm in size, posterior segment cylindrical 1.29 to 1.65 × 0.41—0.53 mm. Ratio of length of posterior to anterior segment 1-1.14. Suckers: oral, terminal, 77—90 × 78 to 107 μ ; acetabulum 90—107 × 116—133 μ , its anterior edge situated at 47—51/100 of the anterior segment; pseudosuckers marginal, reniform, 102—125 × 43—64 μ , in the region between the oral sucker and the pharynx. Tribocytic organ: round to elliptical, 172—189 × 111—163 μ , with a median slit, its anterior edge at 65—68/100 of the same segment, length of tribocytic organ 1/6 to 1/8 of the anterior segment. Proteolytic gland: two feeble masses, nearly equal to the size of the tribocytic organ lie just behind the latter. Gut: prepharynx 17—43 μ in length; pharynx 60—86 × 64—73 μ ; oesophagus 30—73 μ in length; caeca 28—54 μ in diameter, terminate near posterior extremity.

Reproductive systems: gonads generally apart; testes postovarian, anterior testis claviform, 215—258 × 321 to 368 μ , its anterior edge at 36—47/100 of the posterior segment; posterior testis 236—262 × 262—321 μ , symmetrically bilobed, two lobes united anteriorly by an isthmus, its posterior edge at 76—85/100 of the second segment. Seminal vesicle post-testicular. Ovary submedian, pretesticular, 86—120 × 94—129 μ , anterior edge at 25—35/100 of the same segment. Mehlis gland and vitelline reservoir intertesticular. Vitellaria extend from anterior level of tribocytic organ to posterior extremity of body. Bursa copulatrix small, its genital pore opens subterminally and dorsally. Genital cone absent. Eggs: 95 × 52 μ in size, oval, scarce.

Remarks: *Diplostomum spathaceum* is being reported for the first time in India. Earlier this species was reported from the United States, Canada, Alaska, Europe, USSR (Siberia, Kirghizia) and Australia. In fact there are four subspecies known to this species namely *D. spathaceum spathaceum* (Rudolphi, 1819) Braun, 1893; *D. spathaceum indistinctum* (Guberlet, 1923) Hughes, 1929; *D. spathaceum huronense* (La Rue, 1927) Hughes, 1929 and *D. spathaceum murrayense* (Johnston et Cleland, 1938) Johnston et Simpson, 1939. These have been differentiated on the basis of their cercariae and metacercariae. Only in the host range the species described above comes close to *D. spathaceum spathaceum* but it differs from it and other subspecies in its well-developed proteolytic gland. On account of the unavailability of its cercaria and metacercaria it could not be identified up to its subspecies level.

***Diplostomum (Dolichorchis) buteii* Vidyarthi, 1937**

Fig. 1B

Syn. *Diplostomum buteii* Vidyarthi, 1937; *Bolbophorus orientalis* Vidyarthi, 1938; *Neodiplostomum orientalis* (Vidyarthi, 1938) Bhalerao, 1942; *Diplostomum duboisi* Anantaraman and Balasubramaniam, 1953; *Diplostomum (Dolichorchis) duboisi*, Dubois, 1961.

Material examined: 6 specimens from the small intestine of a Pariah Kite, *Milvus migrans* (Boddaert) at the altitude of 6,000 ft above sea level in Simla hills (Himachal Pradesh), India.

Shape and size: body 0.95–1.06 mm long, divided into two segments; anterior segment 0.47–0.53 × 0.38–0.43 mm; posterior segment 0.47–0.53 × 0.26–0.30 mm. Ratio of length of posterior to anterior segment: 1–1.04. Suckers: oral, terminal, 40–45 × 45–50 μ ; acetabulum 45 × 45 μ , its anterior edge at 43–44/100 of the anterior segment; pseudosuckers 40–45 × 35 μ , marginal, situated laterally between oral sucker and pharynx. Tribocytic organ: circular, 140 to 175 × 140–175 μ , its anterior edge at 45–50/100 of the anterior segment. Proteolytic gland: feeble mass at the base of the tribocytic organ. Gut: prepharynx very short; pharynx 40 × 40 μ .

Table 1. *Diplostomum (Dolichorchis) buteii* Vidyarthi, 1937

	Author's observations	According to Dubois, 1970
Body length	0.95–1.06 mm	up to 1.78 mm
Anterior segment	0.47–0.53 × 0.38–0.43 mm	0.44–0.88 × 0.35–0.69 mm
Posterior segment	0.47–0.53 × 0.26–0.30 mm	0.30–0.96 × 0.28–0.69 mm
Ratio of the length: Posterior segment/ anterior segment	1–1.04	0.82–1.49
Oral sucker	40–45 × 45–50 μ	45–75 × 34–68 μ
Acetabulum	45 × 45 μ	23–69 × 31–89 μ
Pseudosuckers	40–45 × 35 μ	34–64 × 30–56 μ
Tribocytic organ	140–175 × 140–175 μ	240–400 × 176–240 μ *
Pharynx	40 × 40 μ	34–62 × 28–57 μ
Oesophagus	indistinct	15–23 μ
Anterior testis	100–105 × 250–325 μ	105–240 × 250–434 μ
Posterior testis	160–180 × 270–300 μ	315–464 × 240–410 μ
Ovary	75 × 75 μ	48–89 × 88–117 μ or (64–112 μ in diameter)
Eggs	100 × 70 μ	64–100 × 33–52 μ
Host	<i>Milvus migrans</i> (Boddaert)	<i>Buteo rufinus</i> (Cretzsch.); <i>Haliastur indus</i> (Bodd.); <i>Milvus migrans</i> govinda Sykes.
Location	Small intestine	Small intestine
Locality	Simla (India)	Lucknow, Allahabad, Madras (India)

*) or 148–250 × 165–400 μ or 128–164 × 96–124 μ

Reproductive systems: anterior testis asymmetrical, $100-105 \times 250-325 \mu$, its anterior edge at 26-28/100 of the posterior segment; posterior testis symmetrically bilobed, H-shaped, $160-180 \times 270-300 \mu$, its posterior edge at 63 to 81/100 of posterior segment. Seminal vesicle post-testicular. Ovary pretesticular, submedian, $75 \times 75 \mu$ in size. Vitelline reservoir intertesticular. Vitellaria extend from the level behind the pharynx to a little in front of posterior extremity. Bursa copulatrix contains genital cone, pore is dorsally subterminal, surrounded by sphincters. Eggs: oval, $100 \times 70 \mu$ in size.

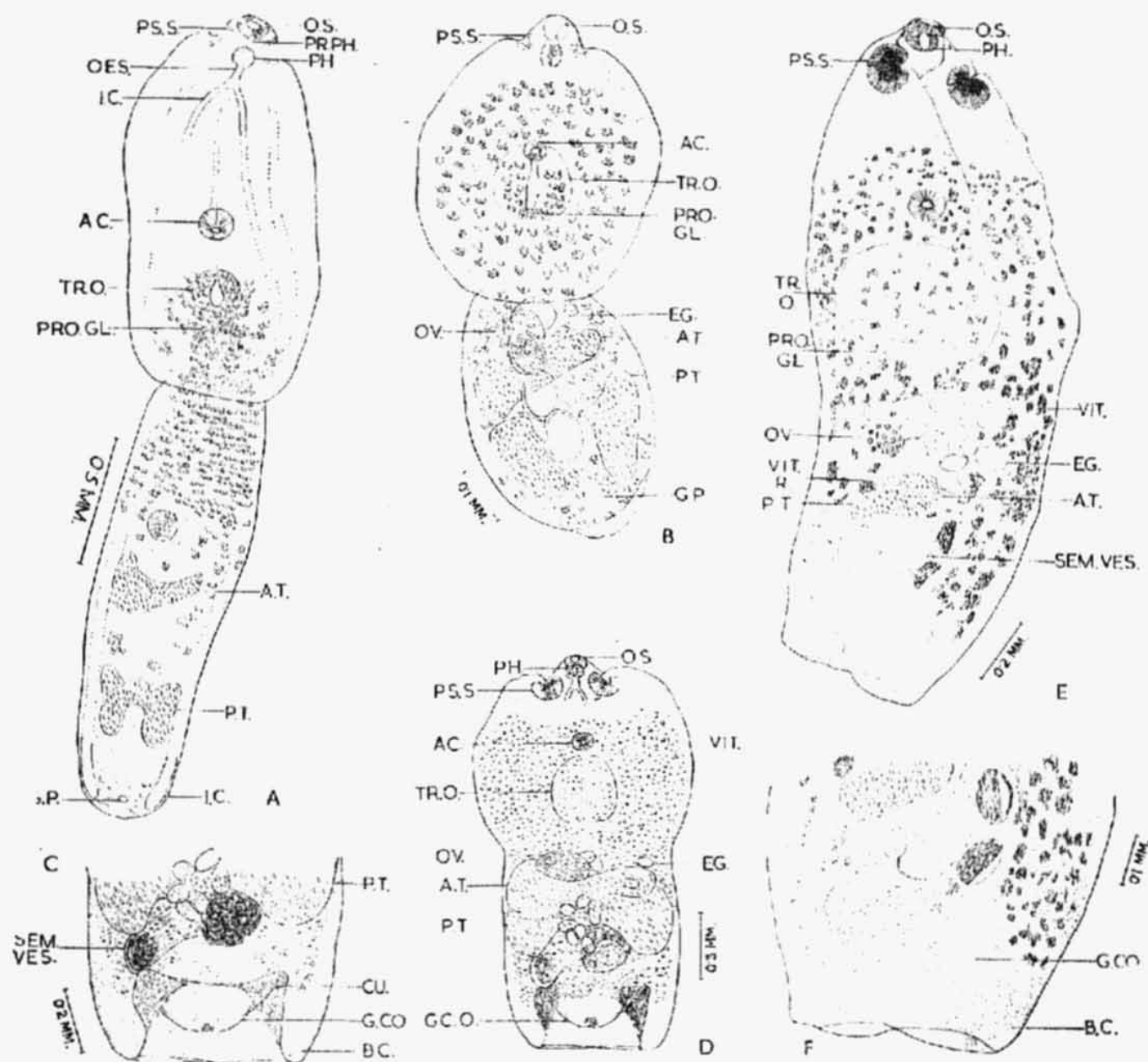


Fig. 1. A—*Diplostomum* (*Diplostomum*) *spathaceum* (Rudolphi, 1819). Whole mount; B—*Diplostomum* (*Dolichorchis*) *butei* Vidyarthi, 1937. Whole mount; C—*Diplostomum* (*Adenodiplostomum*) *odeningi* sp.n. Enlarged portion of posterior segment showing genital cone, cushion-like structure and bursa copulatrix with wide terminal opening; D—*D. odeningi* sp.n. Total view; E—*Diplostomum* (*Glossodiplostomoides*) *vidyarthii* sp.n. Total view; F—*D. vidyarthii* sp.n. Enlarged portion of posterior segment showing genital cone and bursa copulatrix.

Abbreviations: A. T.—anterior testis; AC.—acetabulum; B. C.—bursa copulatrix; CU.—cushion like structure; EG.—egg; G—Co.—genital cone; G. P.—genital pore; I. C.—intestinal caecum; O. S.—oral sucker; OES.—oesophagus; OV.—ovary; P. T.—posterior testis; PH.—pharynx; PR. PH.—propharynx; PRO. GL.—proteolytic gland; PS. S.—pseudosucker; SEM. VES.—seminal vesicle; TR. O.—tribocytic organ; VIT.—vitellaria; VIT. R.—vitelline reservoir.

Remarks: Our observations on the species *D. butei* Vidyrathi, 1937 tally with its original description except for some minor variations which are given in Table 1. Ram Prakash and Pande (1968), unaware of the work of Dubois (1968) redescribed *D. duboisi* from *Milvus migrans* at Lucknow. We agree with Dubois (1968) in dropping *D. duboisi* as synonym of *D. butei*.

***Diplostomum (Adenodiplostomum) odeningi* sp.n.**

Fig. 1C,D

Material examined: 2 specimens from the small intestine of a Pariah Kite, *Milvus migrans* (Boddaert) from the Zoological garden at Simla (Himachal Pradesh), India.

The fluke, 1.69—1.82 mm in length, is distinctly divided into anterior and posterior segments by a lateral constriction. Anterior segment 0.81—0.84 × 0.97—1.01 mm, slightly broader than long and armed with minute cuticular spines along its lateral margins. Posterior segment 0.88—0.96 × 0.8—0.96 mm and its posterior extremity (transversely wide) truncated. Ratio of length of posterior segment to that of anterior is 1.07—1.13. Oral sucker 42—52 × 103—125 μ , terminal. Acetabulum 73—99 × 103 to 142 μ , its anterior edge at 42—43/100 of the anterior segment. Pseudosuckers reniform, 112 × 125 μ , situated laterally at level of hind edge of pharynx. Tribocytic organ, 288 × 256 μ , aspinose, longitudinally elliptical, possessing a median slit; its anterior edge lies at 53—56/100 of the anterior segment. Ratio of length of anterior segment to that of tribocytic organ 2.8. Pharynx 56—60 × 82—103 μ , followed by oesophagus, 38 μ in length. Intestinal caeca slender and terminating near posterior end of body. Gonads are proximate. Testes cover nearly entire breadth of posterior segment. Anterior testis 185—192 × 640—656 μ , asymmetrical, its anterior edge at 16/100 of the posterior segment. Posterior testis 206 × 736 μ , bilobed, symmetrical, its posterior edge lies at 48—49/100 of second segment. Seminal vesicle voluminous, post-testicular. Ovary 128—129 × 256—258 μ , oval, its anterior edge at 2—4/100 of the same segment. Uterus does not ascend beyond intersegmental constriction. Vitellaria extend from the level (30—35/100), i.e., half way between suckers, to that of anterior border of bursa copulatrix or little behind it. They are densely distributed in anterior segment. Bursa copulatrix spacious, its anterior edge at 62—66/100 of posterior segment. It possesses a very wide terminal opening, a characteristic feature of the subgenus *Adenodiplostomum* and shelters a huge genital cone, furnished with a ventral cushion-like structure. Eggs 82—86 × 58—60 μ , oval, operculate.

Discussion. The subgenus *Diplostomum (Adenodiplostomum)* Dubois, 1937 comprised only one species, *Diplostomum triangulare* (Johnston, 1904) Hughes, 1929. The new species differs from it in certain features of the anterior segment, oral sucker and tribocytic organ, shape, size of ovary and eggs, extent of vitellaria, host range and geographical distribution, as shown in the key.

The new species has been named after Professor K. Odening for his very valuable contributions in the study of strigeids. The type specimens have been deposited with the senior author in his collection.

KEY TO SPECIES OF THE SUBGENUS ADENODIPLOSTOMUM DUBOIS, 1937

- 1 Anterior segment longer than broad, cuticular spines restricted to level of tribocytic organ the latter also spinose, oral sucker longitudinally elongated, ovary longitudinally oval, egg 89—96 × 52—57 μ , vitellaria extend up to posterior extremity of the body. Parasites of *Dacelo novaeguineae*, and *Halcyon sanctus*. Australia *D. triangulare*
- Anterior segment broader than long, cuticular spines present throughout its entire lateral margins tribocytic organ aspinose, oral sucker transversely elongated, ovary transversely oval, eggs 82—86 × 58—60 μ , operculate, vitellaria extend up to or slightly behind anterior edge of bursa copulatrix. Parasite of *Milvus migrans*. India *D. odeningi* sp.n.

Material examined: One specimen from the small intestine of a Pariah Kite, *Milvus migrans* (Boddaert) at Simla (Himachal Pradesh), India. Only one fluke of this new species was recovered out of 28 hosts examined by the author.

The fluke, 2.03 mm in length, is thick and elongated without any distinct intersegmental constriction. Maximum breadth of fluke 0.78 mm at level of tribocytic organ. Lateral margins incurved ventrally. Posterior extremity of the fluke truncated. Oral sucker $35 \times 120 \mu$, terminal, transversely elongated. Acetabulum $100 \times 110 \mu$, feebly developed, its anterior edge at 532μ behind anterior extremity of the fluke. Pseudo-suckers reniform, $150 \times 95 \mu$. Tribocytic organ $380 \times 475 \mu$, elliptical. Pharynx $55 \times 90 \mu$, close behind oral sucker.

Testes tandem, proximate, asymmetrical, transversely located. Anterior testis $90 \times 180 \mu$. Posterior testis $105 \times 235 \mu$, its posterior edge at $75/100$ of the entire body length. Seminal vesicle post-testicular. Ovary $120 \times 120 \mu$, pretesticular, submedian, spherical in outline. Vitelline reservoir intertesticular. Vitellaria extend from level little in front of acetabulum to level of genital cone. Bursa copulatrix spacious, it shelters a large genital cone and opens terminally through a wide aperture. The eggs, $98 \times 60 \mu$ in size, are oval.

Discussion: *Diplostomum vidyarthii* sp.n. approaches *D. hieraeti* (Vidyarthi, 1938), the only known species within the subgenus *Glossodiplostomoides* Bhalerao, 1942 in the shape of the body and geographical distribution (India), but differs from it in the extent of vitellaria, shape, size and position of ovary and host.

The new species has been named after Mr. R. D. Vidyarthi. The type specimens have been deposited in the collection of the senior author.

KEY TO SPECIES OF THE SUBGENUS *GLOSSODIPLOSTOMOIDES* BHALERAU, 1942

- 1 Vitellaria extend from the level of acetabulum to a little in front of posterior extremity forming two distinct lateral bands. Ovary $67-100 \times 167-240 \mu$ in size, elliptical and median. Parasite of *Hieraeetus fasciatus* and *Buteo rufinus* *D. hieraeti*
- Vitellaria extend from the level a little in-front of acetabulum to that of genital cone without forming lateral bands. Ovary $120 \times 120 \mu$, round and submedian. Parasite of *Milvus migrans* ... *D. vidyarthii* sp.n.

ЧЕТЫРЕ ВИДА ТРЕМАТОД РОДА *DIPLOSTOMUM* ОТ ПТИЦ ИНДИИ

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Резюме. Четыре вида трематод рода *Diplostomum* Nordmann, 1832 обнаружены в птицах Индии: *Diplostomum spathaceum* (Rudolphi, 1819), *D. butei* Vidyarthi, 1937, *D. odeningi* sp.n. и *D. vidyarthii* sp.n. Приведена определительная таблица видов относящихся к под родам *Adenodiplostomum* и *Glossodiplostomoides*. *D. spathaceum* отмечен в первый раз из Индии. Отмечены некоторые различия относительно *D. butei*.