

TREMATODES OF VERTEBRATES OF RAJASTHAN

M. HAFEEZULLAH

Zoological Survey of India, M-Block, 535-New Alipore,
Calcutta-700053.

INTRODUCTION

The present study is based on the digenetic trematodes of garden lizards, snakes and bats collected from Jodhpur (Rajasthan) and the nearby areas during 1980-82. They belong to the families Dicrocoeliidae, Lecithodendriidae and Plagiorchiidae and are all known forms. Therefore, only their diagnostic features are included in this paper with interesting remarks on variability, zoogeography, host and locality records and synonymies.

The specimens were processed according to the standard methods of collection i. e. flattening under cover glass pressure, killing and fixing with the fixative AFA, preserving in 70% alcohol, staining with borax carmine, differentiation with acid alcohol, dehydration with higher grades of alcohol, clearing with xylol and clove oil, mounting in Canada balsam, and finally drying the permanent mounts on temperature regulated hot plate.

The drawings have been made with the aid of a camera lucida. The material has been deposited with the National Collections of Zoological Survey of India, Calcutta.

Family DICROCOELIIDAE Odhner, 1910

Subfamily DICROCOELINAE Looss, 1899

Genus 1. *Paradistomum* Kossack

1910. *Paradistomum* Kossack, *Ctbl. Bakt. I. Orig.*, 56 (2) : 114.
1944. *Paradistomoides* Travassos, *Mem. Inst. Oswaldo Cruz*, 2 : 263.
1960. *Paradistomum* : Arora and Agarwal, *Bull. zool. Soc. College Sci.*, Nagpur, 3 : 51.
1960. *Paradistomoides* : Arora and Agarwal, *Bull. zool. Soc. College Sci.*, Nagpur, 3 : 51.

Arora and Agarwal (1960) have studied intra-specific variations in *Paradistomum orientalis* (Narain and Das, 1929) in detail in 157 specimens collected from the gall-bladder of *Calotes versicolor* Daud. They have made systematic study of the digenean trematode on the basis of five pure populations, each of one, sixteen, eight and fifty-one specimens while a sixth sample of mixed population of sixty-seven parasites was also included in the study. They have noted marked variations in shape (broad and leaf-like, slender, elongated) and size of the body, width of intestinal caeca

(extremely broad to narrower), length of oesophagus in broad to narrower forms, lobation of testes (from ovoid to indented). positions of ovary and genital pore, etc. in specimens recovered from a single gall-bladder. The most significant variation they have noted is in the anterior extent of vitellaria with respect to the level of the anterior margin of the testes or the ventral sucker-intergrading variations in the gravid individuals collected from the same gall-bladder. On this evidence, they do not agree with the separation of *Paradistomoides* Travassos, 1944 from *Paradistomum* Kossack, 1910. The author has also studied six pure populations (16, 5, 8, 1, 2, 2) recovered from the gall-bladder of *Calotes versicolor* and *Hemidactylus brooki* examined at Jodhpur, Rajasthan. He has also come to the same conclusion that *Paradistomoides* should be considered as a synonym of *Paradistomum*.

1. *Paradistomum orientalis* (Narain and Das)

(Figs. 1, 2)

1929. *Dicrocoelium orientalis* Narain and Das, *J. Bombay nat. Hist.*, 33 (2) : 250.
 1936. *Paradistomum orientalis* : Bhalerao, *J. Helminth.*, 14 : 173.
 1936. *Paradistomum moghei* Bhalerao, *J. Helminth.*, 14 : 170.
 1957. *Paradistomum banarasensis* Baugh, *Proc. natl. Acad. Sci. India*, B, 26 (6) : 417.
 1978. *Paradistomoides orientalis* : Nama and Khichi, *Z. Angew. Zool.*, 60 : 258.
 1973. *Paradistomoides medius* Nama and Khichi, *Z. Angew. Zool.*, 60 : 258. (syn. nov.)
 1973. *Paradistomoides brevis* Nama and Khichi, *Z. Angew. Zool.*, 60 : 259 (Syn. nov.)

Material : Hosts—*Calotes versicolor* Daud., (Squamata : Sauria : Agamidae) ; *Hemidactylus brooki*, (Squamata ; Sauria : Geckonidae) ; location—Gall-bladder ; locality—Jodhpur (Rajasthan) ; no. of specimens—16+5+8+1+2+2=34, on slides, collected in May and October, 1981.

Diagnosis : Body narrow elongated to leaf-like with narrow anterior end and broadly rounded posterior end. Suckers equal to subequal. Prepharynx indistinct pharynx small ; oesophagus slender ; intestinal caeca narrow to fairly broad. Testes ovoid to globular, immediately posterolateral to acetabulum, caecal. Cirrus sac cylindrical to fusiform, lying between acetabulum and intestinal bifurcation. Genital pore at level of intestinal bifurcation. Ovary globular to ovoid, immediately behind testes, median or submedian. Seminal receptacle smaller or subequal or even larger than ovary. Uterine coils filling all available postacetabular space. Vitelline follicles variable in anterior extent being post-testicular to testicular or even pretesticular.

Remarks : *Paradistomum moghei* (Bhalerao, 1936) was recovered from the liver of *Calotes versicolor* and was described as distinct from *P. orientalis*, but Krishnaswamy

and Anantaraman (1956), while studying variations in 91 specimens recovered from the gall-bladder of *C. versicolor*, arrived at the conclusion that it should be a synonym of *P. orientalis*, in spite of differences in body shape, size, vitellaria not extending anteriorly beyond the anterior border of testes, in the contents of the cirrus sac and

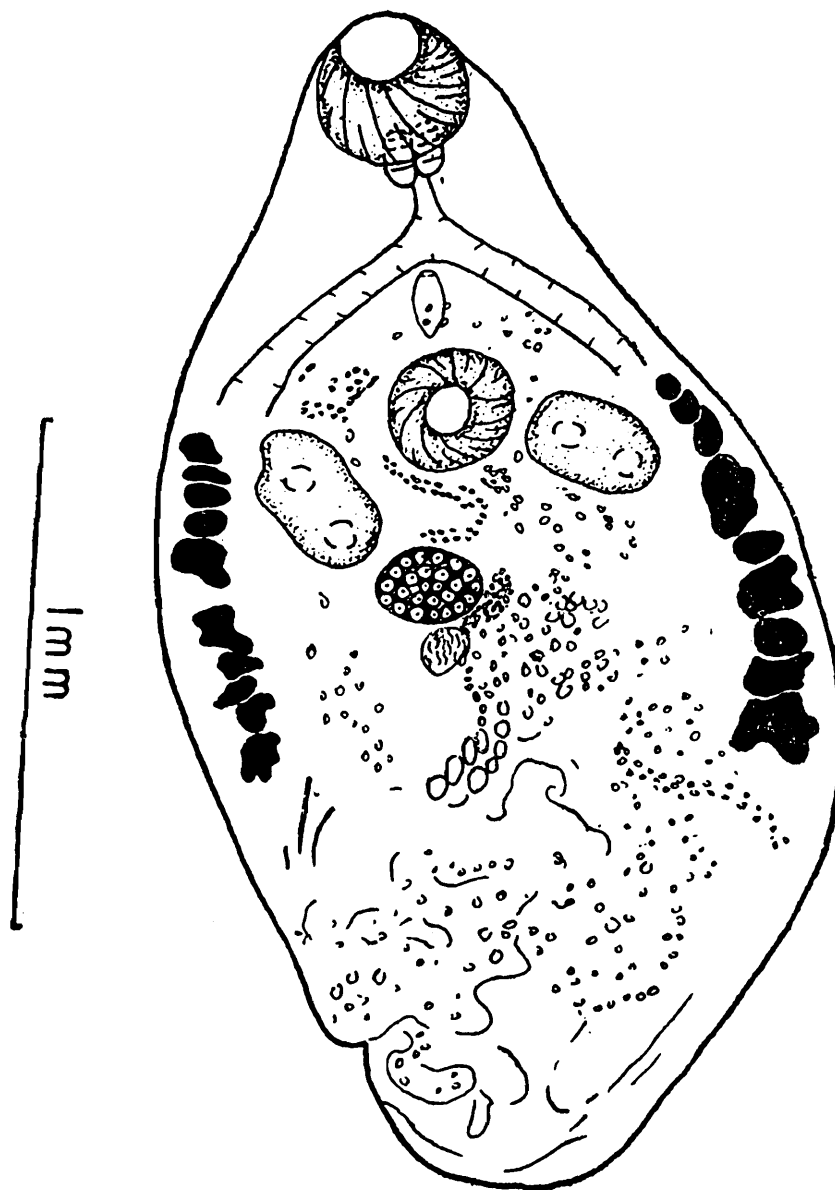


Fig. 1

Figs. 1. *Paradistomum orientalis* from *Hemidactylus brooki*. Entire worms.

wide intestinal caeca. Arora, Agarwal and Agarwal (1962) studied the occurrence of intra-specific variations in *P. orientalis* from the liver [18 (N=18ex.)] and intestine [27 (N=27ex.)] of *C. versicolor*. As a result of this study, they considered *P. moghei* and *P. banarasensis* as synonymous with *P. orientalis*. The authors gave an emended diagnosis of this species.

Nama and Khichi (1973) did not consult Krishnaswamy and Anantaraman (1956), Arora and Agarwal (1960) and Arora, Agarwal and Agarwal (1962) and maintain *Paradistomoides* Travassos, 1944 distinct from *Paradistomum* Kossack, 1910 and *P. moghei* (Bhalerao, 1936) and *P. orientalis* as distinct species. They further added 2 more new

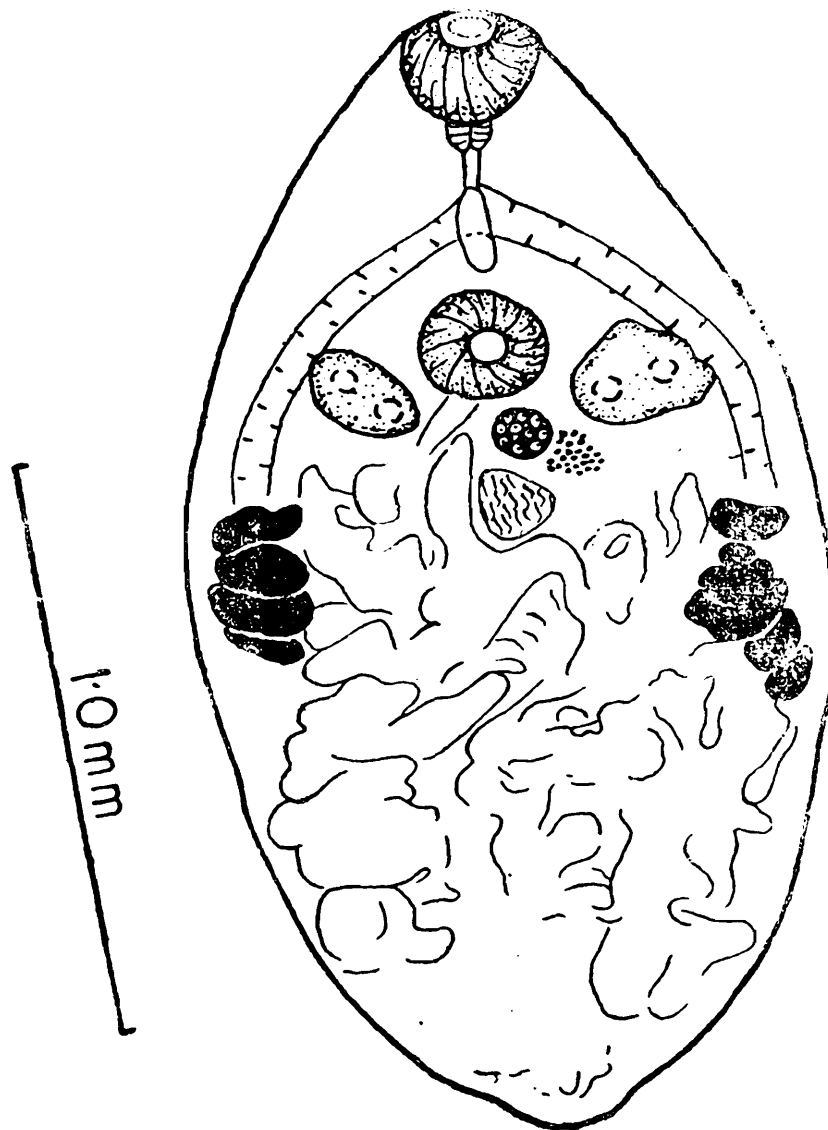


Fig. 2

Fig. 2, *Paradistomum orientalis* from *Hemidactylus brooki*. Entire worms.

species in the genus *Paradistomoides* which were collected from the gall-bladders of *Hemidactylus flaviviridis* from Jodhpur, Rajasthan. The two new species *P. medius* and *P. brevis* fall within the great range of intraspecific variations of *Paradistomum orientalis*. The present author therefore considers both the species as synonyms of *P. orientalis*.

2. *Paradistomum spatulum* (Simha) n. comb.

(Figs. 3, 4)

1958. *Paradistomoides spatulus* Simha, *Z. Parasitenkd.*, 18 : 193.

1973. *Paradistomoides diminutus* Nama and Khichi, *Z. Angew. Zool.*, 60 : 260. (n. syn.)

1973. *Paradistomoides intermedius* Nama and Khichi, *Z. Angew. Zool.*, 60 : 263. (n. syn.)

1973. *Paradistomoides elongatus* Nama and Khichi, *Z. Angew. Zool.*, 60 : 265. (n. syn.)

Material : Hosts—*Calotes versicolor*, (Squamata : Sauria : Agamidae) ; *Eryx conicus*, (Ophidia : Boidae) ; location—Gallbladder ; locality—Jodhpur (Rajasthan) ; no. of specimens—6+4+2=12, on slides, collected in May and October 1981.

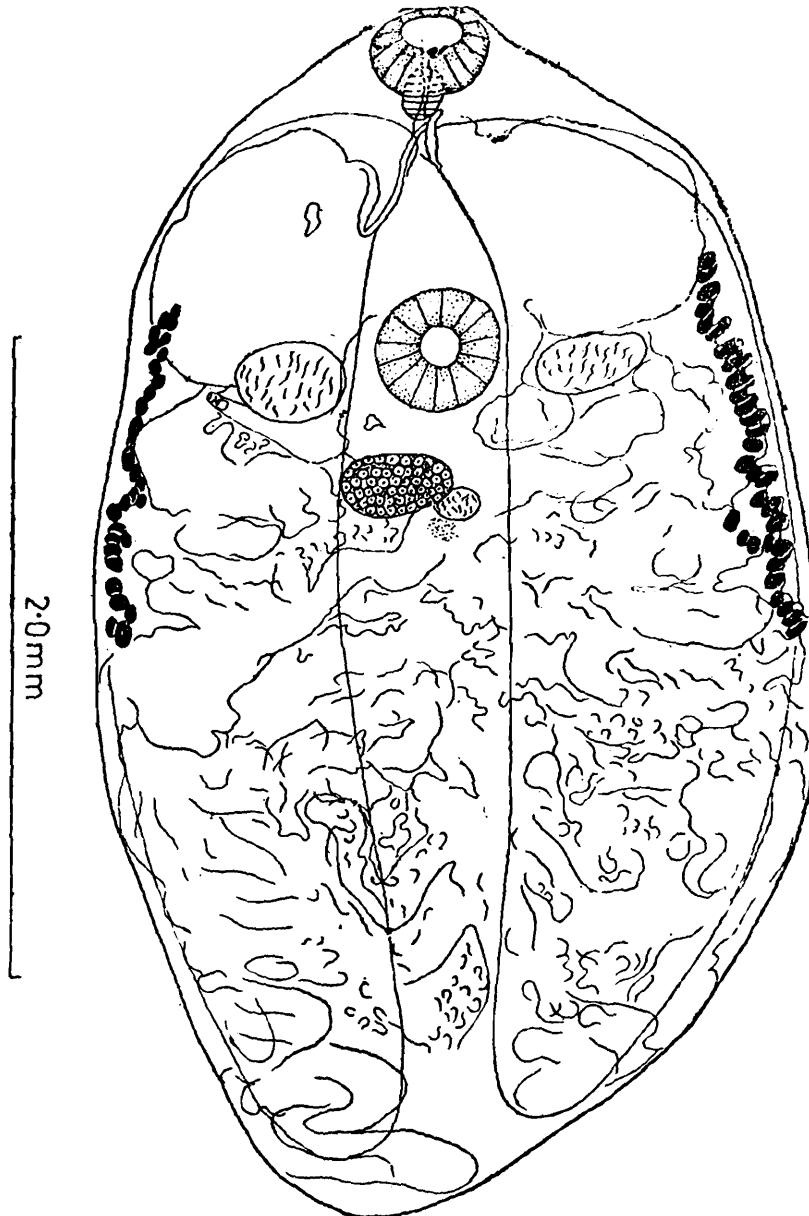


Fig 3

Fig. 3. *Paradistomum spatulum* from *Calotes versicolor*. Entire worm.

Diagnosis : Body large, oblong or spatulate. Oral sucker terminal. Acetabulum in middle of anterior half of body, larger than oral sucker. Pharynx muscular. Oesophagus very short. Caeca much wide, distended, extending slightly short of posterior end of body. Testes symmetrical, one on either side immediately behind acetabulum, smaller or almost equal to latter. Cirrus sac small. Genital opening ventral to

intestinal bifurcation. Ovary entire or of irregular margin, post-testicular, median or submedian. Seminal receptacle and shell gland present near ovary. Vitelline follicles extending from about equatorial plane to level of anterior margin of acetabulum or beyond it, definitely post testes. Dense and close coils of uterus filling entire hind body.

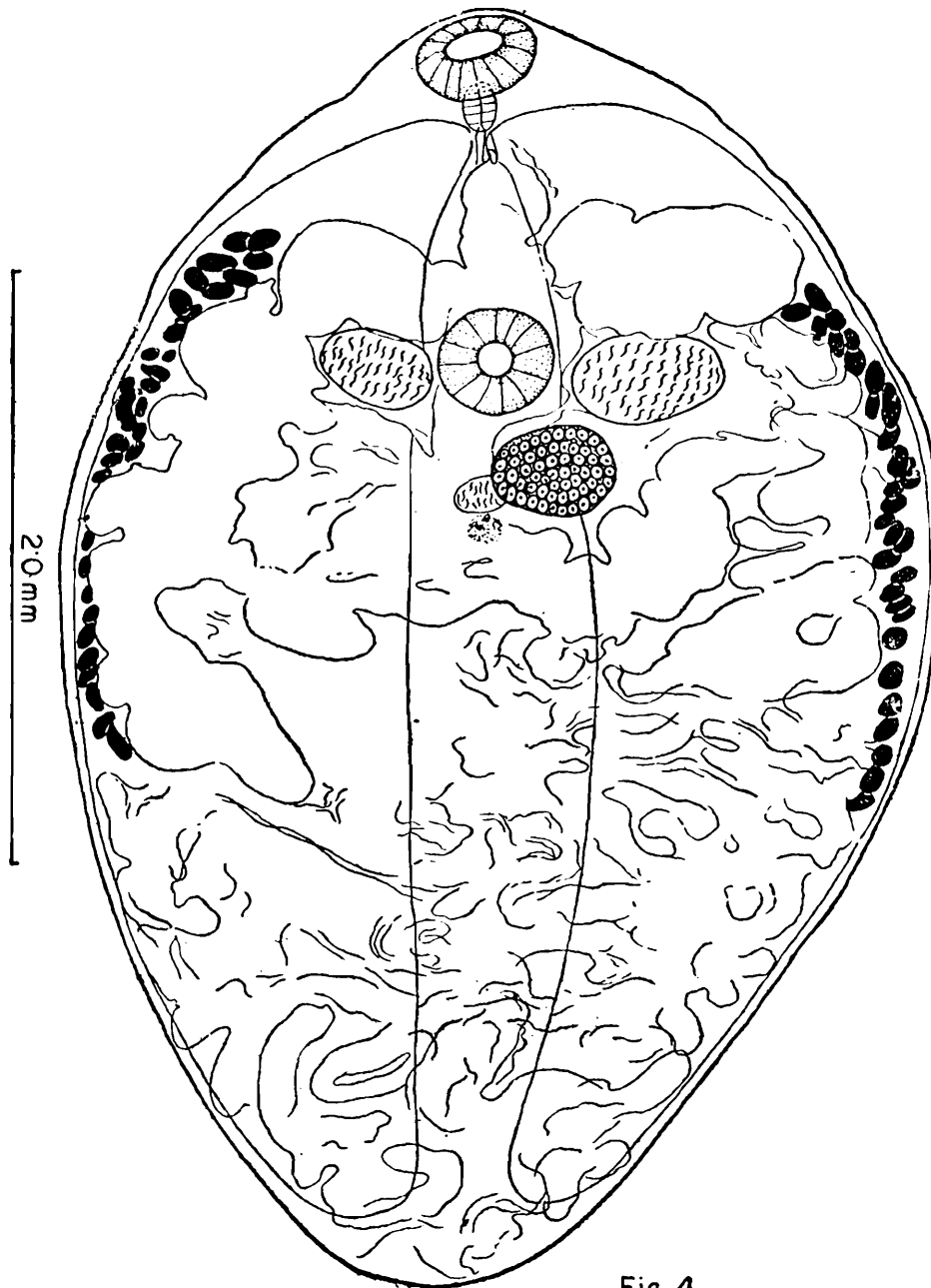


Fig. 4

Fig. 4. *Paradistomum spatulum* from *Eryx conicus*. Entire worm.

Remarks: Simha (1958) described this species from the gall-bladder of the rock lizard, *Calotes numbericola*, from Hyderabad. The present specimens from the gall-bladder of the garden lizard, *Calotes versicolor*, and the snake, *Eryx conicus*, from Jodhpur (Rajasthan), closely resemble Simha's description except in smaller eggs. The body also is not uniformly broad and spatulate in all the specimens from both the

hosts. The present specimens also come very close to *Paradistomum couteleni* (Deblock, Capron and Brygoo, 1962) in body size, extent of vitellaria, small cirrus sac, greatly distended caeca and egg size. It is quite possible that further study may prove *P. couteleni* as synonym of *P. spatulum*. Nama and Khichi (1973) did not compare their species *Paradistomoides diminutus*, *P. intermedius* and *P. elongatus* with *Paradistomoides spatulus* Simha, 1958, and did not consult the papers of Arora and Agarwal (1960) and Arora, Agarwal and Agarwal (1962). In the light of these investigations and study of the present material, *P. diminutus*, *P. intermedius* and *P. elongatus* fall as synonyms of *Paradistomum spatulum* (Simha, 1958).

Family LECITHODENDRIIDAE Odhner, 1911

Subfamily LECITHODENDRIINAE Looss, 1902

Genus 2. *Prosthodendrium* Dollfus

1896. *Lecithodendrium* Looss, (*Partim*), *Mem. Inst. Egypt*, 3 : 86.
 1931. *Prosthodendrium* Dollfus, *Ann. Parasit.*, 9 : 484.
 1943. *Skrjabinodendrium* Skarbilovich, *Dokl. Acad. Nauk SSSR n. s.*, 38 (7) : 223.
 1943. *Chiroptodendrium* Skarbilovich, *Dokl. Acad. Nauk SSSR n. s.*, 38 (7) : 224.
 1943. *Travassodendrium* Skarbilovich, *Dokl. Acad. Nauk SSSR n. s.*, 38 (7) : 224.
 1954. *Longitrema* Chen, *Acta zool. Sinica*, 6 : 150.

The genus *Prosthodendrium* was erected by Dollfus (1931) with *Prosthodendrium dinanatum* (Bhalerao, 1962) as its type species. With the passage of time, a large number of species was added under it. It included species with lobed and unlobed ovaries. Dollfus (1937) divided this genus into two subgenera, viz., *Prosthodendrium* Dollfus, 1931 with *Prosthodendrium (Prosthodendrium) dinanatum* (Bhalerao, 1926) as type species, and *Paralecithodendrium* Odhner, 1911 without a type species. The former lecithodendriid trematodes included with unlobed ovaries while the latter trematodes with lobed ovaries. This arrangement is generally accepted by other workers. Dubois (1960, 1962) revised the subgenera *Prosthodendrium* and *Paralecithodendrium* respectively, reducing the number of species to 23 in the former and 6 in the latter through synonymisation. Later on, a few more species were added to each subgenus. Yamaguti (1971) accepted the validity of *Skrjabinodendrium* on the basis of the characters of *Lecithodendrium orospinosa* Bhalerao, 1926 only, and that of *Longitrema* on the basis of *Prosthodendrium piriforme* Yamaguti, 1939, as the type species, (other species being *Lecithodendrium bhaleraoi* Pande, 1935, *Prosthodendrium chilostomum* (Mehlis, 1831) Macy, 1936, *Prosthodendrium chilostomum madagascariense* Richard, 1966, *Lecithodendrium longiforme* Bhalerao, 1926, *Lecithodendrium longiforme allahabadi* Pande, 1935 and *Lecithodendrium luzonicum* Tubangui, 1928). However, there appears to be no pronounced generic difference between these two genera and others listed above.

3. *Prosthodendrium (Prosthodendrium) longiforme* Bhalerao
(Fig. 5)

1926. *Lecithodendrium longiforme* Bhalerao, *J. Burma Res. Soc.*, 15 : 183.
 1928. *Lecithodendrium luzonicum* Tubangui, *Philippine J. Sc.*, 36 : 366.
 1931. *Prosthodendrium longiforme* : Dollfus, *Ann. Parasit.*, 9 : 484.
 1935. *Lecithodendrium bhaleraoi* Pande, *Proc. Acad. Sc. U.P. Agra Oudh*, 5 (1) : 91.
 1935. *Lecithodendrium langiforme* var *allahabadi* Pande, *Proc. Acad. Sc. U. P. Agra Oudh*, 5 (1) : 93.
 1937. *Prosthodendrium (Pr.) longiforme* : Dollfus, *Bull. Mus. Roy. Hist. Nat. Belgique*, 13 : 1-21.
 1939. *Lecithodendrium kitazawai* Ogata, *Dobutsugaku Zasshi*, 51 (8) : 625.
 1955. *Prosthodendrium (Pr.) longiforme* : Dubois, *Rev. Suisse Zool.*, 62 : 498.
 1956. *Prosthodendrium magnum* Rysavy, *Cosk. parasitol.*, 3 : 167.
 1973. *Prosthodendrium longiforme* : Matskasi, *Parasit. Hung.*, 6 : 84.

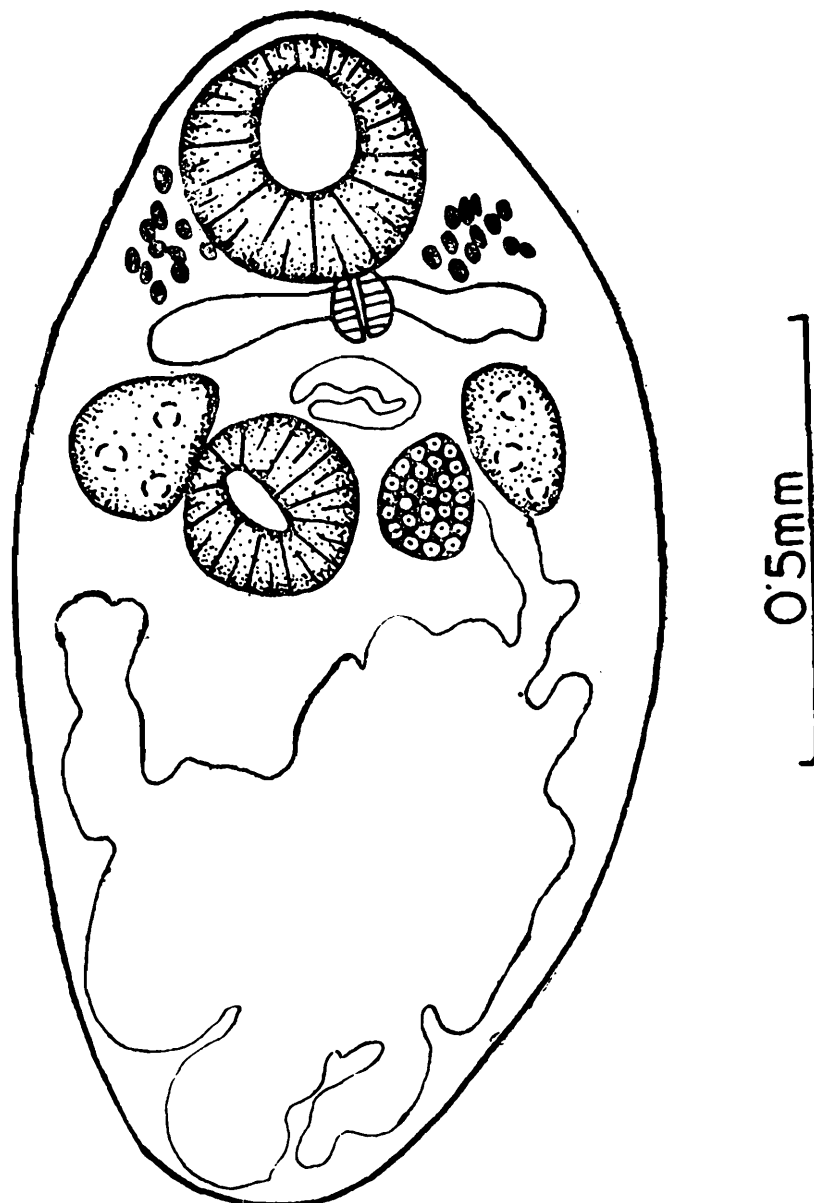


Fig 5

Fig. 5. *Prosthodendrium longiforme*. Entire worm.

Material : Host—*Tadarida aegyptica* Geoffroy, (Family Molossidae) ; location—intestine ; locality—Jodhpur ; no. of specimens—2, on one slide.

Diagnosis : Body elliptically elongated, about 1.30 mm. long. Oral sucker large, subterminal. Oesophagus indistinct. Intestinal caeca wide, extending laterally and obliquely to anterior margins of testes. Acetabulum smaller than oral sucker. Testes on either side of acetabulum. Pseudocirrus sac between acetabulum and intestinal bifurcation. Ovary unlobed, position variable in acetabular zone. Vitelline follicles on either side of hinder part of oral sucker. Uterus occupying whole of postacetabular space.

Remarks : Bhalerao (1926) originally described this species from a bat, *Nyctinomus plicatus*, in Burma and placed it under the genus *Lecithodendrium* Looss, 1896. Dollfus (1931) transferred it to his genus *Prosthodendrium*. Later on, Bhalerao (1936) agreed to it. Pande (1935) described *Lecithodendrium longiforme* var. *allahabadi* and *L. bhaleraoi* from the bat *Nycticejus kuhli* which were synonymised with *P. (Pr.) longiforme* by Dubois (1955). Matskasi (1973) recorded it from 9 different species of bats from Birsivpur, Calcutta, Nalbani (West Bengal), Bhubaneswar, Konark, Udaygiri (Orissa), Mahableshwar (Maharashtra) and Cherrapunjee (Meghalaya) in India. It was also reported from Malaysia, Philippines, Japan, Czechoslovakia, Hungary, U. S. S. R., Poland, Egypt and Afghanistan. Recently, Wason and Johnson (1978) reported it from the bat, *Taphozus perforatus perforatus* from Jodhpur (Rajasthan, India).

4. *Prosthodendrium (Prosthodendrium) parvouterus* (Bhalerao) Dubois

(Fig. 6)

1926. *Lecithodendrium cordiforme parvouterus* Bhalerao, *J. Burma Res. Soc.*, **15** : 182, 183.
1930. *Lecithodendrium cordiforme* of Mödhinger (*nec* Braun, 1900), *Zool. R. Sc. Univ. Heng.*, Budapest **1** (3) : 191-203.
1936. *Prosthodendrium pushpai* Bhalerao, *J. Helminth.*, **14** (4) : 212.
1936. *Prosthodendrium cordiforme* : Bhalerao, *Ibid.*, **14** (4) : 218.
1639. *Lecithodendrium pyramidum* Lukasiak (*nec* Looss, 1896), *Fragm. Faun. Mus. Zool. Polon.*, **4** (5) : 93-106.
1942. *Prosthodendrium pyramidum orientale* Yamaguti and Asada, *Bull. Inst. Sci. Res.*, Manchoukuo, **6** : 498:512.
1954. *Prosthodendrium cordiforme* of Chen (*nec* Brrun, 1900), *Acta zool. Sinica*, **6** : 159.
1955. *Prosthodendrium (Prosthodendrium) parvouterus* : Dubois, *Rev. Suisse Zool.*, **62** : 490, 493, 498, 502, 469-506.
1957. *Prosthodendrium cordiforme* of Yeh (*nec* Braun, 1900), *J. Helminth.*, **31** (3) : 121-125.
1973. *Prosthodendrium parvouterus* : Matskasi, *Parasit. Hung.* **6** : 86.

Material : Host—*Tadrida aegyptica* Geoffroy, (Family Molossidae) ; location—intestine ; locality—Luni (Jodhpur, Rajasthan) ; no. of specimen—32, on slides.

Diagnosis : Ovoid to pyriform ; small, about 1.0 mm long, occasionally broader than long. Suckers almost equal. Intestinal caeca extending obliquely to anterior margins of testes. Testes large, larger than acetabulum, situated on either side of it. Pseudocirrus sac usually dorsal to acetabulum, larger than latter. Ovary postacetabular, larger than acetabulum, smaller than testes. Vitelline follicles anterior to intestinal caeca or overlapping it. Uterus occupying whole of postacetabular space.

Positions of pseudocirrus sac and ovary with respect to acetabulum slightly variable. Shape and size of gonads variable.

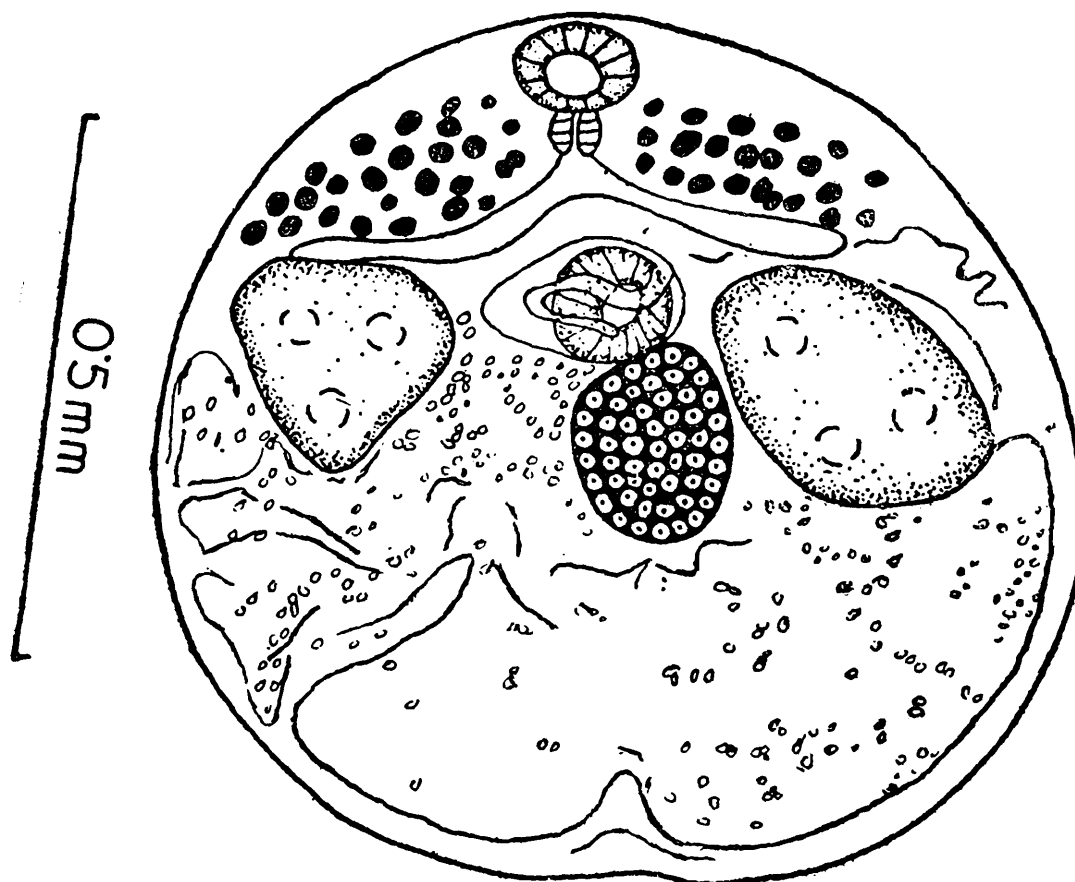


Fig. 6

Fig. 6. *Prosthodendrium parvouterus*. Entire worm.

Remarks : The species was described by Bhalerao (1926) from a bat, *Nyctinomus plicatus* (= *Tadarida plicata*) and placed it in the genus *Lecithodendrium* as a subspecies of *L. cordiforme* Braun, 1900. Dubois (1955) raised the subspecies *parvouterus* to the rank of a species distinct from *L. cordiforme* Braun and transferred it under the genus *Prosthodendrium*. It was later recorded from Hungary, Malaysia, Czechoslovakia, Bulgaria, Poland, Morocco, Zambia, Vietnam, India and Afghanistan. Soud and Ramadan (1977) redescribed it from the bats *Taphozus nudiventris*, *Asellia tridens tridens* and *Otonycteri hemrichi* from Egypt. The details of the present specimens agree

with those given by Bhalerao (1926) and Saoud and Ramadan (1977). However, the body shape may vary from round to oval and the positions of the cirrus sac and ovary may also vary with respect to the ventral sucker. The shape and size of the gonads are also variable. Kifune and Sawada (1980, 1982) and Kifune (1980a, 1982b) recorded it from various places in Japan. Kifune and Lee (1983) collected it from Korea. Matskasi (1973) recovered it from four species of bats from Birsivpur, Calcutta (West Bengal), Ricchai (M. P.) and Ellora caves (Maharashtra).

5. *Prosthodendrium (Paralecithodendrium) ovimagnosum* (Bhalerao) Dollfus

(Figs. 7, 8)

1926. *Lecithodendrium ovimagnosum* Bhalerao, *J. Burma Res. Soc.*, 15 : 188.
 1931. *Prosthodensrium ovimagnosum* : Dollfus, *Ann. Parasit.*, 9 : 483-484.
 1936. *Prosthodendrium ovimagnosum* : Bhalerao, *J. Helminth.*, 14 (4) : 218.
 1938. *Lecithodendrium asadai* Fukui and Ogata, *Zool. Mag. (Japan)*, 51 : 98-99.
 1954. *Prosthodendrium hepaticum* Chen, *Acta zool. Sinica*, 6 : 153.
 1958. *Paralecithodendrium magnioris* Gupta and Bhardwaj, *Res. Bull. Panjab Univ.*, 141 : 75-79.

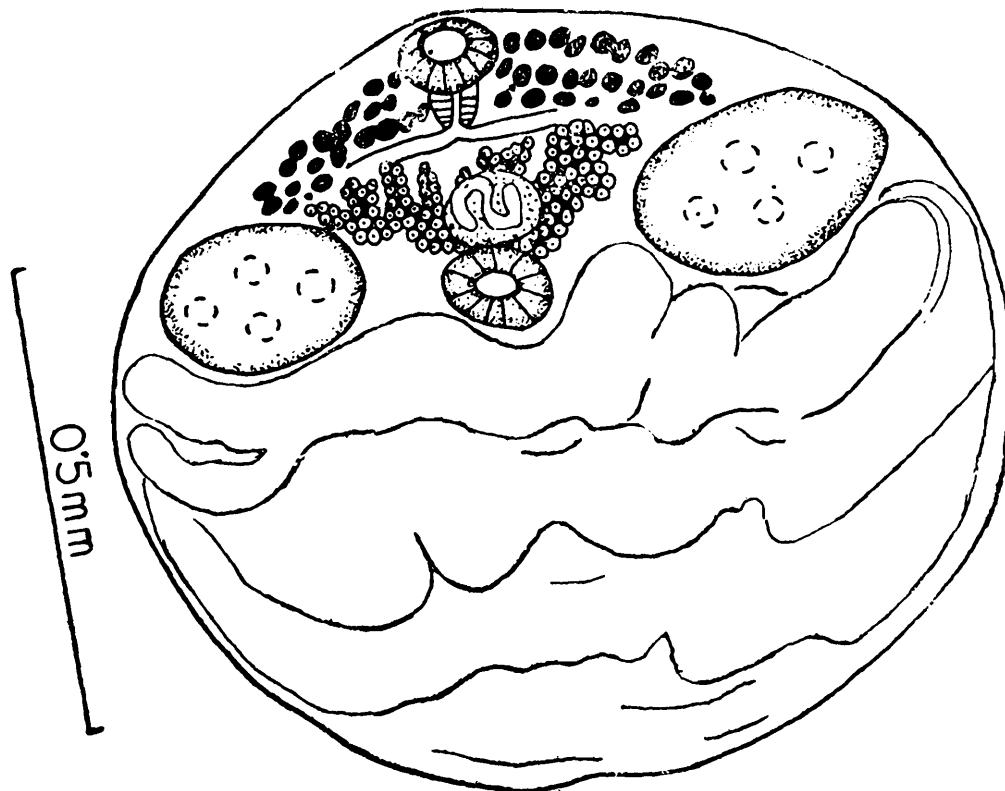


Fig 7

Fig. 7. *Prosthodendrium ovimagnosum*. Entire worm.

Material : Host—*Rhinopama hardwickei* Gray, Family Rhinopomatidae) ; location—intestine ; locality—Bhim Bharak (Jodhpur) ; no. of specimens—17, on slide.

Diagnosis : Body ovoid, small, wider than long. Suckers almost equal. Intestinal caeca extending obliquely to testes. Testes much larger than suckers, situated on either side of acetabulum. Pseudocirrus sac preacetabular. Ovary large, much lobed, preacetabular, extending almost from one testes to other. Vitelline follicles on either side of oral sucker and pharynx, anterior to and occasionally overlapping intestinal caeca. Uterus occupying all available space in hindbody.

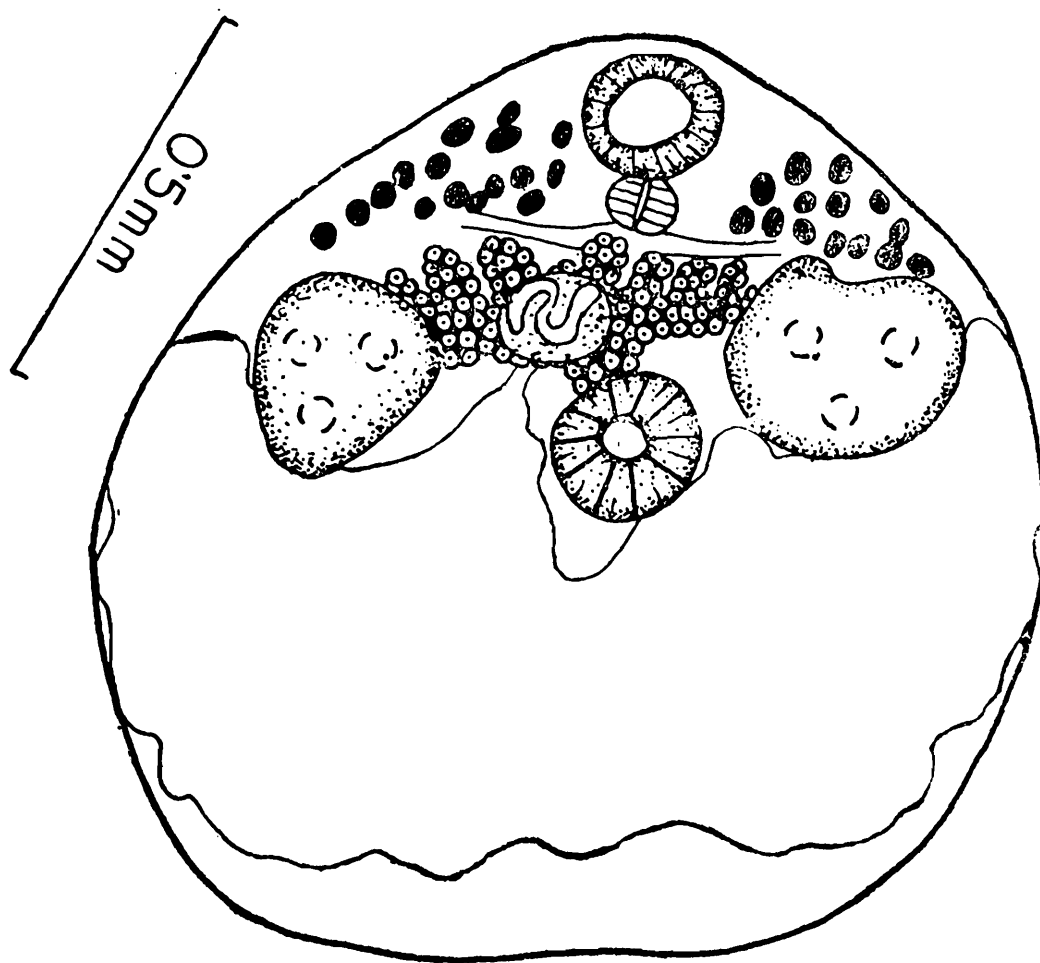


Fig. 8

Fig. 8. *Prosthodendrium ovimagnosum*. Entire worm.

Remarks : Bhalerao (1962) described it as *Lecithodendrium ovimagnosum* from the bat *Nyctonomus plicatus* in Burma. Dollfus (1931) transferred it in the genus *Prosthodendrium* while reviewing the subgenus *Paralecithodendrium* Odhner, 1911. Dubois (1962) accepted the validity of only six species under it and *Prosthodendrium (Par.) ovimagnosum* was one of them. He further synonymised *Lecithodendrium asadai* Fukui and Ogata, 1938 and *Paralecithodendrium magnioris* Gupta and Bhardwaj, 1985 with Bhalerao's species. *Prosthodendrium hepaticum* Chen, 1954 was also enumerated as one of the six valid species in the subgenus *Paralecithodendrium* by Dubois (*loc. cit.*), but Matskasi (1973) regarded it as a synonym of *P. ovimagnosum* on the basis of Vietnamese material.

He further recorded it from Birsivpur, Nalbani, Barkalikapur, Calcutta (West Bengal), Bhubaneswar, Konarak, Udaygiri (Orissa), Richai (M. P.), Elephanta caves and Mahabaleshwar (Maharashtra) in India from the intestine of eight species of bats including *Rhinopoma hardwickei*. Although the present specimens vary in the measurements of various organs as well as in the positions of the ovary and pseudocirrus sac with respect to the ventral sucker, the broadly and essentially conform to the original description. It was also reported from the Philippines, China and North Somaliland.

Family PLAGIORCHIIDAE Lühe, 1901

Subfamily PLAGIORCHINAE Pratt, 1902

Genus 3. *Plagiorchis* Lühe

1899. *Plagiorchis* Lühe, *Zool. Anz., Leipzig*, 22 : 531, 532, 533, 534.

1959. *Renoldstrema* Cheng, *Am. Midl. Nat.*, 6 : 84, 85.

6. *Plagiorchis koreanus* Ogata

(Figs. 9-12)

1938. *Plagiorchis koreanum* Ogata, *Annot. Zool. Japan*, 17 : 581-587.

Material : Host—*Rhinopoma hardwickei* Gray, (Family Rhinopomatidae) ; *Tadarida aegyptica* Geoffroy, (Family Molossidae) ; location—intestine ; locality—Jodhpur ; no. of specimens—3+1, on two slides ; collected on 12.11.1981 and 13.11.1981.

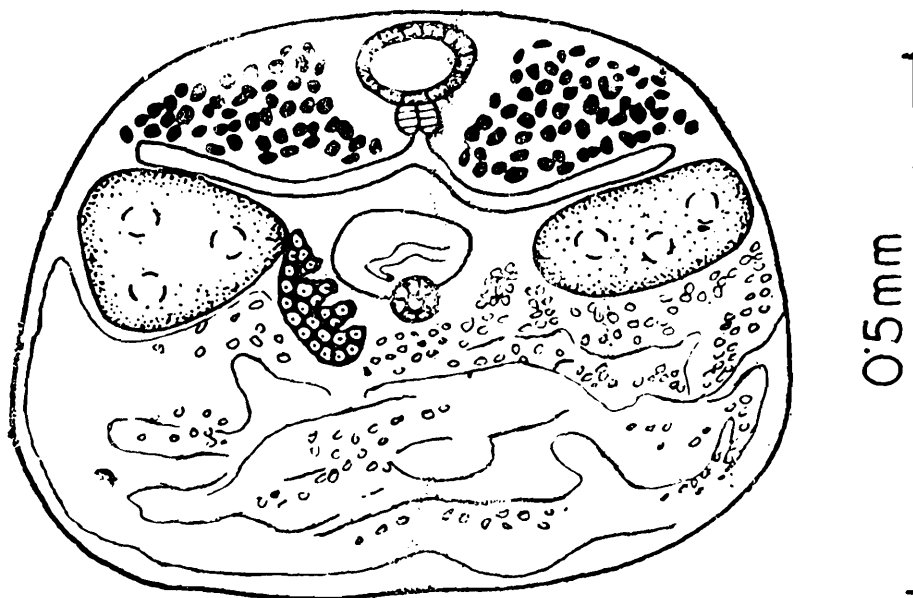


Fig. 9

Fig. 9. *Plagiorchis koreanus* from *Rhinopoma hardwickei*. Entire worm. Dorsal View.

Diagnosis : Body small, less than 2.0 mm long. Oral sucker much larger than ventral sucker. Testes and ovary also larger than ventral sucker. Testes larger than

or equal to or smaller than ovary. Anterior extent of vitellarium in level with anterior or posterior margin of ventral sucker or remaining behind it. Uterus completely descending into caudal space or not.

Remarks : Ogata (1938) first described this species from the bat *Nyctalus aviator* from Korea. Later on, he (1943) reported it from the same host as well as *Rhinopoma ferrumeguium nippon* from Japan. Groschaft and Tenora (1973) reported it from eight

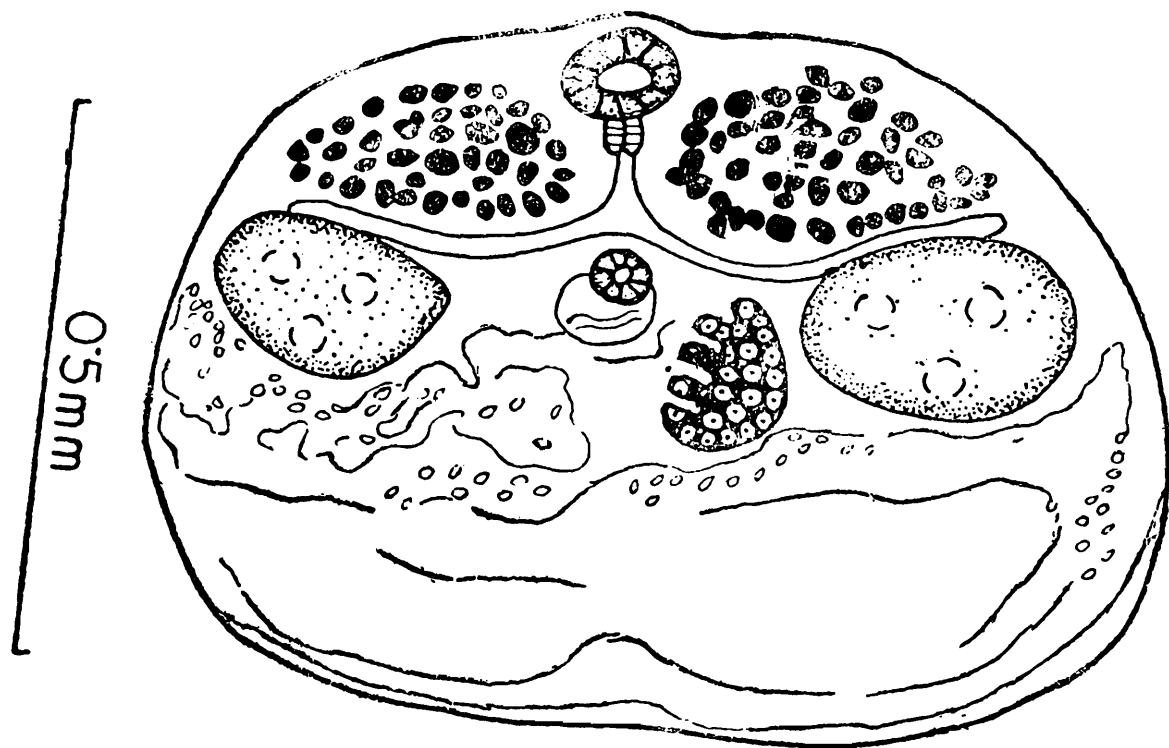


Fig. 10

Fig. 10. *Plagiorchis koreanus* from *Rhinopoma hardwickei*. Entire worm. Dorsal View.

species of bats from Afghanistan, viz., *Eptesicus serotinus*, *E. nasutus*, *Pipistrellus coromandra*, *Mgotis longipes*, *Nyctalus montanus*, *Rhinopoma microphyllum*, *R. hardwickei* and *Rhinolophus lepidus*. Wason and Johnson (1978) recorded it from bats—*Tophozous perforatus* and *Rhinopoma microphyllum*. Kifune and Sawada (1979, 1982) from Japan and Kifune, Sawada and Lee (1983) from Korea recorded it from various species of bats. This is the second report of *Plagiorchis koreanus* from Jodhpur (Rajasthan) and *Tadarida aegyptica* appears to be the new host record.

Some workers including Dubois (1960) considered *Plagiorchis koreanus* Ogata as a synonym of *Plagiorchis vespertilionis* (Muller, 1784) Braun, 1900, the type species of the genus *Plagiorchis* Lühe, 1899, which was accepted by Timofeeva (1962), Hurkova (1962), Hurkova (1963) and Richard (1966) but Sogandares-Bernal (1956), Groschaft and Tenora (*loc. cit.*), Kifune and Sawada (*loc. cit.*) Kifune, Sawada and Lee (*loc. cit.*)

and Wason and Johnson (*loc. cit.*) do not agree with this view and consider Ogata's species distinct from *P. vespertilionis*. The present author concurs with these workers.

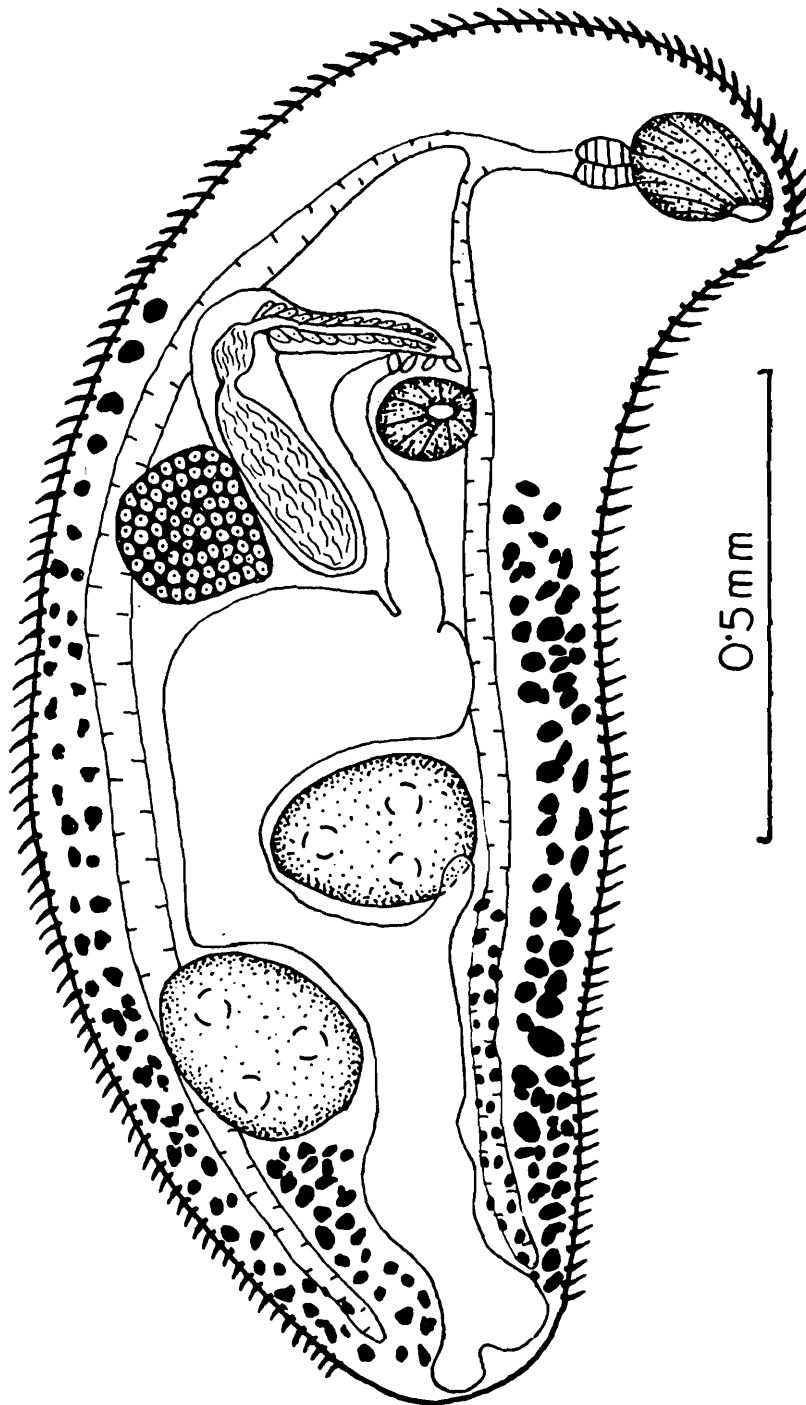


Fig. 11

Fig. 11. *Plagiorchis koreanus* from *Rhinopoma hardwickei*. Entire worm. Ventral View.

Plagiorchis vespertilionis is characterised by a much longer body than that of *P. koreanus*, oral sucker is equal or subequal to ventral sucker and ovary is always smaller than

ventral sucker. Sogandras-Bernal (1956) not only accepted the validity of *P. koreanus* against *P. vespertilionis* but also pointed out that *P. vespertilionis* of Shtrom and Sondak

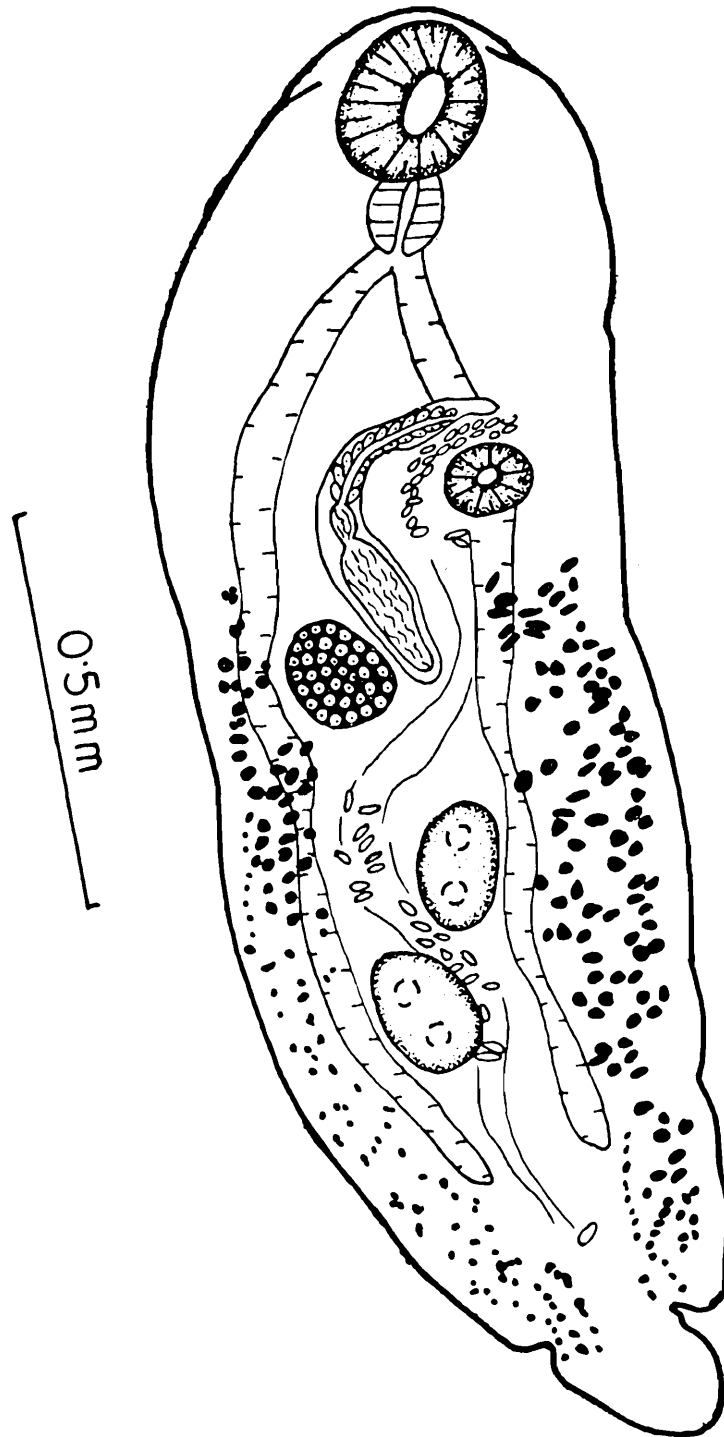


Fig.12

Fig. 12. *Plagiorchis koreanus* from *Tadarida aegyptica*. Entire worm. Ventral View.

(1935) from the bat *Pipistrellus pipistrellus* was misidentified and opened that it is actually *P. koreanus* Ogata, 1938. He came to the conclusion on the basis of body length (1.53 mm) and oral sucker larger than ventral sucker.

SUMMARY

The material for the present study was collected from lizards, snakes and bats from Jodhpur and its environs. The genus *Paradistomoides* has been considered as indistinct from *Paradistomum*. *Paradistomoides medius* Nama and Khichi and *Paradistomoides brevis* Nama and Khichi are considered as synonyms of *Paradistomum orientalis* (Narain and Das). *Paradistomoides diminutus* Nama and Khichi, *P. intermedius* Nama and Khichi and *P. elongatus* Nama and Khichi are synonymised with *Paradistomum spatulum* (Simha). *Prosthodendrium (Prosthodendrium) longiforme* Bhalerao, *Prosthodendrium (Prosthodendrium) parvouterus* (Bhalerao), *Prosthodendrium (Paralecithodendrium) ovimagnosum* (Bhalerao) and *Plagiorchis koreanum* Ogata have been reported from new hosts and locality. Intra-specific variations and synonymies have been discussed.

ACKNOWLEDGEMENTS

The author is obliged to Dr. A. K. Ghosh, Director, Zoological Survey of India, Calcutta, for providing laboratory and library facilities for the study. He is also thankful to Dr. S. K. Bhattacharya, Additional Director, for taking interest in the study.

REFERENCES

- Arora, S. and Agarwal, S. M. 1960. Studies on some intraspecific variations in *Paradistomum orientalis* Narain and Das collected from the gall-bladder of *Calotes versicolor* Daud. : Part I (Dicrocoeliidae : Trematoda). *Bull. zool. Soc., College Sci., Nagpur*, 3 : 43-52.
- Arora, S., Agarwal, M. M. and Agarwal, S. M. 1962. Studies on some intra-specific variations in *Paradistomum orientalis* Narain and Das collected from the liver and intestine of *Calotes versicolor* Daud. ; Part II (Dicrocoeliidae : Trematoda). *Indian J. Helminth.*, 14 (1) : 5-15.
- Bhalerao, G. D. 1926. The intestinal parasites of the bat (*Nyctinomus plicatus*) with a list of the trematodes hitherto recorded from Burma. *J. Burma Res. Soc.*, 15 : 181-189.
- Bhalerao, G. D. 1936. Studies on the Helminths of India. Trematoda III. *J. Helminth.*, 14 (4) : 207-228.
- Dollfus, R. Ph. 1931. Amoenitates helminthological. A propose de la creation de *Lecithodendrium laguncula* Ch. W. Stiles et M. O. Nolan, 1931. *Ann. Parasit.*, 9 : 483-484.
- Dollfus, R. Ph. 1937. Sur *Distoma ascidia* P. J. van Beneden, 1873 (nec Linstow, nec Looss) et le genere *Prosthodendrium* R. Ph. Dollfus, 1931 (Trematoda, Lecithodendriidae). *Bull. Mus. Roy. Hist. Nat. Belgique*, 13 : 1-21.

- Dubois, G. 1955. Les Trématodes de chiroptères de la collection Villy Allen. Étude suivie d'une révision du sous-genre *Prosthodendrium* Dollfus, 1937 (Lecithodendriidae Luhe). *Rev. Suisse Zool.*, **62** : 469-506.
- Dubois, G. 1960. Contribution à l'étude des Trématodes de chiroptères. Révision du sous-genre *Prosthodendrium* Dollfus, 1911 et des genres *Lecithodendrium* Looss, 1896 et *Pycnoporus*, Looss, 1899. *Rev. Suisse Zool.*, **67** : 1-80.
- Dubois, G. 1962. Contribution à l'étude des trématodes de chiroptères. Révision du sous-genre *Paralecithodendrium* Odhner, 1911. *Rev. Suisse Zool.*, **69** : 385-407.
- Groschaft, J. and Tenora, F. 1974. Trematodes of the genus *Plagiorchis* Luhe, 1899 (Plagiorchiidae), parasites of bats in Afghanistan. *Vest. Ceskosl. Spol. zool.*, (1973), **37** : 241-249.
- Hürková, J. 1963. Bat trematodes in Czechoslovakia. I. A. systematical review of occurring species. *Vest. Ceskosl. Spol. zool.*, **27** : 250-276.
- Kifune, T. 1980a. Records of Trematode Parasites of Japanese Bats from Akita Prefecture, Northern Housu. *Med. Bull. Fukuoka Univ.*, **7** (1) : 273-275.
- Kifune, T. 1980b. Records of the Trematode Parasites of Bats from Houshu and Kyushu with Descriptions of Two New Species of the Genus *Prosthodendrium* (Trematoda : Plagiorchiidae, Lecithodendriidae). *Ibid*, **7** (4) : 387-394.
- Kifune, T. and Lee, W. 1983. Trematode parasites of two Korean bats. *Med. Bull. Fukuoka Univ.*, **10** : 3-8.
- Kifune, T. and Sawada, I. 1979. Helminth fauna of bats in Japan. XXI. *Med. Bull. Fukuoka Univ.*, **6** : 291-301.
- Kifune, T. and Sawada, I. 1980. Helminth fauna of bats in Japan. XXIII. *Med. Bull. Fukuoka Univ.*, **7** (2) : 169-181.
- Kifune, T. and Sawada, I. 1982. Helminth fauna of bats in Japan. XXVI. *Med. Bull. Fukuoka Univ.*, **9** : 101-113.
- Krishnaswami, S. K. and Anantaraman, M. 1956. Parasites of reptiles, 1. *Paradistomum* in Indian lacertilians. *Ann. Mag. nat. Hist.*, **9** : 881-887.
- Matskasi, I. 1973. Trematodes of bats in India. *Parasitol. Hung.*, **6** (6) : 77-97.
- Nama, H. S. and Khichi, P. S. 1973. New records of the genus *Paradistomoides* (Trematoda : Dicrocoeliidae) from India. *Z. Angew. Zool.*, **60** : 257-268.
- Ogata, T. 1938. Contribution à la connaissance de la fauna helminthologique Coreene. I. Une nouvelle espèce de trématodes provenant de chauves-souris. *Annot. zool. Jap.*, **17** : 581-586.

- Ogata, T. 1943. (On animals of Mt. Fiji and its adjacent areas (XXVIII). On the parasites of bats collected at the foot of Mt, Fiji). *Hakubutsugaku Zasshi*, 39 : 57-62.
- Richard, S. 1966. Trematodes de chiropteres de Madagascar. I. Identification de *Plagiorchis vespertilionis* et description de trois *Lecithodendriidae* nouveaux. *Ann. Parasit.*, 41 : 413-427.
- Saoud, M. F. A. and Ramadan, M. M. 1977. Studies on digenetic trematodes of the genus *Prosthodendrium* Dollfus, 1931 from some Egyptian bats. 1. Trematodes of the subgenus *Prosthodendrium* Dollfus, 1931. *Folia Parasit.*, Praha, 24 : 249-259.
- Saoud, M. F. A. and Ramadan, M. M. 1977. Studies on diagenetic tematodes of the genus *Prosthodendrium* Dollfus, 1931 from some Egyptian bats. 2. Trematodes of the subgenus *Paralecithodendrium* Odhner, 1911. *Folia Parasit.*, Praha, 24 : 317-321.
- Shtrom, Zh. K. and Sondak, V. A. 1935. (Some new and little known trematode worms belonging to the families Plagiorchiidae and Dicrocoeliidae). *Parazit. Perenosch. i. Iadovit. Shorn. Zhivotn. Robat.* Pavlovskii, 1939, (1934), pp. 348-359 (In Russian).
- Simha, S. S. 1958. Studies on the trematode parasites of reptiles found in Hyderabad State. *Z. Parasitenkd.*, 18 : 161-218.
- Sogandares-Bernal, F. 1956. Four trematodes from Korean bats with description of these new species. *J. Parasit.*, 42 : 200-206.
- Timofeevh, T. N. 1962. On species of *Plagiorchis* Lühe identical with *P. vespertilionis* (Muller, 1780). *Trudy Gelm. Lab. Akad. Nauk. SSSR*, 12 : 228-231.
- Wason, A. and Johnson, S. 1978. *Prosthodendrium longiforme* (Bhalerao, 1926) from a new chiropteran host *Taphozus perforatus* Geoffroy. *Indian J. Parasit.*, 2 (1) : 31-34.
- Yamaguti, S. 1971. *Synopsis of digenetic trematodes of vertebrates, vol. I.* Keigaku Publishing Co., Tokyo, Japan, pp. 1-1074.