FAUNA OF RAJASTHAN, INDIA

PART 8.—TREMATODA

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(With 2 Tables and 6 Text-figures)

CONTENTS

I—INTRODUCTION

(a) *General*

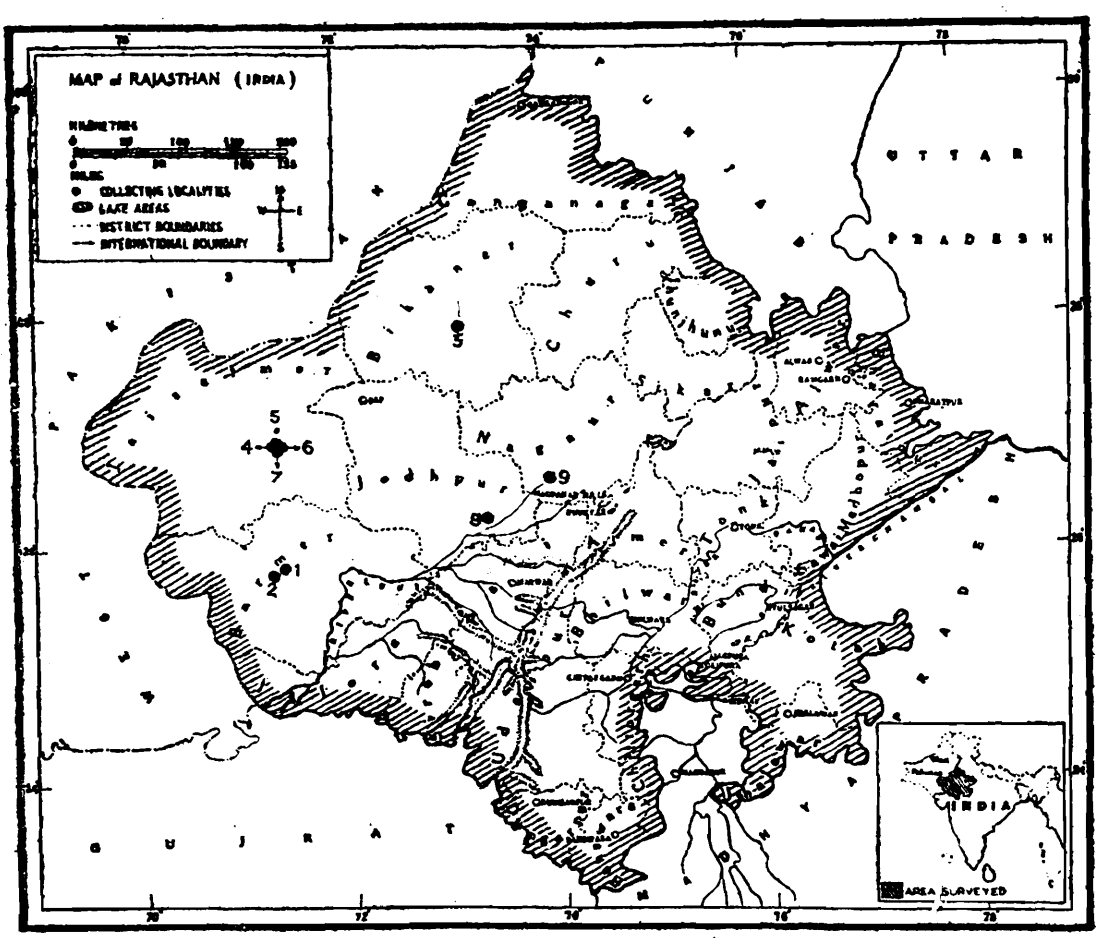
An examination of the literature on the helminth fauna of India shows that no major work on the trematodes of Rajasthan has so far been done. The present study is based mainly on the collection made by the author during September-November, 1962, from the western part of Rajasthan, in the districts of Barmer, Bikaner, Jaisalmer and Jodhpur. In addition, a small collection made by Dr. B. Biswas, of the Zoological Survey of India, from the Nagaur District during December, 1956, has also been studied. For an account of the topography, climate, vegetation, etc. of Rajasthan, *see* Part 1 (General Introduction) of this series of papers (Roonwal, 1968), *Rec. zool. Surv. India*, **61** (3 & 4), pp. 291-375.

In the present account, 15 species belonging to 14 genera and 9 families are reported. All the species are new records for Rajasthan, while the genus *Ophthalmophagus* is first recorded here from India. Three species described herein are new to science. The type-specimens of the new species have been deposited in the National Zoological Collections at the Zoological Survey of India, Calcutta.

(b) *Acknowledgements*

It is a pleasure to gratefully acknowledge the help and the encouragement received from Dr. M. L. Roonwal, Director, Zoological Survey of India, Calcutta, during the collection and study of the material, and also for the valuable suggestions in preparing the manuscript. Thanks are due to other colleagues who have identified the hosts. I am indebted to the Government of Rajasthan, through its Chief Secretary and the Chief Conservator of Forests, for various facilities received during the collection of the material.

II—List of Collecting Stations



TEXT-FIG. 1.—Map of Rajasthan, showing the Collecting Stations for Trematodes.

The present material was collected from Western Rajasthan in the districts of Barmer, Bikaner, Jaisalmer, Jodhpur and Nagaur. The list of the collecting Stations is given in Table 1 (also *see* Text-fig. 1).

TABLE 1.—*List of Collecting Stations for Rajasthan Trematodes (B. Biswas 1956; P. D. Gupta, 1962).*

Locality	District	Approx. Latitude and Longitude	
		Lat. N.	Long. E.
1. Bhap Talab	Barmer	25°51′	71°26′
2. Jalipa Tank	Barmer	25°50	71°23′
3. Devikund	Bikaner	27°56′	73°18′
4. Golab Sagar	Jaisalmer	26°55′	70°57′
5. Station No .15 (1962)	Jaisalmer	26°55′	70°57′
6. Dak Bungalow area, Jaisalmer	Jaisalmer	26°55′	70°57′
7. Gareshwar Tank, Jaisalmer	Jaisalmer	26°55′	70°57′
8. Bilaspur	Jodhpur	26°18′	73°27′
9. Merta	Nagaur	26°35′	74°06′

III—LIST OF TREMATODES KNOWN FROM RAJASTHAN ; AND KEYS FOR IDENTIFICATION

(a) *List of Species*

The following is a list of trematodes known from Rajasthan, and discussed in this paper ; all of them are based on the present record.

Family I. CYCLOCOELIDAE

Genus (1) *Cyclocoelum* Brandes, 1892

1. *Cyclocoelum bikanerensis* n. sp.

Genus (2) *Haematotrephus* Stossich, 1902

2. *Haematotrephus lanceolatum* (Wedl.) Stossich

Genus (3) *Ophthalmophagus* Stossich, 1902

3. *Ophthalmophagus mertensis* n. sp.

Family II. DICROCOELIIDAE

Genus (4) *Anchitrema* Looss, 1899

4. *Anchitrema sanguineum* (Sonsino) Looss

Family III. DIPLOSTOMIDAE

Genus (5) *Neodiplostomum* Railliet, 1919

5. *Neodiplostomum tityense* Patwardhan

Family IV ECHINOSTOMATIDAE

Genus (6) *Paryphostomum* Dietz, 1909

6. *Paryphostomum indicum* (Bhalerao)

Family V HEMIURIDAE

Genus (7) *Halipegus* Looss, 1899 *emend.* Rankin, 1944

7. *Halipegus mehransis* Srivastava

Family VI. LECITHODENDRIIDAE

Genus (8) *Ganeo* Klein, 1905

8. *Ganeo kumaonensis* Pande

9. *Ganeo tigrinum* Mehra & Negi

Genus (9) *Pleurogenes* Lühe, 1901

10. *Pleuvogenes gastroporus* Lühe

Genus (10) *Prosthodendrium* Dollfus, 1931

11. *Prosthodendrium ovimagnosum* (Bhalerao)

Family VII. NOTOCOTYLIDAE

Genus (11) *Notocotylus* Diesing, 1839

12. *Notocotylus barmerensis* n. sp.

Family VIII. PLAGIORCHIIDAE

Genus (12) *Astiotrema* Looss, 1900

13. *Astiotrema* sp.

Genus (13) *Tremiorchis* Mehra & Negi, 1925, *emend.* Verma, *1930*

14. *Tremiorchis ranarum* Mehra & Negi

Family IX. PSILOSTOMATIDAE

Genus (14) *Psilochasmus* Lühe, 1909

15. *Psilochasmus oxyurus* (Creplin) Lühe

(b) *Keys for Identification of Rajasthan Trematodes*

Keys for the identification of the families and genera of the trematods known from Rajasthan are given below.

1. *Key to families of Rajasthan Trematodes*

1(4). Ventral sucker absent.

2(3). Intestinal caecae united posteriorly . . . 1. Cyclocoelidae

3(2). Intestinal caecae not united posteriorly . . 2. Notocotylidae

4(1). Ventral sucker present.

5(6). Body divided into two regions . . . . 3. Diplostomidae

6(5). Body not divided into two regions.

7(8). Head collar present . . . 4. Echinostomatidae

8(7). Head collar absent.

9(10). Vitellaria compact . . . . . 5. Hemiuridae

10(9). Vitellaria follicular.

11(12). Gonads situated in acetabular zone . . . 6. Lecithodendriidae

12(11). Gonads situated behind acetabulum.

13(14). Ovary post-testicular ; testes situated in hind body . . . . 7. Dicrocoeliidae

14(13). Ovary pre-testicular.

15(16). Uterus pre-ovarian . . . 8. Psilostomatidae

16(15). Uterus extending backward and behind the testes 9. Plagiorchiidae

2. *Key to Rajasthan genera of family Cyclocoelidae*

1(2). Ovary post-testicular . . . . . 1. ***Ophthalmophagus***

2(1). Ovary pre-testicular.

3(4). Uterine coils intercaecal; posteriorly not surrounding the testes 2. *Cyclocoelum*

4(3). Uterine coils inter- and extra-caecal; posteriorly surrounding the testes . . . 3. *Haematotrephus*

3. *Key to Rajasthan genera of family Lecithodendriidae*

1(2). Caeca short, not surpassing acetabulum; vitellaria pre-bifurcal; genital pore median and pre-acetabular 1. *Prosthodendrium*

2(1). Caeca long, surpassing acetabulum; vitellaria lying along caeca; genital pore marginal.

3(4). Testes situated asymmetrically one behind the other; muscular cirrus sac absent 2. *Ganeo*

4(3). Testes situated symmetrically at the same level; muscular cirrus sac present . 3. *Pleurogenes*

4. *Key to Rajasthan genera of family Plagiorchiidae*

1(2). Caeca short, terminating in mid-region of body 1. *Tremiorchis*

2(1). Caeca long, terminating near posterior extremity of body . . 2. *Astiotrema*

IV—Systematic Account of Rajasthan Trematodes

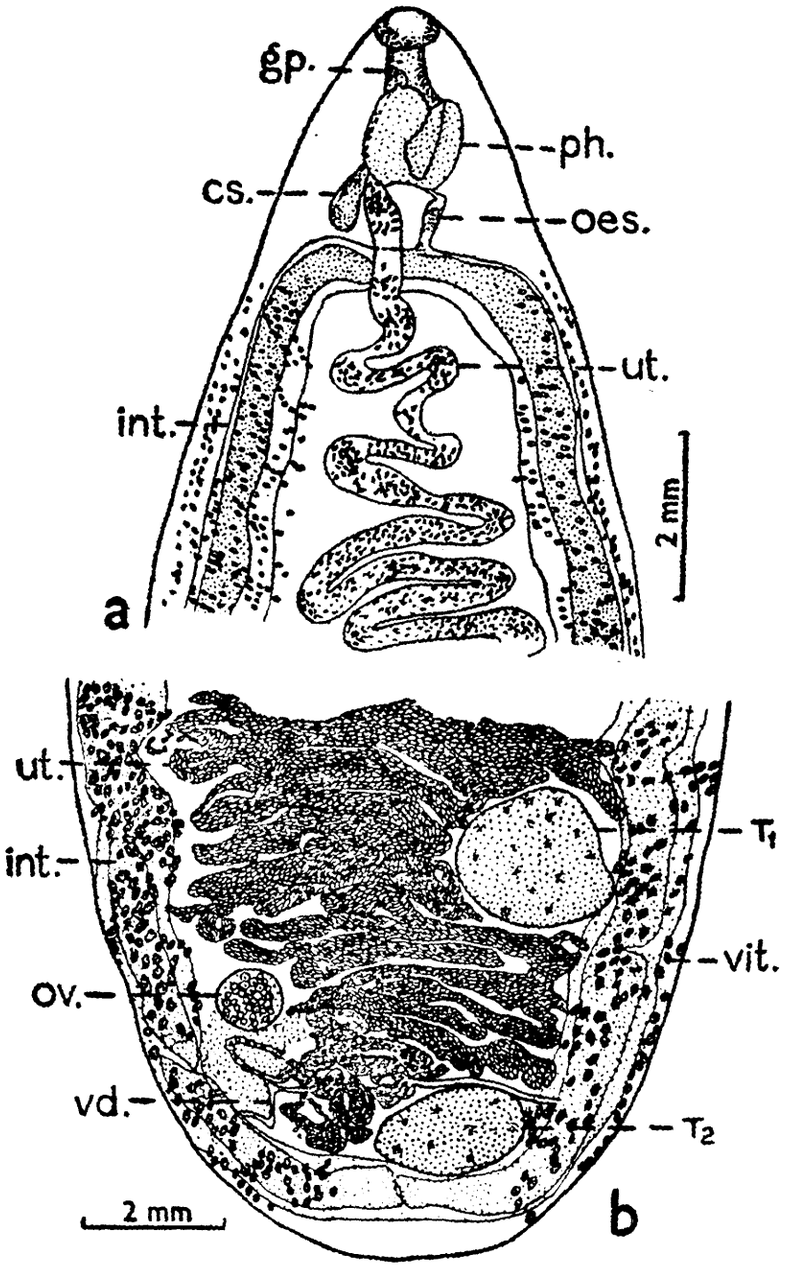
Family I. Cyclocoelidae

1. **Cyclocoelum bikanerensis** n. sp.

(Text-fig. 2 *a*, *b*.)

Material.—(i) 2 exs., from air sacs of the coot, *Fulica atra* L., Devikund, Bikaner Dist., coll. *P. D. Gupta*, 4.x.62. (ii) 14 exs., Calcuta W. Bengal), coll. *J. K. Sen*, from body-cavity of *Fulica atra* ♂, 4.xii.54.

Description.—Length (unpressed) 18-25 mm. Following description based on specimens pressed and mounted on slides :—Length 22-25 mm. ; width 8·5-9·5 mm. Body tapering gradually to a narrow anterior end ; broadly rounded at posterior end ; cuticle devoid of spines ; oral sucker very weak ; excretory sac transversely elongated



TEXT-FIG. 2.—*Cyclocoelum bikanerensis* n. sp.
(*a*) Anterior region. (*b*) Posterior region.

in space behind posterior intestinal arch. Terminal mouth leading to prepharynx (0·63-0·77 mm. long), the latter opening into a pharyux (0·86-1·35 × 0·93-0·97 mm.) ; oesophagus bent, 0·47-0·63 mm. long. Intestinal caeca wide, tubular and indented, running very close to body-wall and forming the intestinal arch at posterior end of body. Oesophagus and caeca filled with blackish sap from host-body.

Testes situated one behind the other on right side in the last quarter of body ; separated from each other by a few uterine coils ; generally transversely elongated, with entire margins (in some cases irregular, with one or two crenulations). Anterior testis 1·46-1·93 × 0·86-1·98 mm.; posterior one 1.56-1.62 × 0·97-1·36 mm. Cirrus sac 1·24-1·25 mm. ; situated entirely in front of intestinal bifurcation ; its posterior portion, lying behind pharynx, saccular ; the anterior portion, situated in the pharyngeal region, very narrow. Genital pore situated in front of pharynx slightly to left of median line. Ovary 0·59-0·82 × 0·74-0·77 mm., almost spherical, lying between and at the opposite side of testes (in one specimen in level with middle of posterior testes). Mehlis' gland lies just behind ovary. Uterine coils occupying almost entire intercaecal space, rarely coming in contact with caeca. Ova 0·090-0·093 × 0·047-0·049 mm.

Vitelline follicles distributed from level of intestinal bifurcation to posterior margin of intestinal arch ; profusely developed, covering the caeca along their entire length and sometimes intruding into intercaecal field. Right vitelline duct traversing entire width of body to meet the left duct some distance behind ovary, and forming a common vitelline duct which joins the Mehlis' gland complex.

Discussion.—*Cyclocoelum bikanerensis* n. sp. resembles *C. mutabile* (Zeder) in the general topography of the organs but differs as follows :— (i) Body larger. (ii) Pharynx larger. (iii) Eggs and other organs smaller. So far, *C. mutabile* has been reported from the nearctic neotropical and palaeotropical regions.

Type-Specimens.—*Holotype* : One example on slide, ex air sacs of *Fulica atra*. Devikund. Reg. No. W-6652/1. *Paratypes* : Two examples as follows :—One on slide (Reg. No. W-6653/1) ; other details as for holotype. The second one on slide (Reg. No. W-6654/1), Calcutta, *vide* Material (ii) above.

Distribution.—RAJASTHAN : Bikaner Dist. *Elsewhere :* Calcutta (W Bengal).

2. **Haematotrephus lanceolatum** (Wedl, 1858) Stossich, 1902

1858. *Monostoma lanceolatum* Wedl, C., *S. B. Akad. Wiss. Wien. (math-naturwiss. Cl.)*, Vienna, **26**, pp. 251-252.
1902. *Haematotrephus lanceolatum*: Stossich, M., *Boll. Soc. Adriat. Sci. nat.*, Trieste, **21**, pp. 2, 4, 5, 23.
1958. *Cyclocaelum titiri* Chatterjee P. N., *J. Parasitol.*, Urbana, **44**, p. 561.
1959. *Cyclocoelum (Haematotrephus) lanceolatum*: Dubois, G., *Rev. suisse Zool.*, Geneva, **66** (1), pp. 75, 76, 78, 96.

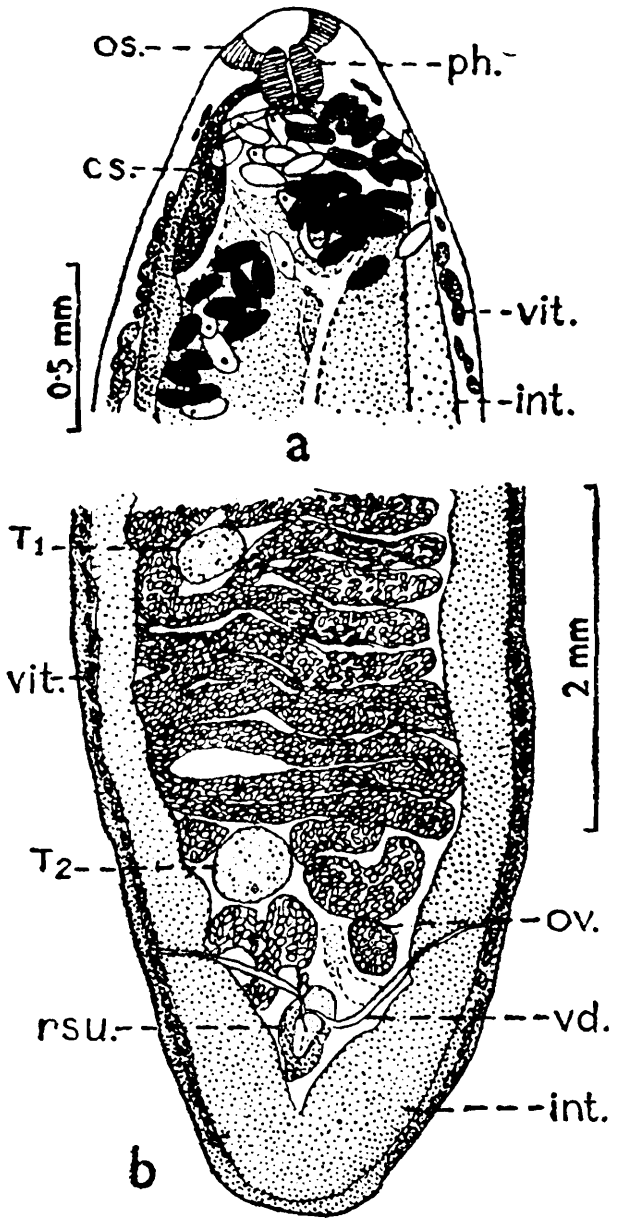
Material.—1 ex., from body-cavity of Black-winged Stilt, *Haemantopus haemantopus haemantopus* (L.) ; Merta (Nagaur Dist.), coll. *B. Biswas*, 30.xii.1956.

Distribution.—RAJASTHAN (first record) : Merta (Nagaur Dist.). *Elsewhere :* India, China, Australia, Egypt, Russia, Japan, Switzerland and U.S.A.

Remarks.—*Cyclocoelum titiri* Chatterji, from the body-cavity of *Haplopterus* [sc *Haplopterus*] *ventralis*, is regarded by Dubois (1959) as a synonym of *Haematotrephus lanceolatum*, and I agree with this view.

3. Ophthalmophagus mertensis n. sp.

(TEXT-FIG. 3 *a, b.*),



TEXT-FIG. 3.—*Ophthalmophagus mertensis* n. sp.
(*a*) Anterior region. (*b*) Posterior region.

Material.—1 ex. (slightly damaged) on slide, from body-cavity of Sandpiper, *Actitis hypoleucos* (L.), Merta (Nagaur Dist.), coll. *B. Biswas*, 30.xii.1956.

Description.—Length *c.* 15 mm. ; width in middle *c.* 3 mm. Anteriorly tapering gradually to a cone ; posteriorly rounded. Oral sucker poorly developed, 0.2 mm. in diameter. Ventral sucker absent. Pharynx 0.20 mm. in diameter. Oesophagus not discernible. Intestinal bifurcation lying immediately behind pharynx. Intestinal caeca reaching the posterior end of body ; caeca wide, provided with crenulations along inner margin ; posterior caecal arch wider than rest of caeca which run very close to body-wall, leaving very little space for development of vitellaria and almost completely obliterating the excretory sac.

Testes situated one behind the other on left side of posterior third of body and separated from each other by a number of uterine coils. Anterior testis oval (0.36×0.48 mm.), situated at begining of posterior third of body. Posterior testis almost rounded (0·42×0.48 mm.); situated just in front of ovary. Cirrus sac elongated (0.50×0.11 mm.), extending behind intestinal bifurcation. Genital pore situated just behind pharynx slightly to left of median line. Ovary subspherical (0·34×0·30 mm.), situated behind posterior testis on right side of median line. Mehlis' gland situated behind ovary. Receptaculum seminis uterinum occupying almost whole space immediately in front of posterior intestinal arch. Uterine coils filling whole of intercaecal field anterior to ovary., never overlapping the intestinal caeca. Ova 0.11-0.14×0.06-0.08 mm.

Vitelline follicles arranged in a single row, being squeezed between intestinal caeca and body-wall ; extending from intestinal bifurcation to slightly in front of posterior margin of posterior caecal arch. Vitelline follicles of two sides not anastomosing with each other.

Discussion.—Opthalmophagus mertensis n. sp. differs from the allied species as follows :—

(*a*) From *O. singularis* Stossich : (i) Larger body-size. (ii) Genital pore post-pharyngeal (*vs.* peribuccal to midway between mouth and pharynx). (iii) Testes widely separated (*vs.* narrowly separated). (iv) Uterine coils restricted to intercaecal field only (*vs.* not so). (v) Oesophagus absent (*vs.* present). (vi) Ovary lies close to posterior testis (*vs.* separated from posterior testis).

(*b*) From *O. oculobius* (Cohn) : (i) Larger body-size. (ii) Testes situated in posterior third of body (*vs.* in anterior half of body). (iii) Uterine coils restricted to intercaecal field (*vs.* not so). (iv) Genital pore postpharyngeal (*vs.* in pharyngeal region). (v) Vitelline follicles of two sides not meeting posteriorly (*vs.* anastomosing posteriorly).

(*c*) From *O. skrjabianus* (Witenberg) : (i) Testes situated in posterior third of body-length and arranged one behind the other (*vs.* in middle length of body and arranged side by side). (ii) Uterine coils restricted to intercaecal field (*vs.* not so). (iii) Vitellaria not united posteriorly (*vs.* united posteriorly).

(*d*) From *O. variolaris* (Fuhrmann) : (i) Larger body-size. (ii) Testes situated in posterior third of body (*vs.* one equatorial or pre-equatorial and the other post-equatorial). (iii) Ventral sucker and pre-pharynx absent (*vs.* present).

(*e*) From *O. magalhaesi* Travassos : (i) Genital pore postpharyngeal (*vs.* between mouth and pharynx). (ii) Testes arranged directly one behind the other on same side (*vs.* obliquely arranged). (iii) Pharynx smaller.

Type-specimen.—Holotype : One specimen (slightly damaged) on slide, Reg. No. W-6651/1 ; details as given above.

Distribution.—RAJASTHAN : Merta (Nagaur Dist.). This is the first record of the genus *Ophthalmophagus* from India.

Family II. DICROCOELIIDAE

4. **Anchitrema sanguineum** (Sonsino, 1894) Looss, 1899

1894. *Distoma sanguineum* Sonsino, P., *P. V. Soc. tosc. Sci. nat.*, Pisa, **9**, pp. 110-116.
1899. *Anchitrema sanguineum* Looss, A., *Zool. Jb.* (*Syst.*), Jena, **12**, pp. 636-640.
1935. *Anchitrema sanguineum:* Pande, B.P., *Bull. Acad. Sci. U.P.*, Allahabad, **4** (4), pp. 376-378.

Material.—1 ex., from intestine of the bat, *Taphozous kachensis kachensis* Dobson, Collecting Station No. 15 (Jaisalmer Dist.), coll. *P. D. Gupta*, 21.x.1962.

Distribution.—RAJASTHAN (first record) : Jaisalmer Dist. *Elsewhere :* India (Allahabad, U.P.) ; Tunisia and Egypt.

Family III. DIPLOSTOMIDAE

5. **Neodiplostomum tityense** Patwardhan, 1935

1935. *Neodiplostomum tityense* Patwardhan, S. S., *Proc. Indian Acad. Sci.*, Bangalore, **2** (1), pp. 25-27.
1936. *Neodiplostomum tityense,* Verma, S. C., *Allahabad Univ. Stud.*, Allahabad, **9**, pp. 175-176.

Material.—10 exs., from intestine of White Scavenger Vulture, *Neophron percnopterus* L., Bhap Talab (Barmer Dist.), coll. *P. D. Gupta*, 3.xi.1962.

Distribution.—RAJASTHAN (first record) : Barmer Dist. *Elsewhere* : Nagpur (Maharashtra).

Family IV ECHINOSTOMATIDAE

6. **Paryphostomum indicum** (Bhalerao, 1927)

1927. *Testiscculus indicum* Bhalerao, G. D., *Proc. 14th Indian Sci. Congr.*, Calcutta, p. 191.
1931. *Paryphostomum indicum* Bhalerao, G. D., *Parasitology*, Cambridge, **23**, pp. 99-102.
1941. *Reptiliotrema indicum:* Baschkirova, E. In Skrjabin, K.I. : *Trematodes of Animals and Man*, Moscow, **12**, pp. 817-818.

Material.—8 exs., from intestine of Monitor Lizard, *Varanus monitor* (L.), Dak Bungalow area, Jaisalmer (Jaisalmer Dist.), coll. *P. D. Gupta*, 23.x.1962.

Distribution.—RAJASTHAN (first record) : Jaisalmer Dist. *Elsewhere* : Northern India.

Remarks.—So far, only one species of the genus, *P. indicum*, is known from a reptilian host, *viz.*, *Uromastix hardwickii*, from North India ; *Varanus monitor* appear to be the second reptilian host.

Bhalerao (1927) created the genus *Testisacculus* and gave a brief description of *T indicum* as the type-species, obtained from *Uromastix hardwickii.* Later (1931), he published a fuller account of apparently the same species designating it as *Paryphostamum indicum.* Although (his synonymy was not indicated by Bhalerao (1931), the descriptions of

Testisacculus indicum and *Paryphostomum indicum* appear to be based on the same material and the characters and host are also identical. The simultaneous appearance of the description of *Stunkandia dilymphosa* along with description of *Testisacculus indicum* and *Paryphostomum indicum* points to the fact that Bhalerao (1927 and 1931) was dealing with same material in two cases. Baschkirova (1941) considered *P. indicum* as belonging to a new genus *Reptiliotrema*. In my opinion the species should be retained in genus *Paryphostomum* and genus *Reptiliotrema* treated as a synonym of *Paryphostomum*.

Family V HEMIURIDAE

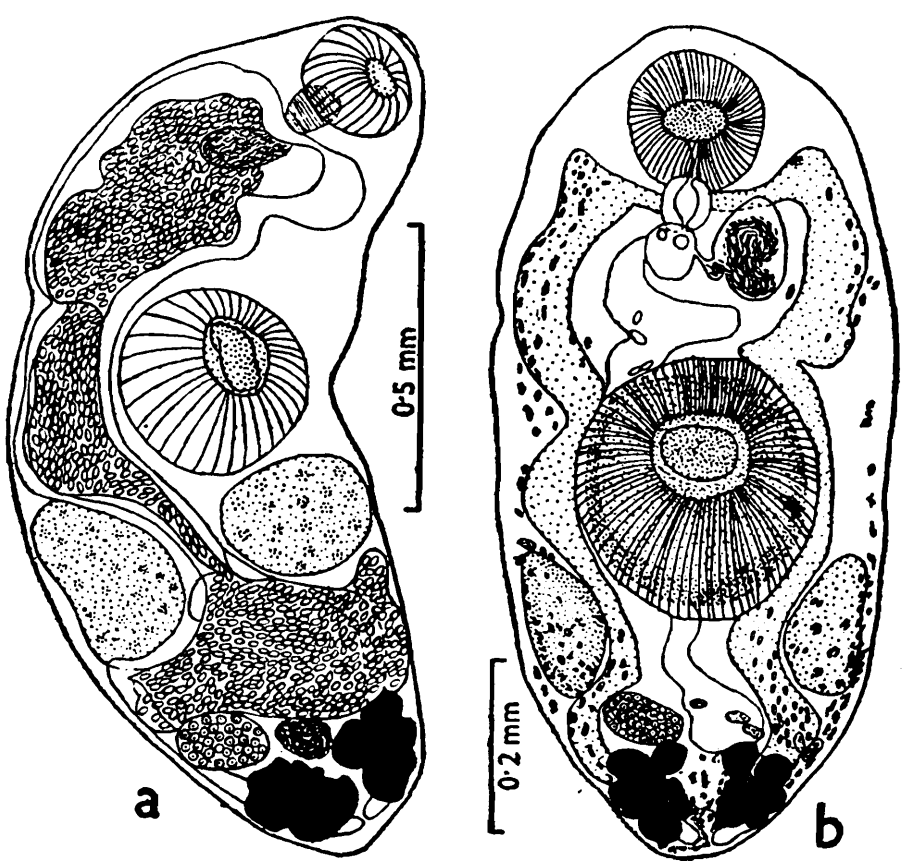
7. **Halipegus mehransis** Srivastava 1933

(TEXT-FIG. 4a, b)

1933. *Halipegus mehransis* Srivastava, H. D., *Bull. Acad. Sci., U.P.*, Allahabad, 3 (1), pp. 42-45.

1944. *Halipegus mehransis*: Rankin Jr., S. J., *Trans. Amer. micr. Soc.*, Menasha, 63 (2), p. 159.

Material.—All coll. *P. D. Gupta*, 1962, from intestine of the frog, *Rana cyanophlyctis* Schneider, as follows :—(i) 2 exs., Jalipa Tank (Barmer Dist.), 4.xi.62. (ii) 6 lots with 6, 3, 1, 1, 2 and 2 exs., Golab Sagar, Jaisalmer Dist., 25.x.62. (iii) One lot, 8 exs., Gareshwar Tank (Jaisalmer Dist.), 26.x.62.



TEXT-FIG. 4.—*Halipegus mehransis* Srivastava. (*a*) Dorsal view of mature specimen with symmetrically arranged testes. (*b*) Ventral view of immature specimen with symmetrically arranged testes.

Distribution.—RAJASTHAN (first record) : Barmer and Jaisalmer Dists. *Elsewhere :* India : Maharashtra (Nagpur) and Uttar Pradesh.

Remarks.—Srivastava (1933) gave the length as 3.1-5.1 mm. ; in the present material it is 2.2-2.6 mm. which is intermediate between that for *Halipegus mehransis* Srivastava and for *H. mehransis* var. *minutum* Srivastava. This fact lends support to the views expressed by Bhalerao (1936), Rankin (1944) and Chauhan (1953) that the variety *minutum* is untenable.

In one mature specimen (2.55 mm.) with uterus full of ova, the testes are comparatively much smaller and slender in shape instead of triangular; the right testis is 0.22×0.06, the left 0.20×0.12 mm. The shape of the oral sucker is also variable—in some rounded (as described by Srivastava), and in a few transversely elongated. In certain cases the ratio of the size of the oral to the ventral sucker is more than 1 : 2.

Two specimens show peculiar arrangement of the testes : One (Text-fig. 4*a*), 1.5 mm., is fully mature with uterus full of ova. The other (Text-fig. 4*b*), 0.87 mm., is at an early stage of maturity with the uterus having a few ova. Both specimens have the testes symmetrically arranged, immediately behind acetabulum or extending to acetabular zone. The suckers are almost circular ; the oesophagus appear to be absent. The shape of the testes varies—almost rounded to antero-posteriorly elongated and somewhat triangular. The ovary is on the left side of the body. The vesicula seminalis lies behind the intestinal bifurcation. The genital pore is immediately behind the pharynx and behind the intestinal bifurcation.

Family VI. LECITHODENDRIIDAE

8. **Ganeo kumaonensis** Pande, 1937

1937. *Ganeo kumaonensis* Pande, B. P., *Proc. Indian Acad. Sci.*, Bangalore, B 6 (2), pp. 116-119.
1954. *Ganeo kumaonensis* ; Singh, K. S., *Trans. Amer. micr. Soc.*, Menasha, 73 (2), pp. 206-207.

Material.—15 exs., from intestine of the frog, *Rana cyanophlyctis* Schneider, Golab Sagar (Jaisalmer Dist.), coll. *P. D. Gupta*, 27.x.1962.

Distribution.—RAJASTHAN (first record) : Jaisalmer Dist. *Elsewhere :* India : Uttar Pradesh (Bhimtal, Dist. Almora ; and Lucknow) and Kashmir.

Remarks.—Fotedar (1959) considers this species as synonym of *G. tigrinum* Mehra & Negi, but I disagree.

9. **Ganeo tigrinum** Mehra & Negi, 1928

1928. *Ganeo tigrinum* Mehra, H. R. & Negi, P. S., *Allahabad, Univ. Stud.*, Allahabad, 4, pp. 66-80.

Material.—All coll. *P. D. Gupta*, 1962, from intestine of the frog. *Rana cyanophlyctis* Schneider, as follows :—(i) 5 lots, with 4, 2, 4, 3 and 2 exs., Golab Sagar (Jaisalmer Dist.), 25.x.62. (ii) 2 lots with 2 (immature) and 3 exs., Golab Sagar, as above, 27.x.62. (iii) 1 ex. Bisalpur Dam (Jodhpur Dist.), 12.x.62.

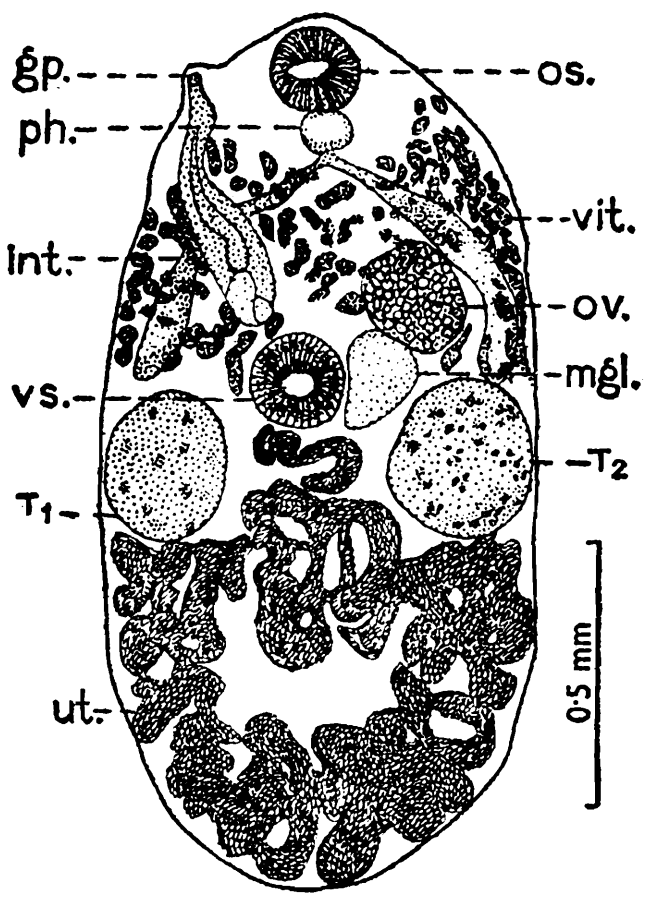
Distribution.—RAJASTHAN (first record) : Jodhpur and Jaisalmer. Dists. *Elsewhere :* India (Uttar Pradesh and Maharashtra) and China.

Remarks.—Some specimens show peculiar variations in the arrangement of gonads and the shape of excretory bladder. Thus, in some cases the gonads are opposed to each other. In one specimen the ovary is situated clearly behind the ventral sucker and the posterior testis. In some other specimens the ovary is located partly in level with the hind testis and the ventral sucker. The excretory vesicle has a variable shape U, V, or Y—shaped.

10. **Pleurogenes gastroporus** Lühe, 1901

(TEXT-FIG. 5)

1901. *Pleurogenes gastroporus* Lühe, M., *Ctbl. Bakt.*, Jena, **30**, pp. 166-171.
1928. *Pleurogenes gastroporus* var. *equalis* Mehra, H. R., and Negi, P. S., *Allahabad Univ. Stud.*, Allahabad, **4**, pp. 86-89.



TEXT-FIG. 5.—*Pleurogenes gastroporus* Lühe, in ventral view.

Material.—2 exs., from intestine of the frog, *Rana cyanophlyctis* Schneider, Gareshwar (Jaisalmer Dist.), coll. *P. D. Gupta*, 24.x.1962.

Distribution.—RAJASTHAN (first record) : Jaisalmer Dist. *Elsewhere :* India : Uttar Pradesh (Allahabad, Varanasi and Lucknow).

11. **Prosthodendrium ovimagnosum** (Bhalerao, 1926)

1926. *Lacithodendrium ovimagnosum* Bhalerao, G. D., *J. Burma Res. Soc.* Rangoon, **15** (3), pp. 188-190.

Material.—Four lots, with 1, 2, 4 and 3 exs., from intestine of the bat, *Taphozous kachensis kachensis* Dobson, Collecting Station No. **15**, Jaisalmer Dist. coll. *P. D. Gupta*, 21.x.1962.

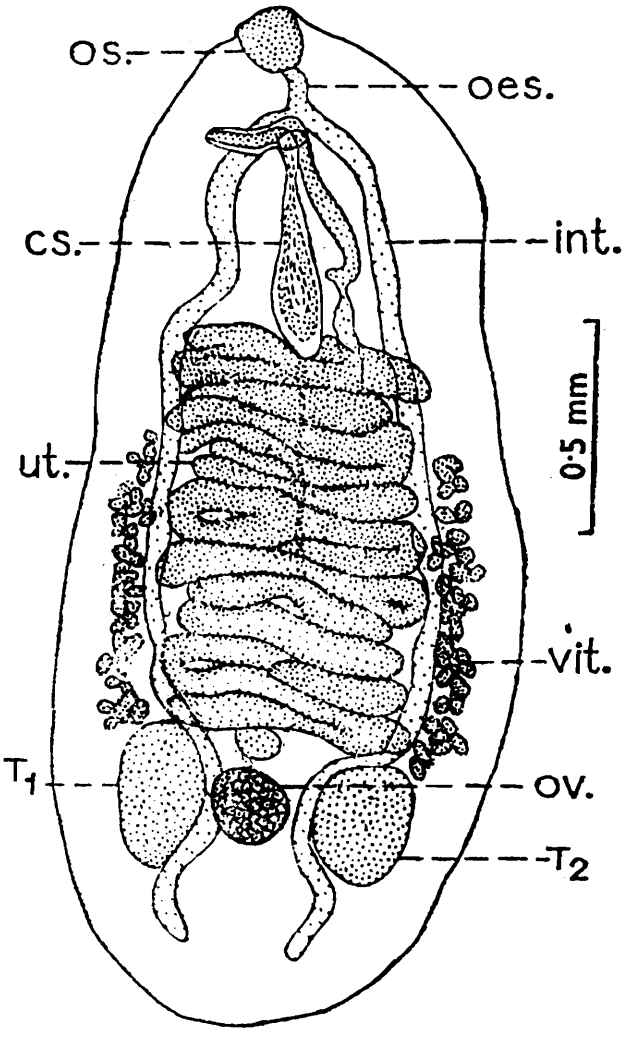
Distribution.—RAJASTHAN (first record): Jaisalmer Dist. *Elsewhere :* India : (Uttar Pradesh, Bengal and Punjab); Burma, the Philippines and Somaliland (Africa).

Remarks : In one specimen the ovary is confined to the left side of the body between the testis and the median line ; in others of the same lot it is slightly less extensive than that described by Bhalerao. The differences are merely individual variations.

Family VII. NOTOCOTYLIDAE

12. **Notocotylus bàrmerensis** n. sp.

(TEXT-FIG. 6)



TEXT-FIG. 6.—*Notocotylus barmerensis* n. sp., in ventral view.

Material.—2 exs., from intestine of the coot, *Fulica atra* L., Jalipa Tank (Barmer Dist.), coll. *P. D. Gupta*, 3. xi. 1962.

Description.—Length 2.42mm.; width (in middle) 1.15 mm. Oral sucker 0.18×0.18mm., pharynx absent, oesophagus 0.14mm. long ; intestinal caeca terminating about 0.04mm. in front of posterior border of body. Testes two, elongated antero-posteriorly ; with entire margins; situated in extracaecal field, occupying space created by inflection of intestinal caeca. Left testis 0.32×0.22mm.; slightly larger than right

(0.30×0.22mm.). Cirrus sac 0.66×0.14mm., situated in first one-third of body ; cirrus eversible, 0.24 mm. long. Genital pore situated just behind intestinal bifurcation. Ovary with entire margin ; lying between the two caeca in testicular region, partly covering the left intestinal caecum ; slightly elongated in transverse plane ; size 0.18×0.23mm; Mehlis' gland lying just in front of ovary. Uterine coils compactly coiled between testes and cirrus sac ; sometimes overlapping the intestinal caeca. Metraterm 0.40mm.; length *c.* 2/3rd of that of cirrus sac. Vitelline follicles commencing at about 0.25mm. behind cirrus sac and extending to anterior margin of testes.

Discussion.—Most of the known species of *Notocotylus* are reported as having lobed gonads, the exceptions being : *N. pacifer* (Noble, 1933) with entire ovary and lobed testes ; *N. parzonae* Harwood, 1939, with entire ovary and slightly lobed testes ; *N. skrjabini* Ablassov, 1953, with entire ovary and lobed testes ; and *N. gibbus* (Mehlis, 1846) Kossack, 1911, with entire ovary and reniform or crenated testes. *N. barmerensis* n. sp. differs from all these species in having both the testes and the ovary with entire margins.

N. barmerensis n. sp. is closely allied to *N. gibbus* (Mehlis) but differs as follows :—(i) Size larger. (ii) Testes rounded (*vs.* reniform ; lobed according to Stunkard and Dunihue, 1931).

Type-Specimens.—Holotype : One ex. on slide, Reg. No. W 6649/1 ; details as above. *Paratype :* One ex., in spirit, Reg. No. W 6650/1 ; from the holotype lot.

Distribution.—RAJASTHAN: Barmer Dist.

Family VIII. PLAGIORCHIIDAE

13. **Astiotrema** sp.

Material.—1 ex. (anterior portion damaged), from intestine of the turtle, *Lissemys punctata granosa* (Schoepff), Bisalpur (Jodhpur Dist.) coll. *P. D. Gupta*, 16.x.1962.

Distribution.—RAJASTHAN : Jodhpur Dist.

Remarks.—As the specimen is damaged, specific identification has not been possible.

14. **Tremiorchis ranarum** Mehra & Negi, 1925

1925. *Tremiorchis ranarum* Mehra, H. R. and Negi, P. S., *Proc. 12th Indian Sci. Congr.*, Calcutta, p. 147.

1926. *Tremiorchis ranarum* : Mehra, H. R. and Negi, P. S., *Parasitology*, Cambridge, **18** (2), pp. 168-181.

1926. *Centrovitus pentadelphi* Bhalerao, G. D., *Parasitology*, Cambridge, **18**(2), pp. 154-159.

Material.—Coll. *P. D. Gupta*, 1962, Jaisalmer Dist., from intestine of the frog, *Rana cyanophlyctis* Schneider, as follows :—(i) 3 exs. ; Gareshwar Tank, Jaisalmer, 26.x.62. (ii) 15 exs., Golab Sagar, 27.x.62.

Distribution.—RAJASTHAN (first record): Jaisalmer Dist. *Elsewhere:* India : Uttar Pradesh (Allahabad, Lucknow) ; Punjab (Karnal) and Maharashtra (Nagpur).

Remarks.—Some interesting features are given below :—Length is 3.57—3.85 mm. In some the diameter of the ventral sucker is equal to, and in others larger than, the oral sucker, prepharynx present. Intestinal caeca extend to just behind anterior margin of anterior testis. Testes post-equatorial. Ovary pre-equatorial. Vitelline follicles distributed from hinder margin of ventral sucker to slightly in front of terminii of intestinal caeca.

Singh (1954) presumed the prepharynx to be absent, while Mehra and Negi 1926 reported it to be present. According to Verma (1930) and Singh (1954) the intestinal caeca reach behind the posterior testis, while according to Mehra and Negi they extend to just behind the front margin of the anterior testis. Regarding the position of the testes, my specimens agree with the description of Bhalerao who reported them to be post-equatorial. Mehra and Negi, and Singh have described the ventral sucker as larger than the oral sucker, and Verma gave the reverse condition.

Family IX. PSILOSTOMATIDAE

15. **Psilochasmus oxyurus** (Creplin, 1825) Lühe, 1909 *emend.* Gupta, 1957

1825. *Distoma oxyurum* Creplin, F. C., *Observations de entozois*, Griefswald, pp. 48-49.

1909. *Psilochasmus oxyurus :* Lühe, M., *Süsswasserfauna Deutschlands*, Jena, Heft 17. pp. 59-60.

1913. *Psilochasmus longicirratus* Skrjabin, K. I., *Zool. Jb.* (*Syst.*), Jena, Abt. I, **35**, pp. 365-368, pl. 13, pp. 4-6.

1921. *Psilochasmus agilis* Travassos, L. *Brazil medico*, Rio de Janeiro, **35** (1), p. 179, fig. 1.

1935. *Psilochasmus japonicus* Ishii, N., *Jap. exp. Med.*, Tokyo, **13** (5), pp. 276-278, fig. 1.

1957. *Psilochasmus oxyurus :* Gupta, P. D., *Parasitology*, Cambridge, **47** (3-4), p. 455.

Material.—1 ex., from intestine of the common teal, *Anas crecca* (L.), Gareshwar Tank (Jaisalmer Dist)., coll. *P. D. Gupta*, 19. x. 1962.

Distribution.—RAJASTHAN (first record) : Jaisalmer Dist. *Elsewhere :* India (U. P. and Mysore) ; the Phillipines, Japan, China, Formosa, Germany, W. Siberia, Egypt, Brazil, Canada and U. S. A.

V—HOST-PARASITE LIST OF RAJASTHAN TREMATODES

(Table 2)

The host-parasite list of the Rajasthan trematodes discussed in this paper is given in Table 2.

TABLE 2.—*Host-parasite list of Rajasthan Trematodes.*

Host: Scientific name (and position)	Host: Common name	Trematode Parasite
(A) AMPHIBIA		
1. *Rana cyanophlyctis* Schneider	Frog	1. *Halipegus mehransis* Srivastava
		2. *Ganeo kumaonensis* Pande
		3. *G. tigrinum* Mehra & Negi
		4. *Pleurogenes gastroporus* Lühe
		5. *Tremiorchis ranarum* Mehra & Negi
(B) REPTILIA		
2. *Varanus monitor* (L.)	Monitor Lizard	1. *Paryphostomum indicum* (Bhalerao)
3. *Lissemys punctata granosa* (Schoepff)	Turtle	2. *Astiotrema* sp.
(C) AVES		
4. *Fulica atra* L.	Coot	1. *Cyclocoelum bikanerensis* n. sp.
		2. *Notocotylus barmerensis* n. sp.
5. *Haemantopus haemantopus* (L.)	Black-winged Stilt	1. *Haematotrephus lanceolatum* (Wedl.) Stossich
6. *Actitis hypoleucos* (L.)	Common Sandpiper	1. *Ophthalmophagus mertensis* n. sp.
7. *Neophron percnopterus* (L.)	White Scavanger Vulture	1. *Neodiplostomum tityense* Patwardhan
8. *Anas crecca* (L.)	Common Teal	1. *Psilochasmus oxyurus* (Creplin) Lühe
(D) MAMMALIA		
9. *Taphozous kachensis kachenvis* Dobson	Bat	1. *Anchitrema sanguineum* (Sonsino) Looss
		2. *Prosthodendrtum ovimagnosum* (Bhalerao)

VI—SUMMARY

1. This is believed to be the first major account of trematodes (Platyhelminthes) from Rajasthan. Fifteen species belonging to 14 genera and 9 families are reported here.

2. All the species are first records from Rajasthan. The genus *Ophthalmophagus* Stossich is recorded for the first time from India.

3. Three new species, namely, *Cyclocoelum bikanerensis* n. sp., *Notocotylus barmerensis* n. sp., and *Ophthalmophagus mertensis* n. sp., are described.

4. Keys for the identification of the families and genera of Rajasthan trematodes are given.

5. A host-parasite list of Rajasthan trematodes is also included.

VII—REFERENCES

ABLASSOV, N. A. 1953. A new trematode—*Notocotylus skrjabini* nov. sp., from the duck (Russian text). *In* Skrjabin : *Trematodes of Animals and Man*, Moscow, **8**, pp. 76-81.

BASCHKIROVA, E. I. 1941. Family Echinostomatidae Diuetz, 1909. *In* Skrjabin : *Trematodes of Animals and Man*, Moscow, **12**, pp. 53-93.

BHALERAO, G. D. 1927. Three new trematodes from reptiles. (Abstract). —*Proc. 14th Indian Sci. Congr.*, Calcutta, p. 191.

BHALERAO, G. D. 1931. Two new trematodes from reptiles, *Paryphostomum indicum* n. sp., and *Stunkardia dilymphosa* n. g. n. sp.—*Parasitology*, Cambridge, **23**, pp. 99-108.

BHALERAO, G. D. 1936. Studies on the helminth Fauna of India. Trematoda. III.—*J. Helminth.*, London. **14** (4), pp. 207-228.

CHATTERJI, P. N. 1958. On a new avian trematode of the genus *Cyclocoelum* Brandes, 1892.—*J. Parasit.*, Urbana, **44**, pp. 559-565.

CHAUHAN, B. S. 1954. Studies on the trematode fauna of India. Pt. IV (Digenea : Prosostomata).—*Rec. Indian Mus.*, Calcutta, **51** (1953), pp. 289-391.

COHN, L. 1902. Mitteilungen über Trematoden.—*Zool. Anz.*, Leipzig, **25**, pp. 712-718.

DUBOIS, G. 1959. Revision des Cyclocoelidae Kossack, 1911 (Trematoda).—*Rev. suisse Zool.*, Geneva, **66**(1), pp. 67-147.

FOTEDAR, D. N. 1959. On a new species of the genus *Ganeo* Klein, 1905 and some notes on the genus.—*J. Helminth.*, London, **33** (2-3), 151-160.

FUHRMANN, O. 1904. Neue Tromatoden.—*Zbl. Bakt.*, Jena, Abt. I. Org, **37**, pp. 58-64.

HARWOOD, P. D. 1939. Notes on Tennessee helminths. IV North American Trematodes of the subfamily Notocotylinae.—*J. Tenn. Acad. Sci.*, Nashville, **14**, pp. 421-437.

KOSSACK, W. 1911. Uber Monostomiden.—*Zool. Jb.* (*Syst.*), Jena, **31** pp. 491-591, 3 pls.

NOBLE, A. E. 1933. Two new trematodes from the American Coot.—*Trans. Amer. micr. Soc.*, Menasha, **52**, pp. 353-360.

RANKIN, S. J. Jr., 1944. A review of the trematode genus *Halipegus* Looss, 1899, with an account of the life-history of *H. amherstensis* n. sp.—*Trans. Amer. micr. Soc.*, Menasha, **63**(2), pp. 149-164.

ROONWAL, M. L. 1968. Fauna of Rajasthan, India. Part 1. General introduction.—*Rec. zool. Surv. India*, Delhi, **61** (3&4), [1963] pp. 291-375, 9 pls.

SINGH, K. S. 1954. On some trematodes collected in India.—*Trans. Amer. micr. Soc.*, Menasha, **73**(2), pp. 202-210.

SRIVASTAVA, H. D. 1933. On new trematodes of frogs and fishes of the United Provinces, India. Part I. Distomes of the family Hemiuridae from North Indian fishes and frogs with a systematic discussion on the family Halipegidae and the genera *Vittelotrema* Guberlet and *Genarchopsis* Ozaki.—*Bull. Acad. Sci. Unit. Press*, Allahabad, **3** (1), pp. 41-60.

STOSSICH, M. 1902. 91 Monostomum mutabile Zeder e le sue forme affine.—*Bull. Soc. adriat. Sci. nat.*, Trieste, **21**, pp. 1-40.

TRAVASSOS, L. 1921. Contribuicao ao conhecimento dos Cyclocoelidae brasileiros.—*Brazil med.* Rio de Janeiro, **35**, pp. 121-123.

VERMA, S. C. 1930. On the synonymy of the genera *Tremiorchis* Mehra & Negi, 1926 and *Centrovitus* Bhalerao, 1926, with the description of *Tremiorchis varanum* n. sp.—*Parasitology*, Cambridge, **22** (2), pp. 302-312.

WITENBERG, G. 1926. Die Trematoden der Familie Cyclocoelidae Kossack, 1911. Beitrag zur Kenntnis der Helminthen fauna Russlands.—*Zool. Jb.* (*Syst.*), Jena, **52**, pp. 103-186.

VII—LETTERING USED IN TEXT-FIGURES

c.s., cirrus sac ; *gp.*, genital pore ; *int.*, intestine ; *mgl.*, Mehlis' gland ; *oes.*, oesophagus ; *os.*, oral sucker ; *ov.*, ovary ; *ph.*, pharynx ; *rsu.*, receptaculum seminis uterinum ; T_1, T_2, testes ; *ut.*, uterus ; *vd.*, vitelline duct ; *vs.*, ventral sucker ; *vit.*, vitellaria.