STILES (C.W.) & HASSALL (A.)

# NOTES ON PARASITES,

21 and 22. -23

BY

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(has all Stiles)

(21-22-23)

*21: A new species of fluke* (Distoma [Dicrocælium] complexum) *found in cats in the United States, with bibliographies and diagnoses of allied forms.*

[With nineteen figures.]

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# NOTES ON PARASITES—21 AND 22.

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*21: A new species of fluke* (Distoma [Dicrocælium] complexum) *found in cats in the United States, with bibliographies and diagnoses of allied forms.*

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In the March number of the American *Veterinary Review* (pp. 692) Stiles gave an abstract of Braun's article on the liver-flukes found in cats and allied animals, in which Braun showed that two known species, *i. e.*, *D. truncatum* and *D. felineum*, and a new species, *D. albidum* were present in European cats. In the *Review* it was stated that Dr. Th. Smith has found a fluke in cats in Albany, which was evidently identical with Braun's new species, *D. albidum*.

Since the abstract went to press Hassall has on two different occasions found liver-flukes which agree with the form found by Dr. Smith, once (December 16, 1893,) in a cat in Baltimore, Md., and once (December 26, 1893,) in a cat in Washington. In the former case eighteen parasites were present, in the latter case there were only two. This material places us in position to extend the knowledge of the geographical distribution of this species in this country beyond the State of New York as far south as Washington, D. C., and also to make a more detailed study of the form. It is certain that liver-flukes occur in cats in some other parts of the country, although it is impossible for us to state at present, to what species they belong.

The liver of the Baltimore cat was of a peculiar dark color, the gall-bladder contained a small quantity of dark bile. Nothing unusual was noticed in the larger bile-ducts, but the first large sub-divisions contained a greenish pus-like fluid, and on pressing the unopened portions of the ducts a fluke was forced out with this fluid. Upon following the ducts further, more distomes and more pus were found, the flukes in all cases having their anterior end directed toward the periphery of the liver; when taken from the bile-ducts the parasites were of a greenish tinge, but when preserved they became pinkish or whitish.

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Upon comparing the form found here with the description and figures given by Braun of the new species *D. albidum*, we felt that it was better to consider the American form as a variety of that species rather than to establish it as a new species, notwithstanding certain differences between the forms, as we feel that there has been altogether too great a tendency among American authors to multiply specific names for parasites found in this country, when in reality many of the forms are practically identical with already described [1] species.

We accordingly prepared a note upon the parasite and were on the point of sending it to press when we received several typical specimens of *D. albidum* directly from Professor Braun. A comparison of these specimens with our own convinced us that the American form was entitled to specific rather than varietal rank. We, therefore, delayed the publication of this article in order to describe the form as a new species rather than a new variety.

Notwithstanding the marked similarity between *D. albidum* (Figs. 1 and 2) and this new species (Figs. 3 and 4) for which we propose the name *D. complexum*, there are several points of difference between the two which can hardly be ascribed to individual or varietal variation.

The first point of difference between the two forms is that our species is much larger than Braun's form. Braun's measurements are 2.5 to 3.5 mm. long; our measurements are: live specimens 5 to 7 mm. long (may stretch to even 10 mm. in length); preserved specimens measure 5 to 6 mm. long. This character alone would not lead us to establish a new species. Braun does not state whether his measurements were based upon preserved or fresh material; the preserved specimens he sent us measure 2.2 to 3 mm. long.

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[1] In a later paper we shall endeavor to show that *Distoma aquilæ* Leidy, 1886, and *Clinostomum gracile* Leidy, 1856, are identical with *D. hererostomum* R. 1809. *D. gastrocolum* Leidy, 1890, with *D. ocreatum* Molin, 1858. Other forms will be given in our revision of Leidy's collection. A comparison of American forms directly with European specimens may, of course, result in establishing many of the former as distinct species, although they may agree very well with the descriptions of the European forms.

*Monostoma molle* Leidy, 1856, from *Sternotherus odoratus* is a distome and should accordingly be named *Distoma* (*Polyorchis*) *molle*. The testicles of this species lie in two longitudinal rows of thirteen each. In this case it is difficult to agree with Braun in suppressing the sub-genus *Polyorchis* Stossich, in fact, we are almost inclined to agree with Stossich in raising it to generic rank (*Polyorchis polyorchis* and *P. molle*). *D. trapezium* Leidy, 1890, is identical with *D. reticulatum* Ramsay Wright, 1879, (nec Looss, 1884.)

A second point of difference between Braun's form and our species is that in the German form (Figs. 1 and 2) the vitellogene glands do not cross the intestinal cæca anteriorly (this holds good for Braun's figure and description, and for four specimens of Braun's material which we have mounted), while in seven mounted specimens of the American form (Figs. 3 and 4) now before us, the vitellogene glands cross the intestine anterior to the acetabulum and come together in the median line, thus surrounding the uterus—hence the specific name *complexum*. Although there is some variation in the extent to which the vitellogene glands are developed in both forms, they are much more profusely developed in the American than in the German form.

A fourth point of difference is that while in the four mounted specimens of *D. albidum* before us, the uterus is not so well or extensively developed as to prevent the acetabulum from being distinguished, in the American form it is so developed that it is with the greatest difficulty that the acetabulum can be discovered in mounted specimens; in unmounted specimens the acetabulum is very evident.

A fifth and most important difference is that the ovary of *D. albidum* is round or oval while that of *D. complexum* is distinctly tri-lobate.

A sixth difference is in the size of the ova, which in *D. albidum* measure 0.027 to 0.032 mm. long by 0.013 to 0.016 mm. broad while the ova of *D. complexum* are slightly smaller (0.024 mm. long by 0.012 mm. broad).

A seventh and very distinct difference between the two species is brought out by hæmatoxylin and more clearly by acid carmine, *i. e.*, in reference to the parenchyma of the body. In Braun's species if a transverse line is drawn through the body at about the height of the ovary, it will be noticed that the parenchyma posterior (caudad) of this line is much denser than that anterior to the line, so that in stained preparations the posterior portion of the body is much darker than the anterior, owing evidently to the more crowded nuclei. In *D. complexum* no such difference is noticed.

Still another difference is that this transverse line divides a broader posterior portion from a narrower anterior portion in *D. albidum*, while this difference in breadth is not so apparent in the American form.

From this discussion it must be admitted that the American form is entitled to specific rank distinct from *D. albidum*. Braun, too, is of this opinion, as we have just received a letter from him to the effect that he had examined a specimen this Bureau sent to him and believed the American form distinct from his *D. albidum*, although very closely related to it.

The other forms of closely related Distomes found in cats and allied animals are: *D. felineum* (Figs. 5–8), *D. viverrini* (Fig. 9), *D. truncatum* (Figs. 11–12), *D. conjunctum* (Figs. 13–15), *D. tenuicolle* (Fig. 16) and *D. sinense*, but a glance at the figures will suffice to show that our proposed new species cannot be confounded with any of these forms.

Before giving the specific descriptions, etc., of these forms, it may be well to call attention to an important point in individual variation, topographical anatomy and correlated position which has apparently been overlooked by former authors.

In his specific diagnoses of the distomes of cats Braun states (and in translating Braun's diagnoses in the review referred to above, the original was followed) that in the case of *D. truncatum*, the *left* testicle lies about one-fourth its length in front of the *right* testicle; in *D. albidum*, the *receptaculum seminis* is described as lying on the *right* of the ovary. In both of these cases the words italicized above (*left, right, right,*) should read, *right, left, right*, if his description is to agree with his drawings. This is shown both by Braun's figures of these two species and by his figures and description of *D. felineum*, in which the terms *right* and *left*, as given in the text agree with those sides as given in the drawings. (It is here assumed that as the acetabulum is drawn distinctly in Braun's figures, the ventral view has been taken.)

If Braun's figure (Plate 1, Fig. 1) of *D. albidum* is now compared with our figure (Fig. 2) of a specimen which Braun sent to us, it will be noticed that the testicles in our figure agree with Braun's description, but not with his figure. In all four preparations of *D. albidum* which we have, the right testicle is posterior to the left, and the *receptaculum seminis* is on the right side. Before receiving Braun's specimens we had noticed the discrepancy between his figure and his description and were led to examine several allied forms in order to find an explanation for this discrepancy.

This study of *right* and *left* immediately suggests a point in topographical anatomy, which may possibly be utilized in some cases in specific determinations, or if not of use as a specific character, will certainly be an excellent example of individual variation.

A study of distomes in general teaches us that they possess a right and left testicle, and that the excretory canal runs between the two. In many of the elongated forms, it is noticed there is not room enough for the testicles to lie side by side, but one of them is crowded in front of the other. In the case of *D. felineum*, (Cf. Braun's figure and description ; also Railliet's figure of *D. conus* [= *D. felineum*] in Neumann), the right testicle is posterior of the left testicle, the *receptaculum seminis* is on the right side of the ovary. In *D. albidum*, according to the figure by Braun, the left testicle is posterior of the right testicle, the *receptaculum seminis* is on the left side of the ovary ; according to Braun's description, however, the *receptaculum seminis* is on the *right* side of the ovary. *D. truncatum*, as stated above, is figured with the right testicle anterior to the left, but is described as having the left testicle anterior to the right. In Braun's figure of *D. tenuicolle R.*, the left testicle is posterior to the right, and the *receptaculum seminis* is figured on the left of the ovary.

From these statements it will be seen that all of the figures thus far referred to agree in having the *receptaculum seminis on the side of the ovary corresponding to the posterior testicle, i. e.*, when the right testicle is posterior, the *receptaculum seminis* is on the right side and *vice versa*. At first we thought that this could be used as a character in determining which testicle was right, and which was left, in case the excretory canal was not to be seen, and that we would find that in some forms the right testicle would always be posterior, in other forms anterior of the left. Braun's apparent *lapsus calami*, referred to above, however, induced us to examine another form which Hassall has found very common in the liver of the American crow, (*Corvus americanus*), and once in *C. ossifragus*. This species is very closely allied to *D. longissimum*, which von Linstow described from *Ardea stellaris*. In this [1] form we find one testicle

[1] This parasite is so closely allied to von Linstow's *D. longissimum* that we hesitate to describe it as a new species without first comparing it with von Linstow's type-specimens. The American form differs very greatly in some points from von Linstow's description, as will be

in front of the other, but in the four specimens which we examined the topography was not constant. In two complete specimens, the right testicle was posterior to the left, and the *receptaculum seminis* was on the right of the ovary, (Fig. 17); in the other specimens, however, (fragments of the posterior end, dorsal surface was determined by the opening of Laurer's canal), the left testicle was posterior to the right, and the *receptaculum seminis* was on the left side of the ovary.

This case of the correlation between the position of the receptaculum and the ovary is thus borne out in this species, but we see that here the position of the right or left testicle (as anterior or posterior) cannot be used as a specific character. This immediately brought up the question as to whether the words *right*, *left* and *right* in Braun's descriptions of *D. albidum* and *D. truncatum* are really to be looked upon as errors or whether this disagreement between his descriptions and figures is simply an unconscious statement on Braun's part that there is an individual variation in these species corresponding to the individual variation of *D. longissimum*. In four of the specimens of *D. felineum*, which we owe to the kindness of Professor Braun, the the right testicle is posterior to the left, and the *receptaculum seminis* is on the left side.

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seen in the analytical key (*vid. infra*), but a comparison with von Linstow's figure (Plate IV., Fig. 19) shows that the forms cannot be widely separated. Until we can examine von Linstow's material or he can examine ours, we propose to describe the American form as a provisional new variety. The diagnoses of the two animals are as follows :—

*Distoma* (*Dicrocœlium*) *longissimum* von Linstow, 1883.—Body very elongate, cylindrical, 20 mm. long by 1 mm. broad; spines absent; oral sucker 0.28 mm. in diameter; acetabulum slightly larger (0.34 mm.) on boundary of first and second anterior sixths of body, genital pore immediately anterior to acetabulum. Pharynx nearly as large as oral sucker, œsophagus as long as pharynx, intestinal cæca extend to posterior end of body. Testicles lobate, in posterior sixth, one in front of the other; penis not seen. Ovary lobate; vesicula seminalis large, globular; shell-gland anterior to ovary, diffuse; vitellogene glands lateral in third fourth of the body, not extending posterior to ovary; eggs 0.026 mm. by 0. 015. Contractile vesicle ?

Habitat. Liver of *Ardea stellaris* in Turkestan.

*D.* (*D.*) *longissimum* var. *corvinum* S. & H. var. nov., 1894—(Will probably prove to be a new species). Body very elongate, cylindrical or flat, 12 to 29 mm. long, 1 mm. broad; spines present; oral sucker 0.424 mm. in diameter; acetabulum o 248 mm. on boundary between first and second thirds of body. Genital pore immediately anterior to acetabulum. Pharynx smaller than oral sucker; œsophagus as long as pharynx; intestinal cæca extend to posterior extremity. Testicles globular, in posterior eighth of body, right (or left) anterior to left (or right); penis absent. Ovary globular, anterior of testicles; vesicula seminalis posterior and lateral of ovary; shell-gland rather diffuse; Laurer's canal very evident; uterus enormously developed, situated between ovary and genital pore; vitellogene glands lateral, confined to posterior half of body, beginning at middle and extending to posterior testicle or beyond; eggs 0.028 by 0.016 mm. End portion of excretory canal sigmoid, running between the testicles.

Habitat. Biliary ducts of *Corvus americanus* and *C. ossifragus*. U. S. A. (Maryland and D. C.)

Type deposited in U. S. National Museum, Washington, D. C.

In one of two specimens of Rudolphi's *D. truncatum* (Fig. 12), for which we are indebted to Geheimrath Möbius, of Berlin, the right testicle is posterior to the left, while in Braun's figure (Plate III, Fig. 11), the left is slightly posterior to the right.

Upon re-examination of our specimens of *D. complexum*, we found the same variation and the same correlation, for of the ten mounted specimens we examined the left testicle was posterior to the right in four cases, the right testicle posterior to the left in six cases, and in all cases the *receptaculum seminis* was on the side of the ovary corresponding to the posterior testicle. It may be also added that in Cobbold's figure of *D. conjunctum*, (Plate III, Fig. 13), the left testicle is posterior to the right, while in figures given by McConnell (Fig. 14), Lewis and Cunningham (Fig. 15), the right testicle is posterior to the left.

In most cases there is a great temptation to look upon the correlation of position between the *receptaculum seminis* and the posterior testicle as a mechanical effect of the position of the anterior testicle, but it seems doubtful whether this will hold in *all* cases.

These statements of variation may be summarized as follows:

| | | | | | | Plate. | Fig. |
|---|---|---|---|---|---|---|---|
| *D. albidum* | left test. post. | | right test. ant. | | Braun's figure | I. | 1 |
| | right | " | left | " | " description | | |
| | right | " | left | " | S. & H., 4 slides | I. | 2 |
| *D. conjunctum* | left | " | right | " | Cobbold's figure | III. | 13 |
| | right | " | left | " | McConnell's figure | III. | 14 |
| | right | " | left | " | L. & C.'s figure | III. | 15 |
| *D. felineum* | right | " | left | " | Braun's figure and desc. | I. | 5 |
| | right | " | left | " | Railliet's figure | II. | 7 |
| | right | " | left | " | Rivolta's figure | II. | 8 |
| | right | " | left | " | S. & H., 4 slides | I. | 6 |
| *D. longissimum* var. *corvinum.* | left | " | right | " | S. & H., 2 slides | | |
| | right | " | left | " | S. & H., 2 slides | IV. | 17 |
| *D. tenuicolle* | left | " | right | " | Braun's figure and desc. | IV. | 16 |
| *D. complexum* | left | " | right | " | S. & H., 4 slides | I. | 4 |
| | right | " | left | " | S. & H., 6 slides | | |
| *D. truncatum* | left | " | right | " | Braun's figure | III. | 11 |
| | right | " | left | " | Braun's description | | |
| | right | " | left | " | S. & H., 1 slide | III. | 12 |

The *receptaculum seminis* in all cases is on the side of the ovary corresponding to the posterior testicle.

Although it is evident from the above discussion that the relative position of the right and left testicle is too inconstant

to be used as a specific character in these forms, a comparison of the number of figures of various authors brought out the fact that authors have as a general rule not shown in their drawings whether it was the right testicle or the left testicle which is anterior or posterior and we are not yet in a position to determine whether the topography is constant in other species or not. It will, of course, generally be necessary to examine a number of specimens of a given species to determine a point of this nature.

The comparison of various drawings brought out another matter in topography which may possibly serve as a taxonomic principle, at least in distinguishing species, and one which most authors have ignored entirely, *i. e.*, the topographical relations of the excretory canal. As Braun has already shown, this canal pursues a sigmoid course between the testicles in the case of certain allied species, (*D. felineum* and *D. tenuicolle*), and the same holds true for *D. complexum*, *D. longissimum* var. *corrinum* and *D. conjunctum*.

In Stossich's figure of *D. scorpænæ* (see also Braun's Vermes. Taf. XXII, Fig. 9), still another topography is given, the excretory canal running ventrally of both testicles, the left testicle being posterior to the right. In *D. sinense* and in von Linstow's figure of *D.* (*Dicrocœlium*) *cylindraceum*, (see Braun's Vermes, XXII, 6,) the canal runs *dorsally* of the testicles, and Hassall has found a Distoma (*Brachylaimus*, Fifth Section), in *Cistudo carolina* which presents the same topography.

Naturally we do not care to go so far as to assert at the present moment that the topography of the end portion of the excretory system will serve as a taxonomic principle in all cases, but the examples cited above show that at least three different positions may be assumed by this organ, and that in those species where the testicles are posterior it will be worth while to pay more attention to this point.

As this study of the topography necessitates a change in some of the specific diagnoses, we append revised descriptions below :

Genus [1] *Distoma* Retz (Type species *D. lanceolatum*). Subgenus *Dicrocœlium* (type species *D. lanceolatum*).

[1] Cf. Ch. Wardell Stiles. The Anatomy of the large American Fluke (*Fasciola magna*) and a comparison with other species of the genus *Fasciola*, s. st.; *Journ. Comp. Med. and Vet. Arch.* 1894. In this paper I follow Cobbold in limiting the generic term *Fasciola* L. to flukes of the type of *F. hepatica*, accepting *Distoma* Retz as the generic name for flukes of the type *D. lanceolatum*.

First section : The genital glands lie anterior to the uterine folds, (*D. laceolatum*, Fig. 19).

Second section : The genital glands lie posterior to uterus or in posterior portion of body, partially covered with the uterus.

Under this section the flukes given below agree also in the following characters :—

The testicles are never exactly side by side, but one (right or left) is regularly more or less posterior to the other (left or right); no penis is present; vitellogene glands never extend posterior to the testicles.

### 1. DISTOMA (DICROCŒLIUM) TRUNCATUM (Rud., 1819).

Plate III, Figs. 11–12.

[1819–1894.]

| Synonymy. | Literature. |
|---|---|
| '19. *Amphistoma truncatum* n. sp. . | RUDOLPHI.—Entoz. Syn., p. 91 et 359. |
| ('23.) *A. truncatum* . . . . . | WESTRUMB.—In Isis, p. 597 (from Dies., '50). |
| ('25.) *Distoma conus* n. sp. . . . . | CREPLIN.—Observationes de entozoois. I. Gryph., p. 50 (from Braun, '93*b*). |
| ('36.) *Amphistomum truncatum* . . . | DIESING.—Monogr. d. Gatt. *Amphistomum* u. *Diplodiscus;* Ann. d. Wien. Mus. I, 252. Tab. XXII, 13–15 (from Dies., '50). |
| ('39.) *Distoma conus* . . . . . | CREPLIN.—Art. Eingeweidewürmer. Ersch. v. Gruber's Encyklop. d. Wiss. u. Künste. XXXII, p. 286, in nota (from Braun, '93*b*). |
| '45. *Distoma conus* Crepl. . . . . | DUJARDIN.—Hist. nat. d. Helm., pp. 331 et 440. |
| '50. *Amphistomum truncatum* Rud. | DIESING.—Syst. Helm. I., 404 (except syn. *D. lanceolatum* Sieb.). |
| ('51.) . . . . . | CREPLIN.—Nachträge zu Gurlt's Verch. d. Th. bei w. Entozoen gefunden worden sind; Arch. f. Naturg., Jahrg. XVII, p. 279, Anm. (from Braun, '93*b*). |
| ('58.) *Distomum conus* Crepl. . . . | WAGNER.—Beiträge z. Entwgesch. d. Eingeweidewürmer. Haarlem. Tab. XXII, 1–2, p. 102 (from Braun, '93*b*). |
| ('58.) *Distomum lanceolatum* Meh. . | DIESING.—Revis. d. Myzhelm; Sitzb. d. K. Akad. d. Wiss., Wien. Math. Nat. Kl., XXXII, 332 (from Braun, '93*b*). |

| Synonymy. | Literature. |
|---|---|
| ('70.) *Distomum conus* Crepl. . . . | HILGENDORF u. PAULICHI.—Ektasie des Ductus choledochus u. d. gr. Gallengänge, bedingt durch Anhäufung von Plattwürmern bei einem Vielfrass (Gulo borealis); Berlin. Klin. Wochensch., VII, 566–567 (from Braun). |
| ('74.) *Distoma campanulatum* n. sp. | ERCOLANI.—Osservazioni di elmintologia reguardanti: III. Una nuova specie di distoma parimenti del cane domestico; Memoria Accad. delle Scienze dix Bologna, ser. 3, tom. 5. ——Giorn. Anat. Fisiol. e Patol. degli Animali, pp. 33–40, Pisa, 1875. ——Boll. Soc. Med. Bologna, pp. 274–279, 1875 (from Parona's Elm. ital.) |
| '78. *Distoma conus* Crepl. . . .<br>*Amphistomum truncatum* Rud. | VON LINSTOW.—Compend. d. Helm., p. 43, 44. |
| '82. *Distoma truncatum* Ercol. .<br>*D. campanulatum* Ercol. | PERRONCITO.—I parassiti, etc., pp. 284–286. |
| ('85.) *Distomum campanulatum* Ercol. | VAN TRIGHT, J.—Distomen in der Leber des Hundes; Die Tierarzt., Jhg. XXIV, pp. 84-85 (after Braun). |
| '86. *Distoma campanulatum*, Ercol.<br>*D. truncatum*, Rud., et *D. conis*, Crepl. | PERRONCITO.—Trattato sulle malattie degli animali dom., p. 250. |
| ('86–'87.) *Distomum campanulatum* | JONG, D. A.—Dist. camp. en D. felineum bij den hond; Tijdsch. v. Veeartsenijk. en Veeteelt, XIV, Utrecht, pp. 57–62 (from Braun, '93*b*). |
| ('87.) . . . . . | ZWAARDEMAKER, H.—Tijdsch. v. Veeartsenijk. en Veeteelt, XIV. Utrecht, p. 265 (from Braun, '93*b*). |
| ('89.) *Distomum truncatum* Ercol. . | SONSINO.—Studie e notizie elm. *D. conus* e forme affini; Proc verb. d. Soc. Tosc. d. sc. nat., 7 luglio, Pisa (from Braun, '93*b*). |
| '89. *D. campanulatum* Ercol. .<br>*D. conus* Crepl.<br>*D. truncatum* Ercol. | LEUCKART.—Die Parasiten d. Menschen. 2. ed., I. 2., p. 357. Anm. |
| '90. . . . . | ZWAARDEMAKER, H.—Cirrhosis parasitaria; Virchow's Arch. f. path. Anat., CXX, pp. 199–203, mit 2 Taf |

Synonymy.

'92. *Distoma truncatum*, Rud., pro parte (non fig.)

'93*a*. *Distomum* (*Dicrocœlium*) *truncatum*.

'93*b*. *Distomum* (*Dicrocœlium*) *truncatum*.

'93*c*. *D.* (*D.*)*truncatum* . . . . .

'94. *Distoma* (*D.*) *truncatum* (Rud.)

'94. *Distoma* (*D.*) *truncatum* (Rud.)

Literature.

NEUMANN.—Traité d. Maladies parasit., p. 529; Eng. transl., p. 544.

BRAUN, MAX.—Ueber die Distomen in der Leber der Hauskatzen; Zool. Anz., No. 428, pp. 347–355.

BRAUN, MAX.—Die Leberdistomen der Hauskatze (Felis catus domestica) und verwandte Arten; C. f. B. u. P., XIV, pp. 381–392, 422–428, Fig. 1.

— Helm. Notiz. 1: *Distomum campanulatum*, Ercol.; C. f. B. u. P., XIV, 802–803.

STILES.—Review of Braun, '93*b*; American Vet. Rev., pp. 691–696.

STILES and HASSALL.—The present paper.

*Specific Diagnosis.*—Length 2 mm., form conical (pointed anteriorly, truncate posteriorly); integument thickly and regularly covered with fine spines; oral sucker and ventral acetabulum about the same size (0.134–0.172 mm.), the acetabulum being situated slightly anterior of the middle of the body; the oral sucker is followed immediately by a pharynx 0.091 mm. long, the latter by a very short œsophagus posterior to which the intestine branches into the two cæcal sacs which extend to the posterior extremity of the body. Immediately anterior to the blind posterior ends of these cæca are situated the two elliptical (non-lobated) testicles (0.172–0.376 mm. long), seldom side by side at the same height, as one testicle (the right or left) generally lies about one-fourth of its length in front of the other (the left or right). Anterior to the testicles, either in the median line or slightly laterally, is found the globular ovary, which is smaller than the testicles and generally covered by the uterus. The lateral vitellogene glands, like the uterus, are situated in the middle third of the body, and are composed of ten to twelve acini each side. Genital opening anterior to acetabulum; cirrus is absent, but the winding end (vesicula seminalis) of the vas deferens is generally evident. Eggs 0.029 mm. long by 0.011 mm. broad. Excretory pore in the middle of the posterior extremity, which is surrounded by a muscular ridge. Color of fresh specimen whitish, with a brownish spot (uterus). (Translated and modified from Braun, '93*b*.)

*Hosts.—Phoca vitulina, Felis catus domestica, Canis familiaris, C. vulpes, Halichœrus fœtidus, Gulo borealis.*

*Geographical Distribution.*—Germany, Holland, Italy and France.

Types in Coll. Rud., Berlin Museum; U. S. Nat. Mus., Washington.

### 2. D. (D.) ALBIDUM Braun, 1893.

Plate I, Figs. 1–2.

[1893–1894.]

| Synonymy. | Literature. |
|---|---|
| '93*a*. *Distomum* (*Dicrocœlium*) *albidum* sp. n. | Braun—vide Br. '93*a* sub. *D. truncatum* (supra). |
| '93*b*. *Distomum* (*D.*) *albidum* n. sp. | —v. Br. '93*b* sub, *D. truncatum*, Fig. 2. |
| 94*a*. *Distoma* (*D.*) *albidum* Braun, (exc. "D. conus [?]") | Stiles—v. Stls. '94*a* sub. *D. truncatum*. |
| '94*b*. *Distoma* (*D.*) *albidum* Braun. | Stiles and Hassall.—The present paper. |

*Specific Diagnosis.*—Length 2.5–3.5 mm.; breadth 1–1.6 mm.; body spatulate, the anterior portion being narrower and generally separated by a constriction from the broader flat, posterior end; the posterior end is rounded, and does not possess the sucker-like muscular ridge. Posterior portion with denser nuclei. Integument thickly covered with spines ("Dornen"), which are somewhat larger on the anterior portion than on the posterior portion: these spines frequently fall, especially from the posterior portion. Oral sucker slightly larger than the acetabulum or nearly the same size (0.323–0.301 mm., smaller specimen 0.269–0.242); acetabulum in the median line on the border between the first and middle thirds of the body, and occasionally more or less obscured by the uterus. Oral sucker followed by pharynx, the latter by a very short œsophagus; intestinal cæca extend into the posterior end of the body. Testicles lobate, in posterior half of the body, right (or left) in front of left (or right); ovary round or oval, 0.242 mm. in diameter (slightly less than one-half the diameter of the testicles); lateral of ovary is situated a pyriform receptaculum seminis, which is larger than the ovary; shell-gland rather diffuse, composed of unicellular glands; vitellogene glands composed of numerous acini, and extend from about the posterior end of the œsophagus to about the middle of the

body. Genital opening anterior to the acetabulum, cirrus absent; excretory pore on posterior end. Eggs 0.027–0.032 mm. long by 0.013–0.016 mm. broad. Color of worm white, with brown spot (uterus). (Translated and modified from Braun, '93*b*.)

*Host.*—Cats.

*Geographical Distribution*—Königsberg, Germany (Braun); Alfort, France (Railliet).

Types—Coll. Braun, Königsberg; Coll. Stiles, U. S. Nat. Mus.; Coll. B. A. I.

### 3. D. (D.) COMPLEXUM sp. n., 1894.

Plate I, Figs. 3–4.

[1894.]

| Synonymy. | Bibliography. |
|---|---|
| '94*a*. "*D. conus* (?)" sub. *D. albidum* | STILES—vide STLS. '94*a* sub. *D. truncatum*. |
| '94*b*. *D.* (*D.*) *complexum* sp. n. . . | STILES and HASSALL.—The present paper. |

*Specific Diagnosis.*—Length 5–7 mm. (can stretch to 10 mm.); breadth 1.5–2 mm.; body linguiform, not so separated into anterior and posterior portion as in *D. albidum*; anterior end rather pointed, posterior end rounded, but does not possess any muscular ridge. Integument covered with spines. Oral sucker terminal or by contraction may appear subterminal, of about the same size as acebatulum (0.33 to 0.39); acetabulum in median line about on boundary between first and second fourths of body and very much obscured by uterus. Oral sucker followed by pharynx, œsophagus very short; intestinal cæca extend to posterior end of body. Testicles lobate (three to eight lobes) in posterior half of body, one (right or left) in front of the other (left or right), separated by sigmoid end of excretory system. Ovary trilobate, lateral of ovary is situated pyrifom receptabulum seminis; shell-gland same as in *D. albidum*; vitellogene glands confined to anterior half of body, cross the intestines and meet in the median line, thus encircling the uterus. Genital opening anterior to acetabulum; penis not seen. Eggs average 0.024 by 0.012 mm. Color of fresh worm greenish; of preserved specimens whitish to pinkish, with dark brown spot (uterus).

*Host.*—Cats.

*Geographical Distribution.*—New York, Maryland and District of Columbia.

Types deposited by B. A. I. in U. S. Nat. Mus.; typical specimens with Braun and in Berlin Mus.

(To be continued.)

### 4. D. (D.) FELINEUM (Gurlt, 1831), Riv., 1884.

Plate I, Figs. 5-6; Plate II, Figs. 7-8.

[1831–1894.]

| Synonymy. | Literature. |
|---|---|
| '31. *Distoma conus* . . . . . | GURLT.—Lehrbuch d. path. Anat. d. Haus-äugethiere, pp. 373–375, Tab. VIII, Figs. 34–36. |
| ('36.) *Distoma lanceolatum* . . . . | V. SIEBOLD.—Helm. Beiträge II. *Syngamus trachealis*, ein doppelleibiger Eingeweidewurm; Arch. f. Naturg., I, p. 113, in nota. |
| '58. *Distomum lanceolatum*, Mehl. . | DIESING v. DIES.—'58, sub. *D. truncatum*, p. 332. |
| '78. *Distomum lanceolatum*, Mehl. . | V. LINSTOW.—Compendium d. Helm., p. 30. |
| '84. *Distomum felineum*, Riv. . . | RIVOLTA.—Sopra una specie di distoma nel gatto e nel cane; Giorn. di Anat., fisiol., et patol. degli animali. XVI, p. 20. |
| ('85.) *Distomum lanceolatum* . . . . | VAN TRIGHT v. VAN TR.—'85, sub. *D. truncatum*. |
| (86–'87.) *Distomum felineum* . . . | DE JONG v. DE J.—Sub. *D. truncatum*. |
| '89. *Distomum conus*, Sonsino . . . | SONSINO v. SONSINO.—'89, sub. *D. truncatum*. |
| '89. *Distomum felineum*, Riv. . . | LEUCKART v. LKT.—'89, sub. *D. truncatum*, p. 339 et 357. |
| '92. *D. truncatum*, Rud., pro parte . | NEUMANN.—Traité d. Malad. par. non-microb., 2. ed., p. 529, fig. 284 (après Railliet, inéd.), Eng. transl., p. 544. |
| '93*a*. *Distomum* (*Dicrocœlium*) *felineum*, Riv. | BRAUN v. BR.—'93*a*, sub. *D. truncatum*. |
| '93*b*. *Distomum* (*D.*) *felineum*, Riv. | V.—'93*b*, sub. *D. truncatum*, fig. 2. |
| '94. *Distoma* (*Dicrocœlium*) *felineum*, Riv. | STILES v. STLS.—'94, sub. *D. truncatum*. |

*Specific Diagnosis.*—Body 10–13 (seldom 18) mm. long by 1.25–2.5 mm. broad; flat, anterior end conical, posterior end rounded; the anterior fifth of body separated from the remainder by a constriction; acetabulum situated at plane of

constriction. Color reddish, transparent; oral sucker and ventral acetabulum of same size (0.28 mm. diameter); pharynx (0.204 mm. long by 0.161 mm. broad) follows oral sucker; œsophagus 0.2 mm. long; intestinal cæca extend to the posterior end of the body. Testicles lobate, situated in posterior end one anterior to the other; ovary slightly lobate, anterior of testicles; receptaculum seminis lateral and posterior to ovary; shell-gland diffuse, composed of unicellular glands; vitellogene glands lateral in middle third of body, and composed of eight to nine groups of small acini. Genital pore immediately anterior to acetabulum. Eggs 0.030 mm. long, 0.011 mm. broad. (Translated and modified from Braun, '93*b*.)

*Hosts.*—Cat, dogs and glutton (*Gulo borealis*).

*Geographical Description.*—Germany, Holland, Italy and France.

NOTE.—Winogradoff has recently found a fluke in man in Siberia, which he described under the name *Distomum sibiricum*, but which Braun considers as identical with *D. felineum*. The parasite was found in 8 out of 124 post-mortem examinations.

Braun, who has examined Winogradoff's drawings (but not his specimens), asserts that this supposed new species, *D. sibiricum*, is unquestionably identical with *D. felineum*. *D. sibiricum* Win., 1892, must accordingly be added to the above list of synonyms, man to the list of hosts, Siberia to the geographical distribution, and the following to the literature:

*Winogradoff, K.*—On a new species of distome in the liver of man; Nachricht v. d. Kais. Univ. Tomsk. IV, 1892, Abt. 2. No. 13, pp. 116–130, 1 Taf. ——. A second case of *Distomum sibiricum* in the liver of man; ibid., No. 9, pp. 131–136.

The internal parasites of man, according to the results of pathological anatomy; ibid., 1892, 13 pgs. (Quoted from Braun; the originals are in Russian.)

*Braun.*—"Ueber ein für den Menschen neues Distomum aus der Leber;" C. J. B. u. P., xv, 1894, pp 602–606.

### 5. D. (D.) VIVERRINI (Poirier).

[1886–1894.]

| Synonymy. | Literature. |
|---|---|
| '86. *Distomum viverrini*, sp. n. . . | POIRIER, J.– Trématodes nouveaux on peu connus; Bul. Soc. Philom. d. Paris, pp. 27–29, III, 1–3. |
| '92. *D.* (*D.*) *viverrini*, Poir. . . . . | STOSSICH v. STOS.—'93, p. 24, sub. *D. truncatum*. |
| '94. *Distoma* (*D.*) *viverrini*, Poir. . | STILES and HASSALL.—The present paper. |

*Specific Diagnosis.*—Body 6 mm. long by 2 mm. broad; white, lanceolate, convex dorsally, flat ventrally; oral sucker and acetabulum about the same size (0.23 mm.), acetabulum at boundary between first and second anterior third of body (1.8 mm. from anterior end). Pharynx present, œsophagus three times as long as pharynx, intestinal cæca extend to posterior extremity. Genital pore immediately anterior to acetabulum; testicles four-lobed in posterior end, one anterior to the other; ovary multi-lobed; *receptaculum seminis* lateral of ovary; Laurer's canal present: shell-gland rather diffuse; vitellogene glands lateral of intestines, beginning just behind the acetabulum and extending slightly beyond second third of the body; uterus in second third of body; egg ovoid, 0.026 mm. by 0.013 mm. End portion of excretory system sigmoid. (Based upon Poirier, '86.)

*Habitat.*—Biliary ducts of ——— ——— (*Felis viverrina*), France.

### 6. D. (D.) TENUICOLLE (Rud.)

[1819–1894.]

| Synonymy. | Literature. |
|---|---|
| '19. *Distoma tenuicolle*, R. . . . . | RUDOLPHI.—Ent. Syn., p. 93 et 365. |
| '45. *D.* (*D.*) *tenuicolle*, R. . . . . | DUJARDIN.—Hist. nat., p. 444. |
| '50. *Distomum tenuicolle*, R. . . . | DIESING.—Syst. Helm., p. 337. |
| '59. *Distoma tenuicolle*, R. . . . . | COBBOLD.—Syn. Dist., p. 6–7. |
| '92. *Distoma* (*Brachylaimus*) *tenuicolle*, R. . . . . | STOSSICH v. STOSSICH.—'92, p. 18–19, sub. *D. truncatum.* |
| '93*a*. *Distomum* (*D.*) *tenuicolle*, R. . | BRAUN v. BR.—'93*a*, sub. *D. truncatum* (supra). |
| '93*b*. *Distomum* (*D.*) *tenuicolle*, R. . | v. BR.—'93*b*, fig. 4, sub. *D. truncatum* (supra). |
| '94. *Distoma* (*D.*) *tenuicolle* . . . | STILES and HASSALL.—The present paper. |

*Specific Diagnosis.*—8–10.12 mm. long by 1.12 mm. broad; lanceolate, flat, anterior fourth quite thin; acetabulum slightly larger than oral sucker and situated just in front of boundary between first and second fourth of body; posterior end bluntly pointed; testicles four to five-lobed, one posterior to the other and separated by sigmoid end portion of excretory system; ovary oval; uterus profusely developed; vitellogene glands extend from about the acetabulum to the ovary; eggs small, elliptical. Intestinal cæca extend to posterior end of body.

*Habitat.*—Liver of *Phoca barbata* (found by Treutler, 1788).

## 5. D. (D.) CONJUNCTUM (Cobbold, 1859).

[1859–1894.]

| Synonymy. | | Literature. |
|---|---|---|
| '59. | *Distoma conjunctum*, Cob. . . | COBBOLD.—Syn. Dist., p. 8. |
| ('60.) | " " " . . | Further observations on Entozoa, with experiments, Linn., Trans., XXIII, p. 349, pl. 33, 1–2. |
| ('61.) | " " " . . | List of Entozoa, including Pentastomes, from animals dying at the Zool. Soc. Menag. betw. 1857–60; Proc. Zool. Soc., Lond. |
| '64. | " " " . . | Entozoa, London, p. 20–22, pl. II. |
| ('72.) | " " " . . | LEWIS and CUNNINGHAM.—Microscopical and Physiol. Researches. Appendix C. (foot note); Eighth Annual Rep. San. Comm., with Govt. of India, Calcutta, p. 168. |
| '73. | " " " . . | COBBOLD.—The Internal Parasites of Dom. Animals, London, p. 81. |
| ('76.) | " " " . . | MCCONNELL.—The Lancet, March 4. ——Repr. in the Veterinarian. |
| ('78.) | " " " . . | The Lancet, March 30, p. 476. |
| '79. | " " " . . | COBBOLD.—Parasites, etc., pp. 30–33. |
| '81. | " " " . . | KÜCHENMEISTER und ZÜRN.—Paras. d. Menschen, 2. ed., Leipzig, p. 335. VIII, 10*b*. |
| '82. | " " " . . | PERRONCITO.—I Parassiti, etc., p. 285. |
| '83. | " " " . . | BRAUN, M.—D. th. Par. d. Menschen. pp. 65–66. |
| '86. | " " " . . | RAILLIET.—Eléments d. zool. méd. et agric., p. 297. |
| '86. | " " " . . | PERRONCITO.—Trattato, etc., p. 250. |
| '89. | " " " . . | LEUCKART.—Die Par. d. Menschen. 2. ed., 4. L., p. 355, fig. 162–163. |
| '92. | *Distoma truncatum*, Rud. (pro parte). | NEUMANN v. N.—'92, p. 529, sub. *D. truncatum*. |
| '92. | *Distomum conus*, Crepl. (pro parte). | STOSSICH v. STOS.—'92, p. 24–25, sub. *D. truncatum*. |

*Specific Diagnosis.*—6 to 12 mm. long, by 2.5 mm. broad; body transparent when fresh, lanceolate, posterior extremity obtusely pointed. Cuticle covered with minute spines. Acetabulum slightly smaller than oral sucker, situated on border of about second and third seventh (Cobbold's figure)—second and third fifteenth (McConnell's figure)—of body. Genital pore immediately anterior to acetabulum. Oral sucker followed by

a pharynx, this by a very short œsophagus, this in turn by two simple intestinal cæca which extend to posterior end of body. Testicles in posterior portion of body, right (or left) anterior to left (or right); cirrus absent. Ovary globular, rather large, somewhat posterior to uterus; uterus well developed; shell-gland?; vitellogene glands extend from a short distance back of the œsophagus—but anterior of acetabulum—to anterior testicle (after Cobbold's figure)—(or from a short distance posterior to acetabulum to posterior testicle, after figures by McConnell, and Lewis Cunningham). Eggs 0.035 mm. by 0.021 mm. End portion of excretory system sigmoid. (Diagnosis based upon figures and writings by former authors).

*Habitat.*—Biliary ducts of American fox (*Canis fulvus*), examined in London; of Man in India.

Authors have not hesitated to unite the form found by McConnell, and Lewis and Cunningham, in one species. While not desiring to separate the forms into two species without having the original material before us, we will venture to express our doubt whether this union is justified, for the following characters shown in the figures referred to can hardly be ascribed to individual variation: *first*, in Cobbold's figure the acetabulum is situated two-sevenths of the length of the body posterior to the mounth and a considerable distance posterior to the branching of the intestines, while in the the other figures it is immediately posterior to the branching of the intestine; *secondly*, the difference of position of the vitellogene glands given in the figures exceeds all limit of individual variation to which we are accustomed in the allied forms.

## Summary.

1. A new species of flukes (*D. complexum*) is found in American cats.

2. In many species of the second section of the subgenus *Dicrocœlium*, the end portion of the excretory system (contractile vesicle) pursues a sigmoid course between the testicles.

3. In some of the species (*D. albidum*, *D. conjunctum*, *D. longissimum* var. *corvinum*, *D. complexum*, *D. truncatum*) either the right or the left testicles may be anterior or posterior.

4. This variation is not yet established for *D. felineum* or *D. tenuicolle*, but will in all probability be found in these species also.

5. In all these species the *receptaculum seminis* is on the side of the ovary corresponding to the posterior testicle; in some (all?) cases the diffuse shell-gland is on the side corresponding to the anterior testicle (cf. Figs. 6 and 17; this correlation was established in *D. albidum* only).

6. In all these cases the position of the right or left testicle is therefore subject to too great individual variation to be as a specific character.

7. The topography of the contractile vesicle (end portion of excretory canal) may perhaps prove to be a character of considerable value in classification.

8. It seems exceedingly doubtful whether *D. conjunctum*, found in man by Lewis, etc., is identical with *D. conjunctum* Cobbold found in the American fox (*Vulpes vulpes* var. *fulvus*).

9. Cobbold's species need a thorough revision, carried out by some helminthologist who can obtain Cobbold's original specimens and compare them with other material.

10. The form mentioned in this paper under the provisional name *D.* (*D.*) *longissimum* var. *corvinum* will probably be shown to be a new species, but the type should be compared with v. Linstow's type before it is given specific rank.

11. The following table will serve as a provisional key to the species discussed in this paper:

1. Uterine coils and ovary posterior to testicles . . . . . *D. lanceolatum.*
   Uterine coils and ovary anterior to testicles . . . . . 2.

2. Posterior extremity provided with muscular ridge . . . . *D. truncatum.*
   Posterior extremity without muscular ridge, rounded or pointed . . . 3.

3. Testicles branched, and frequently extending beyond the intestinal cæca into the lateral fields; excretory system runs dorsally of testicles . . . . . *D. sinense.*
   Testicles lobate, confined (with possible rare exceptions) to median field; excretory canal sigmoid, between the testicles (see *D. longissimum*) . . . . . 4.

4. Œsophagus longer than pharynx . . . . . 5.
   Œsophagus equal to or shorted than pharynx . . . . . 6.

5. Anterior portion thin, extended like a neck; posterior portion not very broad; ovary globular; body 8–10 mm. long . . . . . *D. tenuicolle.*
   Anterior portion not so thin or extended; posterior portion rather broad; ovary lobate; body 6 mm. long . . . . . *D. viverrini.*

6. Ovary lobate . . . . . 7.
   Ovary globular; spines present . . . . . 8.

7. Spines present; body 25–35 mm. long; vitellogene glands extend from end of œsophagus (anterior of acetabulum) to middle of body . . . . . *D. albidum.*
Spines absent; body 10–18 mm. long; vitellogene glands in middle third of body, not extending anterior to acetabulum . . . *D. felineum.*

8. Vitellogene glands extend into anterior half of body; worm not over 12 mm. long; hab. mammals . . . . . 9.
Vitellogene glands confined to posterior half of body; worm elongate, 12–29 mm.; hab. birds . . . . . 10.

9. Acetabulum some distance from œsophagus; vitellogene glands extend from near œsophagus to anterior testicle (after Cobbold) . . . . . *D. conjunctum.*
Acetabulum close to end of œsophagus; vitellogene glands begin some distance posterior to acetabulum and extend to posterior testicles (after McConnell, and Lewis and Cunningham) . *D. conjunctum.*

10. Acetabulum about on boundary between first and second anterior sixths; testicles lobate; excretory canal (?); ovary lobate; vitellogene glands begin at about middle and extend to shell-gland and ovary; spines absent . . . . . *D. longissimum.*
Acetabulum on boundary between first and second anterior thirds; testicles globular; end of excretory canal sigmoid, between testicles; ovary globular; vitellogene glands begin at middle and extend to posterior testicle or beyond; spines present . . . . . *D. longissimum* var. *corvinum.*

22: A case of Echinococcus in a Camel.

At present we have no idea of the extent of the Echinococcus hydatid in this country, and on that account it is well to record every case found, so that we may trace the distribution of the parasite. The following are the only cases of its presence in domesticated animals in the United States and Canada recorded in this laboratory:—

Welch recorded three cases of the hydatid in hogs in Maryland; Moore has found two cases in hogs in Washington, D. C.; Stiles one case in cattle in Nebraska; Kilborne one case of the adult in dogs in Washington; Wheeler condemned the livers of 117 out of 2000 hogs between July 15 and September 15, 1891, in New Orleans; Osler found it in 2.9 per cent of the (1037) hogs he examined in Montreal. A number of cases have also been recorded in Man.

To these cases may now be added a case in a camel. The patient belonged to a traveling circus and was left in Washington for the winter. It died of general tuberculosis and upon postmortem examination Dr. Buckingham found a growth in

the liver which he sent to the laboratory for examination. The cyst, which was about 35 mm. in diameter, contained a collapsed and more or less degenerated bladder-like object which excited our suspicion and which upon microscopic examination proved to be an *Echinococcus polymorphus*, containing numerous heads.

Echinococcus hydatids are said to be quite common in Texan cattle, but we cannot confirm the report for none of the cases (about twenty-five in number) which have been referred to us as *Echinococcus* represented this parasite. The cases we examined were abscess which bore a striking resemblance to this parasite, but which upon being opened were totally devoid of any inner membrane, heads or hooks, and contained only a mass of pus.

23 : An interesting anomaly in *Moniezia plaissima*.

In our Revision of the Adult Cestodes of Cattle, Sheep and Allied Animals, we showed that this species agreed with the other species of the genus *Moniezia* in having the genital pores on the lateral margin. Quite recently in examining some mounted specimens of this species we noticed one segment in which the left genital pore is perfectly normal, opening on the margin ; the right genital pore, however, opens on the *dorsal surface* of the segment just between the two longitudinal canals. All of the neighboring pores are perfectly normal.

It is possible to shift the position of the genital pores by rolling the preparation in mounting, but the case here recorded is not to be accounted for in that way, as in all cases of this artificial displacement of the pore, several pores are affected at the same time.

B. A. I., U. S. Department of Agriculture. III. 20 1893.

PLATE I.

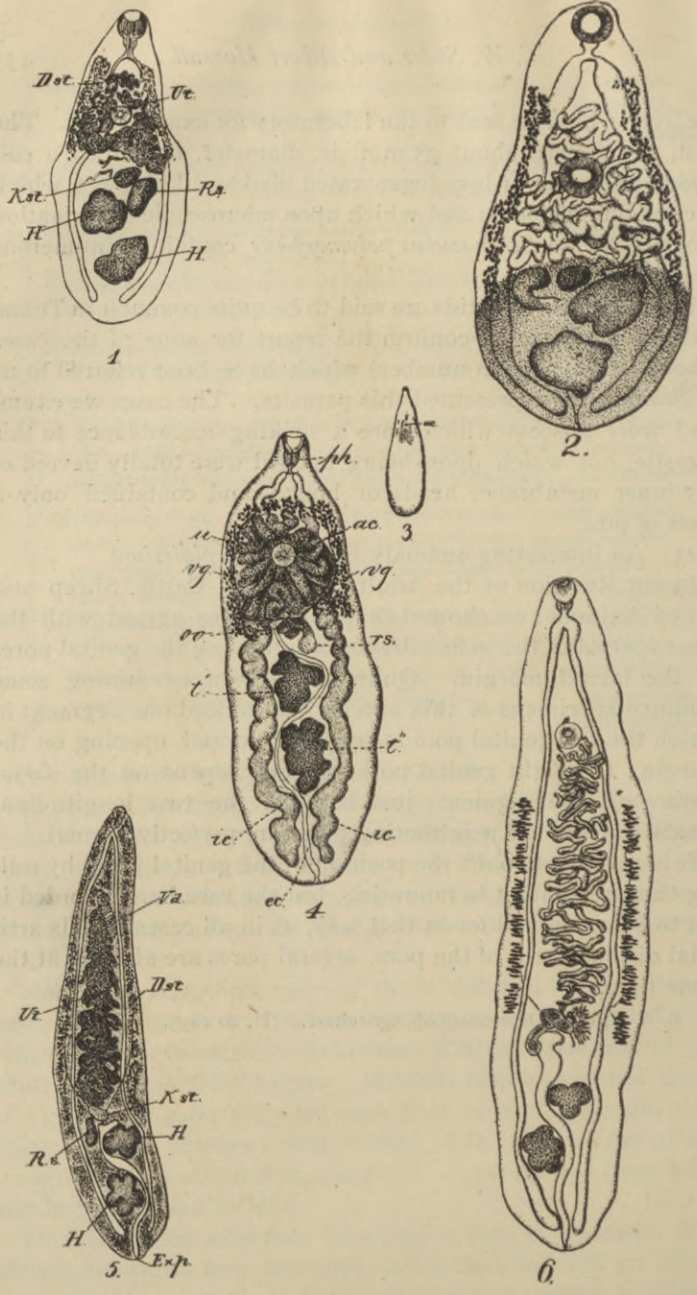
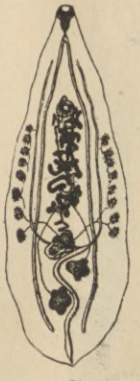



Fig. 1.—*Distoma albidum*, Braun. Copied from Braun's article, '93*b*.
Fig. 2.—*D. albidum*. From one of Braun's original specimens, colored with acid carmine. Orig.
Fig. 3.—*D. complexum*, sp. n.
Fig. 4.—*D. complexum*, stained with acid carmine to show the internal anatomy.
Fig. 5.—*D. felineum*, after Braun, '93*b*.
Fig. 6.—*D. felineum*, from one of Braun's specimens stained in acid carmine. Orig.

PLATE II.



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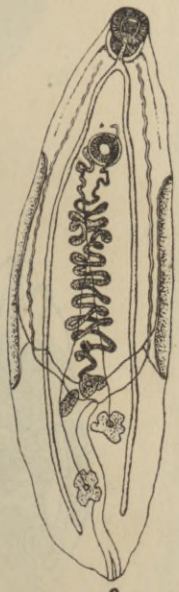

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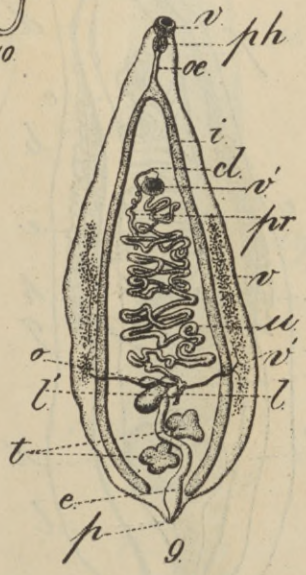
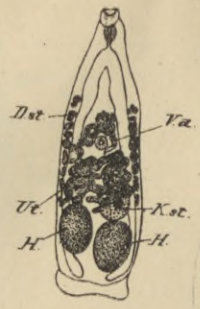
10.




9.

Fig. 7.—*D. felineum*. Neumann's Fig 284 "*D. conus* seu *truncatum*"
Fig. 8.—*D. felineum*. Rivolta's original figure.
Fig. 9.—*D. viverrini*. Poirier's original figure.
Fig. 10.—Egg of *D. viverrini*; after Poirier.

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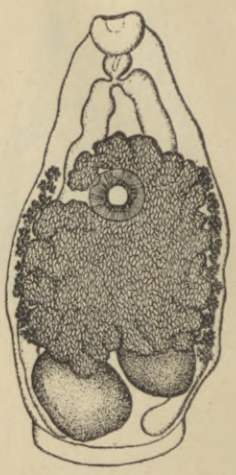

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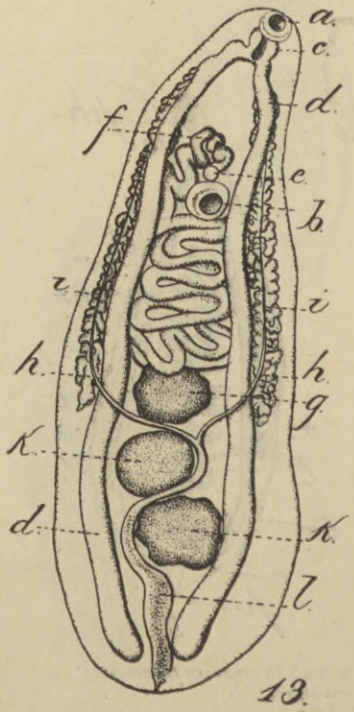
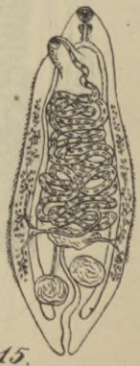



13.

14.



15.

Fig. 11.—*D. truncatum* (R.), after Braun, '93*b*.
Fig. 12.—*D. truncatum* (R.), from one of Rudolphi's original specimens.
Fig. 13.—*D. conjunctum*, Cobbold. After Cobbold.
Fig. 14.—*D. conjunctum*, after McConnell, from Leuckart) Fig. 1).
Fig. 15.—*D. conjunctum*, after Lewis and Cunningham, from Leuckart.

Fig. 16.—*D. tenuicolle*, (R.), after Braun, '93*b*.
Fig. 17.—*D. longissimum*, var. *corvinum*. Orig.
Fig. 18.—*D. longissimum*, v. Linstow, after v. L., 1883.
Fig. 19.—*D. lanceolatum*, Mehlis. Orig.