cidal and metacercaricidal activities. Metacercariae exposed to serum in intact cysts were unaffected but displayed metacercaricidal behavior when exposed without cysts. When heated for 30 min at 56 C, serum produced no response from either larval stage.

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Diplectanum lacustris sp. nov. (Dactylogyroidea: Diplectanidae), a Monogenetic Trematode from the Gills of the Nile Perch

JUNE P. THURSTON[1] AND I. PAPERNA[2]

During surveys of fish parasites in Ghana and Uganda, specimens of a monogenetic trematode were obtained from the gills of two species of *Lates*, the Nile Perch. The trematode was identified as a new species of *Diplectanum* (Dactylogyroidea: Diplectanidae). *Diplectanum* is predominantly a parasite of marine teleosts, and the present species is therefore unusual in occurring on a fresh water fish. Interestingly, however, the genus *Lates* is classified by Greenwood (1966) in the Family Centropomidae, which is composed mainly of marine fish. *Lates calcarifer*, which is the host of *Diplectanum latesi* Tripathi, 1955 in India, is an estuarine species.

Materials and Methods

Five specimens of *Lates albertianus* were obtained in Uganda from Lake Albert and nine from the River Nile between Lakes Victoria and Kyoga, while three specimens of *Lates niloticus* were obtained from the newly formed Volta Lake in Ghana.

Methods used in collecting the monogeneids, and in their fixation, mounting and measurement were similar to those used in earlier studies (Paperna and Thurston, 1969). In addition, some specimens were stained with Semichon's carmine and cleared in clove oil, but examination of these preparations revealed little more anatomical detail than the examination of specimens mounted in glycerin jelly.

Diplectanum lacustris sp. nov.

Description

This parasite exhibits a wide range of shapes and sizes, from typical "slender" forms in which the opisthaptor is well delineated from the body, to "gravid" forms which are proportionately wider and usually longer than the "slender" forms and in which the opisthaptor is almost completely embedded in the pos-

[1] Makerere University College, Kampala, Uganda.
[2] Ghana-Israel Technical Aid Programme, Accra, Ghana. Present address: Kimron Veterinary Institute, Beit Dagan, Israel.

terior end of the body (Figs. 1, 2). The opisthaptoral armature (Fig. 3) remains of the same shape and size in the two forms.

The postero-dorsal pair of anchors have only a vestigial inner root, while in the antero-ventral pair of anchors the outer root is extremely long. Hooklets are vestigial. The dorsal and ventral squamodiscs consist of 10–11 concentric rows of rodlets, the two distal rows of which are composed of only rudimentary rodlets.

Reproductive organs appear well developed in both "slender" and "gravid" forms, but only one uterine egg (Fig. 4) was found in 12 "gravid" specimens that were examined, and none was found in 80 "slender" specimens. The "slender" forms were fully mature because in several specimens ova were observed lying in the oviduct, having just been shed from the ovary. "Gravid" specimens contain dense masses of vitelline follicles. The copulatory organs lack any sclerotization or additional structures (Fig. 5). All measurements are in microns.

Measurements

"Slender" specimens (based on 6 specimens): Total length, 650–1000; breadth, 150–250; opisthaptor 50–150 in depth, 100–200 in breadth; squamodiscs 30–40 in depth, 50–70 in width; postero-dorsal pair of anchors 60–70, inner root vestigial; antero-ventral pair of anchors 70–80, inner root 10–20, outer root 40–60; lateral bars 35–40, median bar 50–60; hooklets vestigial.

"Gravid" specimens (based on 8 specimens): Total length 1,000–2,000; breadth 300–500; opisthaptor 50–150 × 150–250; anchors 60–80; uterine egg 46 × 23 (without the filament). Measurements of anchors, bars and squamodiscs as in "slender" specimens.

Hosts and localities: *Lates albertianus*, Lake Albert and the Victoria Nile, Uganda. *Lates niloticus*, Volta Lake, Ghana. The holotype is in the collection of the second author, and paratypes are deposited in the British Museum of Natural History, London.

Differential diagnosis

The long outer root in one of the pairs of anchors and the absence of sclerotonized cirrus are distinct characters which separate *Diplectanum lacustris* from all other known species of *Diplectanum*.

Diplectanum latesi, which was described by Tripathi (1955) from *Lates calcarifer* in India, differs from *Diplectanum lacustris* in the number of concentric rows in the squamodiscs in addition to differences in the morphological pattern of the cirrus and the shape of the anchors. The size of *D. latesi*, 550–940 by 110–250, corresponds to that of the "slender" form of *D. lacustris*.

Comparison of the parasite fauna of fish from different localities

Superficial examination of *Lates niloticus* from the Volta Lake showed that almost all were infested with the "gravid" form of *D. lacustris*, while "slender" forms were found as well on two fish which were subjected to more detailed examination. Crustacean parasites, *Ergasilus kandti*, were few in number.

Both "gravid" and "slender" forms were likewise found on *Lates albertianus* from Lake Albert, as is shown in Table 1. The parasite was found on three out of the five fish examined. The mean number of parasites in these three infected fish was 16, and the maximum number in this limited survey was 39. On the other hand, these Nile Perch were heavily infested with the crustacean gill parasite *Ergasilus kandti*.

Nine specimens of *Lates albertianus* from the Victoria Nile have been examined, and all were infested with *Diplectanum lacustris*; only the "slender" form was found. The mean number of parasites per fish was 104, and the maximum number recorded was 405. There seems to be no correlation between the size of the Nile Perch and the number of *D. lacustris*. *Ergasilus kandti* was not found on *Lates albertianus* from the Victoria Nile. Another crustacean parasite, *Dolops ranarum*, was frequently found on Nile Perch from both the lake and the river, but has not been included in the table.

At present, no reason can be given for the absence of *Ergasilus kandti* from Nile Perch in the Victoria Nile, nor for the heavy infestations of *D. lacustris* in these fish. It is possible that in Lake Albert the heavy infestations with *Ergasilus kandti* may make the gills less suitable for monogeneans to become established, and therefore may be the reason for the low rate of infestation with *D. lacustris*. Fryer (1965) recorded very heavy infestations of *E.*

Table 1. Numbers of *Diplectanum lacustris* and crustacean parasites from the gills of *Lates albertianus* from Lake Albert and the Victoria Nile. An asterisk indicates that gills from only one side of the fish were examined. *Dolops ranarum* is not included in this table.

Date	Locality	Fish Standard length cm	Fish weight kg	No. *D. lacustris* "slender"	No. *D. lacustris* "gravid"	No. Crustacea		
	Lake Albert							
Sept. 1967	Butiaba	25	–	0	8	55	*Ergasilus kandti*	Note 1
Sept. 1967	Butiaba	30	–	0	0	80	*Ergasilus kandti*	Note 1
Sept. 1967	Butiaba	30	–	25	14	43	*Ergasilus kandti*	Note 1
Sept. 1967	Butiaba	70	–	0*	1*	963*	*Ergasilus kandti*	Note 1
Sept. 1968	Butiaba	18	–	0	0	0		Note 2
	Victoria Nile							
Jan. 1966	Kalagala Falls	–	2.5	17	0	0		Note 3
Jan. 1966	Kalagala Falls	–	3.2	88	0	0		Note 3
Feb. 1966	Mbulamuti	–	22.0	16	0	0		Note 4
Sept. 1967	Mbulamuti	–	2.7	105	0	0		Note 4
Sept. 1967	Mbulamuti	100	25.0	94*	0*	0*		Note 4
Sept. 1967	Mbulamuti	130	41.0	12*	0*	0*		Note 4
Oct. 1968	Mbulamuti	55	–	84	0	0		Note 4
Oct. 1968	Mbulamuti	75	–	10	0	1	larval lernaeid	Note 4
Nov. 1968	Mbulamuti	67	4.5	405	0	0		Note 4

Note 1. Fish bought from local fishermen; exact locality unknown.
Note 2. Fish caught in shallow water.
Note 3. Fish caught in rapidly flowing water.
Note 4. Fish caught in water flowing at a medium rate.

kandti on *Lates albertianus* from Lake Albert but noted that the gills appeared to suffer little damage from the parasite. Greenwood (1966), however, listed heavy parasitization of the gills as a contributory factor in the periodic mass mortality of *Lates albertianus* in Lake Albert, which is probably chiefly associated with deoxygenation of the water. The crustacean parasites, being the more numerous, are likely to be more important than the monogeneans in contributing to these deaths.

It is interesting to note that the parasite faunas of the two samples of *Lates albertianus* are now different, although the fish in the Victoria Nile originated from Lake Albert. Nile Perch had been restricted to Lake Albert and the Albert Nile, but on a number of occasions between 1954 and 1960 specimens were taken from the Butiaba region of Lake Albert and were released at various places along the Victoria Nile above the Murchison Falls. More than 500 fish were transported during this time (Anderson, 1961). They are now well established and are being fished commercially and by anglers. No precautions were taken against transferring parasites from Lake Albert to the Victoria Nile.

Summary

1. A new species of monogenetic trematode, *Diplectanum lacustris*, is described from the gills of two Nile Perch species, *Lates albertianus* in Uganda and *Lates niloticus* in Ghana. It differs from other species of *Diplectanum* in possessing a long outer root to one of the pairs of anchors, and also in lacking a sclerotinized cirrus.

2. A broad "gravid" form of *D. lacustris* is found on fish from the Volta Lake and from Lake Albert, in addition to typical "slender" specimens; but only the "slender" form has been found on Nile Perch from the Victoria Nile.

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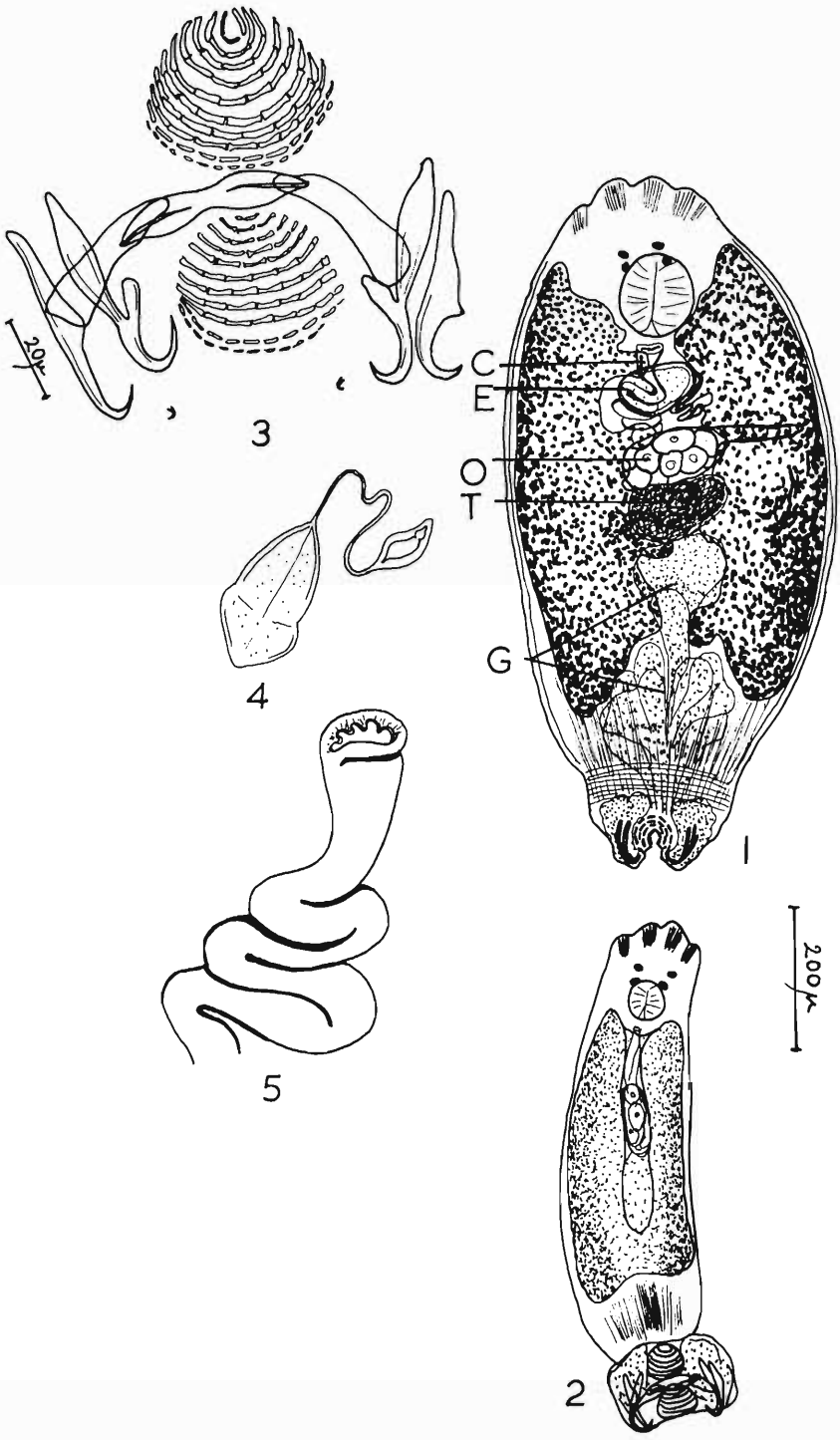
Figures 1–5. *Diplectanum lacustris* from the gills of the Nile Perch. 1. "Gravid" form. 2. "Slender" form. 3. Anchors, bars, and squamodiscs. 4. Intrauterine egg. 5. Copulatory organ.
Abbreviations: C, copulatory organ; E, egg; G, cement glands; O, ovary; T, testes.



3. Specimens of *Lates albertianus* from Lake Albert are less heavily infested with *D. lacustris* than specimens from the Victoria Nile. This may be because the fish from Lake Albert are heavily infested with the crustacean gill parasite *Ergasilus kandti*, whereas this parasite is absent from the Victoria Nile fish.

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Litobothrium alopias and *L. coniformis*, Two New Cestodes Representing a New Order from Elasmobranch Fishes[1]

MURRAY D. DAILEY

Department of Biology, California State College at Long Beach

A massive infection of two unusual cestodes was found in the spiral valve of two bigeye thresher sharks, *Alopias superciliosus* (Lowe, 1840) (O. Pleurotremata, Fam. Alopiidae). The first shark was caught on 22 October 1966, in about 183 meter (100 fathoms) of water, one and one half nautical miles off Newport Beach, California. The second host was found on 24 August 1968, shot through the head, on Bolsa Chica State Beach, Huntington Beach, California.

Under the existing systems of cestode classification (Hyman, 1951; Wardle and McLeod, 1952; Yamaguti, 1959; Joyeux and Baer, 1961), holdfast morphology is used as the distinguishing characteristic at the ordinal level. In light of the unique holdfast features which restrict placement of these two distinct cestodes in any existing orders, coupled with the fact that the parasite is well established, being found in large numbers in two separate hosts examined almost two years apart, the new order Litobothridea is proposed.

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Methods

Worms were removed from the spiral valve and fixed in Lavdowsky's fluid (AFA) and Bouin's fluid. Whole mounts were stained with

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Figures 1–6. ***Litobothrium alopias*** **gen. n., sp. n. 1. Strobilate worm. 2. Anterior end of specimen showing apical sucker and modified segments. 3. Mature proglottid. 4. Segments number 16–19 showing isthmus between four muscular, laciniated projections. 5. Transverse section through muscular region of Figure 4. 6. Transverse section through preovarian region of mature proglottid. Abbrevations: C, cirrus; CC, cuticular cells; CM, circular muscle; CS, cirrus sac; DEV, dorsal excretory vessel; LM, longitudinal muscle; LN, lateral nerve; MG, Mehlis gland; OV, ovary; T, testis; UT, uterus; VAG, vagina; VD, vas deferens; VEV, ventral excretory vessel; VIT, vitellarium.**