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A New Genus in the Family Lepocreadiidae (Trematoda:
Digenea) with Notes on the Status of Some Taxa Within
the Family

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Abstract

Neocreadium geniagni n.g., n.sp., is a lepecreadiid trematode characterised by the presence of a lymphatic system, fine projections extending from the excretory vesicle wall into the parenchyma, a small cirrus sac which is almost entirely pre-acetabular, and the absence of gland cells around the external seminal vesicle. *N. geniagni* is known from the uranoscopid, *Geniagnus monopterygius*. The most closely related genera are *Lepocreadium* Stossich, 1903, and *Neolepidapedon* Manter, 1954. The status of some taxa within the family Lepocreadiidae is briefly discussed.

INTRODUCTION

THIS report is the first of a series devoted to studies on the digenetic trematodes of New Zealand marine fishes. Major contributions to our knowledge of the fauna have been made by Manter (1954, 1960) while a few species have been described or reported by Monticelli (1889), Fyfe (1953, 1954), and Yeh (1954).

The new species described below was collected from *Geniagnus monopterygius* (Bloch & Schneider) taken by otter trawl in Wellington Harbour during the course of a collecting programme by the Zoology Department, Victoria University of Wellington. I would like to thank the staff and students who were responsible for the collection of host material; Dr J. A. F. Garrick for helpful criticisms of the manuscript; and Dr H. W. Manter, of the University of Nebraska (U.S.A.), for examining slides and making valuable suggestions regarding the status of this species.

MATERIALS AND METHODS

Specimens of *Geniagnus monopterygius*, collected by otter trawl from Wellington Harbour, were generally transported alive in a seven gallon plastic bucket filled with sea-water to the Island Bay Marine Laboratory, where they were killed and the alimentary canal removed. Examination of the various sections of the alimentary canal of the host (apart from the pyloric caeca and gall bladder) was carried out as suggested by Manter (1954) except that 0.7% saline was used for washing rather than tap water. The pyloric caeca were dissected free from the

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intestine, each was opened along its length, pinned out in a small dissecting dish, covered with 0.7% saline, and examined with the aid of a Zeiss "Opton" binocular microscope. The gall bladder was separated from the liver, punctured, and its contents allowed to drain into a syracuse watchglass where they were examined.

The trematodes found in the above examination were fixed in warm formol-acetic-alcohol under slight pressure of a coverslip, stained in Delafield's haematoxylin or acetic-acid-alum-carmin, and mounted in Canada balsam, using standard procedures. Equally good results were obtained with both of the stains mentioned. Observations were made on the lymphatic and excretory systems of a few living specimens mounted in a drop of 0.7% saline.

Microscopic examinations were made with a Zeiss G.F.L. binocular microscope and drawings with the aid of a Zeiss camera lucida. Measurements were made by comparing camera lucida drawings with scales that had been prepared from camera lucida recordings of a graduated slide for all lens combinations used. Nomenclature follows that used by Manter (1954).

Family LEPOCREADIIDAE Nicoll, 1934

Subfamily LEPOCREADIINAE Odhner, 1905

Neocreadium n.g.

GENERIC DIAGNOSIS: Lepocreadiidae, Lepocreadiinae. Gonads tandem. Relatively small cirrus sac present which is almost entirely preacetabular, and contains an internal seminal vesicle, prostatic vesicle, small cirrus, and prostate cells. Long external seminal vesicle present, not surrounded by gland cells. Seminal receptacle between ovary and anterior testis. Uterus preovarian. Excretory vesicle with fine projections extending from its wall into parenchyma. Lymphatic system present. Type and only species:

Neocreadium geniagni n.g., n.sp. (Text-fig. 1, A-E)

HOST: *Geniagnus monopterygius* (Bloch & Schneider); yellow-spotted star-gazer; family Uranoscopidae.

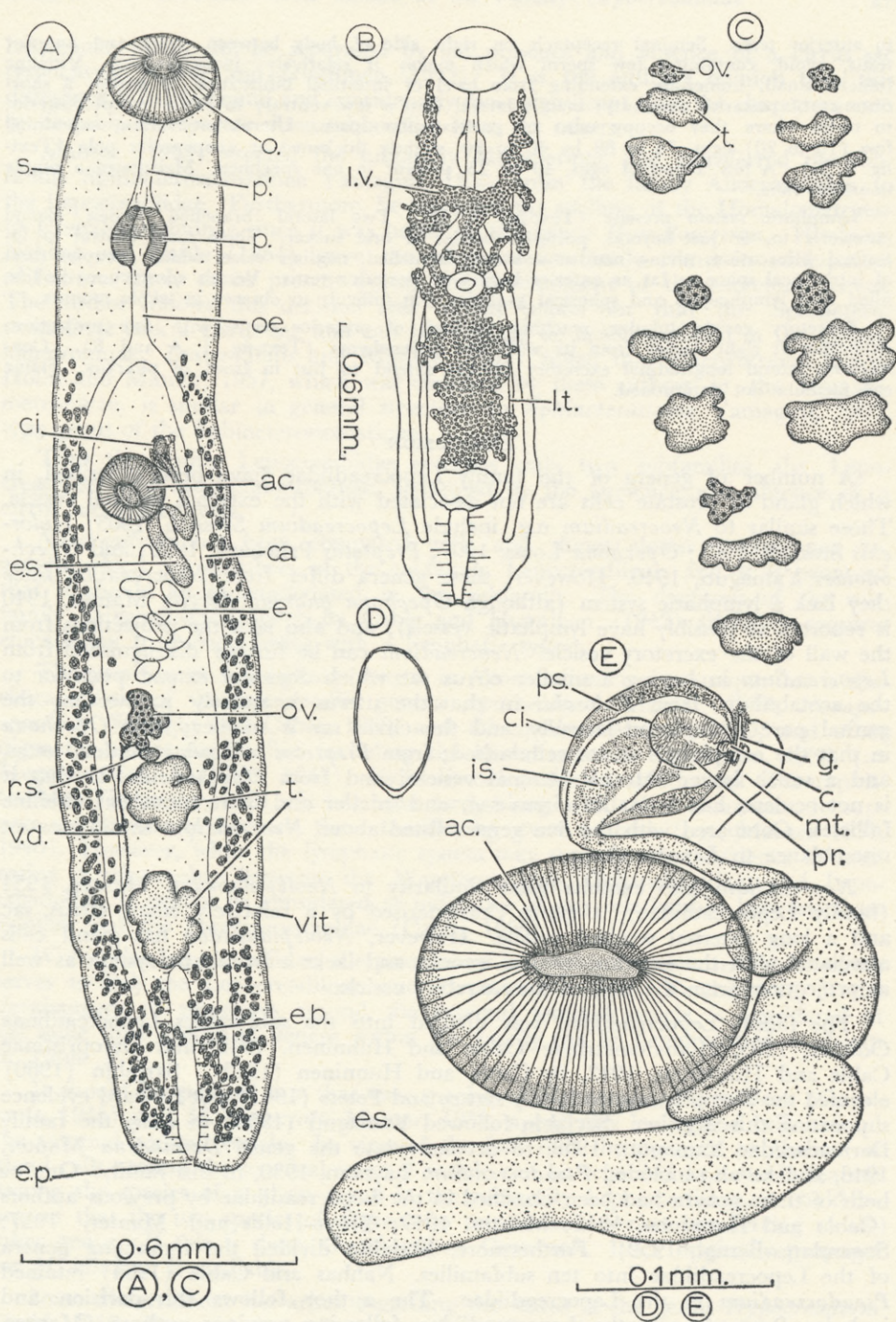
LOCATION: Intestine, pyloric caeca and gall bladder.

LOCALITY: Wellington Harbour, New Zealand.

HOLOTYPE AND PARATYPES: Dominion Museum, Wellington, New Zealand; collection numbers ZW234 and ZW235 respectively.

DESCRIPTION (based on 15 specimens with measurements on five; all measurements, with the exception of egg size, which is given in microns, are given to the nearest tenth of a mm): Body elongate, bluntly rounded anteriorly, truncate posteriorly. Edges of body very thin posterior to testes, thrown into frill-like folds in life. Cuticle spined. Mature specimens measure from 1.9 to 2.5 long by 0.5 to 0.7 in greatest width which is 0.4 to 0.8 from posterior extremity. Oral sucker slightly ovoid, 0.2 to 0.3 long by 0.2 to 0.3 wide. Acetabulum ovoid to circular, 0.1 to 0.2 in transverse diameter. Sucker ratio 1: 0.6 to 0.7. Forebody 0.8 to 1.0, usually about 35-40% total length. Prepharynx long, 0.1 to 0.2; pharynx 0.1 to 0.2 long by approximately 0.1 wide, anterior half modified as a sphincter region with circular muscles; oesophagus approximately as long as prepharynx; intestinal bifurcation anterior to acetabulum, 0.7 to 0.9 from anterior extremity; caeca extending past testes but terminating 0.2 to 0.3 from posterior extremity.

Testes tandem, irregularly lobed (Text-fig. 1, A and C), generally wider than long, separated by a gap of up to 0.1. Genital pore slit-like, to left of mid-line, slightly anterior to acetabulum. Cirrus sac small (Text-fig. 1, E), more or less ovoid, approximately 0.1 long, either entirely or anterior two-thirds anterior to acetabulum; it contains an internal seminal vesicle in its basal part followed by an ovoid prostatic vesicle, and a small, inconspicuous cirrus. Prostate cells present in cirrus sac. External seminal vesicle prominent, 0.5 to 0.7 long, with a few convolutions, widening posteriorly. It may lie along left side of body almost parallel with main body axis (Text-fig. 1, A), or, its posterior half may run transversely across body posterior to acetabulum reaching right side of body (Text-fig. 1, E). Gland cells absent from around external seminal vesicle. Ovary lobed or with irregular margin (Text-fig. 1, A and C), considerably smaller than testes, approximately 0.5 anterior



TEXT-FIG. 1.—*Neocreadium geniagni* n.g., n.sp. A—Adult, ventral view. B—Semi-diagrammatic ventral view of lymphatic vessels. C—Variation in the shape of ovary and testes in five specimens. D—Egg, showing thickening at the anopercular pole. E—Ventral view of terminal reproductive organs.

Abbreviations: ac., acetabulum; c., cirrus; ca., caecum; ci., cirrus sac; e., egg; eb., excretory vesicle; e.s., external seminal vesicle; e.p., excretory pore; g., genital pore; i.s., internal seminal vesicle; l.t., longitudinal excretory tubule; l.v., lymphatic vessel; mt., metraterm; o., oral sucker; oe., oesophagus; ov., ovary; p., pharynx; p', prepharynx; pr., prostatic vesicle; ps., prostate cells; r.s., seminal receptacle; s., spines; t., testes; v.d., vitelline duct; vit., vitelline follicle.

to anterior testis. Seminal receptacle on right side of body between ovary and anterior testis, ovoid, containing few sperm which makes it relatively inconspicuous. Vitelline follicles small, numerous, extending from level of intestinal bifurcation to within a short distance of posterior extremity; mainly lateral (but a few ventral) to caeca except posterior to testes where they occupy most of posttesticular space. Uterus preovarian, containing few (10 to 20) eggs, 74 to 88 by 40 to 50, slightly thickened at anopercular pole (Text-fig. 1, D). A few abnormal eggs, 40 by 25, present in one specimen. Metraterm a simple unarmed tube.

Lymphatic system present (Text-fig. 1, B). Two lateral branched vessels extend anteriorly to, or just beyond, posterior border of oral sucker. These meet ventral to intestinal bifurcation, giving rise to a broad, branched, median vessel which occupies most of intercaecal space as far as anterior border of posterior testis. Vessels conspicuous in life, filled with lymphocytes and spherical granules, but difficult to observe in whole mounts.

Excretory vesicle tubular, reaching to level of posterior testis, with fine projections extending at right angles from its wall into parenchyma (Text-fig. 1, A and B). Conspicuous lateral longitudinal excretory tubules extend to just in front of pharynx. Flame cell formula not determined.

DISCUSSION

A number of genera of the family Lepocreadiidae have been described, in which gland or prostatic cells are not associated with the external seminal vesicle. Those similar to *Neocreadium* n.g. include *Lepocreadium* Stossich, 1903; *Holorchis* Stossich, 1901; *Opechona* Looss, 1907; *Preptetos* Pritchard, 1960; and *Opechonoides* Yamaguti, 1940. However, these genera differ from *Neocreadium* since they lack a lymphatic system (although *Opechona pharyngodactyla* Manter, 1940 is reported to possibly have lymphatic vessels), and also lack the projections from the wall of the excretory vesicle. *Neocreadium* can be further distinguished from *Lepocreadium* in having a smaller cirrus sac which does not extend posterior to the acetabulum; from *Holorchis* in that the uterus is entirely preovarian, the genital pore is displaced laterally, and the cirrus sac is smaller; from *Opechona* in that the oesophagus is not cellularised; from *Preptetos* in having tandem testes, and a much larger external seminal vesicle; and from *Opechonoides* in that it is not oculate, has a smaller cirrus sac, and smaller and more numerous vitelline follicles. Compared with the five genera listed above, *Neocreadium* shows greatest resemblance to *Lepocreadium*.

Neocreadium also exhibits some similarity to *Neolepidapedon* Manter, 1954 (family Lepocreadiidae), a genus characterised by a relatively small cirrus sac and a long external seminal vesicle. However, *Neolepidapedon* has gland cells associated with the external seminal vesicle, and lacks a lymphatic system as well as projections from the wall of the excretory vesicle.

The family Lepocreadiidae was divided into the subfamilies Lepocreadiinae Odhner, 1905, Homalometrinae Cable and Hunninen, 1942, and Deropristinae Cable and Hunninen, 1942, by Cable and Hunninen (1942). Skrjabin (1960) elevated the Deropristinae to family status, and Peters (1961) put forward evidence supporting this decision. Skrjabin followed Yamaguti (1958) in using the family Dermadenidae Yamaguti, 1958, to accommodate the genus *Dermadena* Manter, 1946, and he also included *Pseudocreadium* Layman, 1930, in this family. One or both of these genera had been classified in the Lepocreadiidae by previous authors (Cable and Hunninen, 1942; Manter, 1947; Bravo-Hollis and Manter, 1957; Sogandares-Bernal, 1959). Furthermore, Skrjabin divided the remaining genera of the Lepocreadiidae into ten subfamilies. Nahhas and Cable (1964) retained *Pseudocreadium* in the Lepocreadiidae. The author follows this decision and includes *Dermadena* in the Lepocreadiidae, following previous authors (Manter, 1947; Sogandares-Bernal, 1959). These genera are so similar to some of those retained by Skrjabin in the Lepocreadiidae that they do not appear to warrant separation into a separate family. As far as the subfamilies enumerated by Skrjabin are concerned, the author prefers to retain only the Lepocreadiinae and Homa-

lometrinae which can be separated by the presence and absence of a cirrus sac respectively (Cable and Hunninen, 1942). It is the author's opinion that this difference is fundamental and considerably more significant than the characters used by Skrjabin to separate these subfamilies from the others.

Manter (1963) erected the subfamily Megaperinae and transferred the subfamily Sphincterostomatinae Yamaguti, 1958, from the family Allocreadiidae to the Lepocreadiidae. Furthermore, he emended the spelling of the Homalometrinae to Homalometroninae since it was based on the genus *Homalometron*. However, Nahhas and Cable (1964) gave the Megaperinae family status in anticipation of features likely to be present during the development of the excretory system. The author follows this decision and further points out that the Sphincterostomatinae lack a cirrus sac and can accordingly be accommodated in the Homalometroninae. Bravo-Hollis and Manter (1957) noted that *Dactylotrema* Bravo-Hollis and Manter, 1957, which was classified by these authors in the Homalometroninae, is similar in general structure to *Sphincterostoma* Yamaguti, 1937, type genus of the Sphincterostomatinae.

Thus the family Lepocreadiidae contains only two subfamilies, the Lepocreadiinae and Homalometroninae, separated by the presence and absence of a cirrus sac respectively.

Neocreadium has been compared with, and shows closest resemblance to, genera which are members of the subfamily Lepocreadiinae, and it is proposed that it should be accommodated in this subfamily. The diagnosis of the subfamily Lepocreadiinae given by Cable and Hunninen (1942) therefore requires emendation to include forms with a lymphatic system.

The presence of a lymphatic system in *Neocreadium* is not unique but is also characteristic of the lepocreadiid genera *Apocreadium* Manter, 1937, *Neapocreadium* Siddiqui and Cable, 1960, and *Choanodera* Manter, 1940, and other digenetic trematode families including the Waretrematidae Srivastava, 1939 (= Megasolenidae Skrjabin, 1942), Gyliuchenidae Ozaki, 1933, and Paramphistomidae Fiscoeder, 1901. It has been used, along with other characters, to support a relationship between these families by some authors (e.g., Manter 1937, 1940). However, while the lymphatic system may support other evidence in indicating a relationship between the Waretrematidae, Gyliuchenidae, and Lepocreadiidae, it cannot be considered as indicative of any relationship between these families and the Paramphistomidae (Cable, 1956).

Within the Lepocreadiidae, the presence of a lymphatic system in *Neocreadium* serves to link the Lepocreadiinae and Homalometroninae. Furthermore, if the development of structures around the external seminal vesicle is considered at the same time groups of genera within the family can be demonstrated as shown in Table I.

It should be pointed out that two species of *Myzoxenus*, *M. insolens* (Crowcroft, 1945) and *M. crowcrofti* Manter, 1954, apparently lack gland cells around the external seminal vesicle. In view of the fact that the presence or absence of gland cells around the external seminal vesicle can be regarded as a stable feature among the species of a given genus in the subfamily Lepocreadiinae, it could be argued that the two species of *Myzoxenus* mentioned warrant transferring to another genus. If this is done, *Gnathomyzon* Crowcroft, 1945, originally proposed for *M. insolens*, is available.

Some disagreement has arisen regarding the status of the genus *Hypocreadium* Ozaki, 1936. Recently, Sogandares-Bernal (1959) reviewed the literature dealing with this problem and synonymised *Hypocreadium* with *Pseudocreadium* Layman, 1930. Nahhas and Cable (1964) have supported this decision. Sogandares-Bernal maintained that to accept these two genera as distinct on the basis of the position of the ovary and the extent of the uterus is not valid as intergradations of

these characters exist in the two genera. However, Yamaguti (1958) has shown that *Hypocreadium* is distinct in having gland cells outside the cirrus sac and around the external seminal vesicle whereas these are lacking in *Pseudocreadium*.

TABLE I

Groupings of Genera in the Subfamilies Lepocreadiinae and Homalometroninae of the Family Lepocreadiidae.

The two subfamilies are related by the presence of a lymphatic system in *Neocreadium* of the Lepocreadiinae, and *Apocreadium*, *Neapocreadium* and *Choanodera* of the Homalometroninae. While *Neocreadium* has been isolated from other genera of the Lepocreadiinae, the fact that it has a naked external seminal vesicle relates it to group A2 of the Lepocreadiinae in the table below.

Family LEPOCREADIIDAE

Subfamily LEPOCREADIINAE (Cirrus sac present)	Subfamily HOMALOMETRONINAE (Cirrus sac absent)
A. No lymphatic system	A. No lymphatic system
1. No external seminal vesicle	<i>Cadenatella</i>
<i>Proenenterum</i>	<i>Crassicutis</i>
<i>Stegodexamene</i>	<i>Postporus</i>
<i>Guggenheima</i>	<i>Homalometron</i>
<i>Cableia</i>	<i>Microcreadium</i>
<i>Enenterum</i>	<i>Myzotus</i>
2. Naked external seminal vesicle	<i>Dactylotrema</i>
<i>Lepocreadium</i>	<i>Pancreadium</i>
<i>Folliorchis</i>	<i>Trematobrien</i>
<i>Pseudocreadium</i>	<i>Sphincterostoma</i>
<i>Opisthogonoporus</i>	<i>Lobatotrema</i>
<i>Opechona</i>	<i>Marsupiacetabulum</i>
<i>Dermadena</i>	
<i>Eocreadium</i>	B. Lymphatic system present
<i>Multitestis</i>	<i>Apocreadium</i>
<i>Lepocreadioides</i>	<i>Neapocreadium</i>
<i>Pseudoholorchis</i>	<i>Choanodera</i>
<i>Hairana</i>	
<i>Holorchis</i>	
<i>Bianium</i>	
<i>Preptetos</i>	
<i>Diploproctodaeum</i>	
<i>Trigonotrema</i>	
<i>Spiritestis</i>	
<i>Gnathomyzon</i>	
<i>Opechonoides</i>	
3. External seminal vesicle surrounded by gland cells	
<i>Dihemistephanus</i>	
<i>Neolepidapedon</i>	
<i>Hypocreadium</i>	
<i>Rhagorchis</i>	
<i>Aephniidiogenes</i>	
<i>Myzoxenus</i>	
<i>Labriifer</i>	
<i>Allolepidapedon</i>	
4. Membrane around gland cells of external seminal vesicle	
<i>Lepidapedon</i>	
B. Lymphatic system present	
<i>Neocreadium</i>	

LITERATURE CITED

- BRAVO-HOLLIS, MARGARITA, and MANTER, H. W., 1957. Trematodes of marine fishes of Mexican waters. X. Thirteen Digenea, including nine new species and two new genera, from the Pacific coast. *Proc. Helm. Soc. Wash.*, 24(1): 35-48, 22 figs.
- CABLE, R. M., 1956. *Opistholebes diodontis* n.sp., its development in the final host, the affinities of some amphistomatous trematodes from marine fishes and the allocreadioid problem. *Parasit.*, 46(1): 1-13, 8 figs.
- and HUNNINEN, A. V., 1942. Studies on *Deropristis inflata* (Molin), its life history and affinities to trematodes of the family Acanthocolpidae. *Biol. Bull.*, 82(2): 292-312, 11 figs.
- CROWCROFT, P. W., 1945. New trematodes from Tasmanian fishes (Order Digenea. Family Allocreadiidae). *Pap. Proc. Roy. Soc. Tas.*, 1944 (1945), 61-69, 2 pls.
- FYFE, M. L., 1953. *Otodistomum plunketi* n.sp., a large trematode from a Lord Plunket's shark, *Scymnodon plunketi* (Waite). *Parasit.*, 43 (3, 4): 187-190.
- 1954. *Tricotyledonia genypteri* n.g., n.sp., a three-suckered trematode from the red ling, *Genypterus blacodes* Bloch & Schn.. *Parasit.*, 44 (3, 4): 325-328.
- MANTER, H. W., 1937. A new genus of distomes (Trematoda) with lymphatic vessels. *Hancock Pac. Exp.*, 2(3): 11-22, 1 pl.
- 1940. Digenetic trematodes of fishes from the Galapagos Islands and the neighbouring Pacific. *Alan Hancock Pac. Exp.*, 2(14): 329-497, 19 pls.
- 1947. The digenetic trematodes of marine fishes of Tortugas, Florida. *Amer. Mid. Nat.* 38(2): 257-416, 152 figs.
- 1954. Some digenetic trematodes from fishes of New Zealand. *Trans. roy. Soc. N.Z.*, 82(2): 475-568, 11 text-figs.
- 1960. Some additional Digenea (Trematoda) from New Zealand fishes. *Lib. Hom. E. Caballero y C. (Mexico)*: 197-201, 4 figs.
- 1963. Studies on digenetic trematodes of fishes of Fiji. II. Families Lepocreadiidae, Opistholebetidae, and Opecoelidae. *J. Parasit.*, 49(1): 99-113, 32 figs.
- MONTICELLI, F. S., 1889. Notes on some entozoa in the collections of the British Museum. *Proc. Zool. Soc. Lond.*, 21-22: 321-325.
- NAHHAS, F. M., and CABLE, R. M., 1964. Digenetic and aspidogastrid trematodes from marine fishes of Curacao and Jamaica. *Tulane Stud. Zool.*, 11(5): 167-228, 52 figs., 3 tables.
- PETERS, L. E., 1961. The genus *Skrjabinopsolus* (Trematoda: Digenea) with reference to the allocreadioid problem. *Amer. Mid. Nat.*, 65(2): 436-445, 15 figs.
- SKRJABIN, K. I., 1960. (*Trematodes of animals and man. Principles of trematodology*, XVIII. Izdatelstvo Akademii Nauk. S.S.S.R. 746 pps.) (In Russian.)
- SOGANDARES-BERNAL, F., 1959. Digenetic trematodes of marine fishes from the Gulf of Panama and Bimini, British West Indies. *Tulane Stud. Zool.*, 7(3): 69-117, 62 figs., 5 tables.
- YAMAGUTI, S., 1958. *Systema Helminthum. Vol. I. The digenetic trematodes of vertebrates. Parts I and II.* Interscience Publishers Inc., New York and London. 1575 pps.
- YEH, L. S., 1954. On some trematodes of marine fishes from New Zealand. *Revist. Parasit.*, 15(4): 675-684.

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ADDENDA

Subsequent to printing of the above account the author's attention was drawn to the existence of the genus *Neolepocreadium* Thomas, 1960. This genus, which belongs to group A2 of the Lepocreadiinae in Table I, is very similar to *Neocreadium* n.g. but does not have a lymphatic system or projections from the wall of the excretory vesicle.