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A NEW SPECIES OF TAPEWORM OF THE GENUS  
PROTEOCEPHALUS FROM THE PERCH  
AND THE ROCK BASS<sup>1</sup>

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The collections on which this study is based were made by Professor A. S. Pearse of the University of Wisconsin in the course of investigations on the parasites of the fishes of Wisconsin lakes and by the writer while making similar investigations on the fish of Douglas Lake in northern Michigan. Professor Ward, of the University of Illinois, has also kindly permitted a study of the tapeworms of the perch in his very extensive collections. To Professors Pearse and Ward my thanks are due for the use of their material.

**Proteocephalus pearsei**, new species

*Diagnosis*: Characters of the genus. Size small; total length about 24 mm.; scolex of variable size, as large as 0.3 mm. broad by 0.13 mm. long. Neck relatively long, 1.3 to 3

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<sup>1</sup>Contribution from the Biological Station and the Department of Zoology, University of Michigan.

mm. long. The four suckers small, measuring 0.051 to 0.087 mm. in diameter, with the average of ten about 0.071 mm. Fifth sucker functional, about 0.034 mm. in diameter. First proglottids broader than long, measuring about 0.32 to 0.48 mm. by 0.012 to 0.050 mm. Mature proglottids broader than long or nearly quadrate, 0.446 by 0.361 mm. to 0.896 by 0.245 mm. Ripe proglottids differing greatly in length and breadth, varying from 0.882 mm. broad by 0.782 mm. long in ovigerous proglottids to 0.446 mm. broad by 1.316 mm. in old proglottids nearly ready to be dehisced. Genital pore marginal, situated at 0.3 to 0.46 of the length of the proglottid from the anterior end. Testes numerous, about 60 to 90 in each proglottid, apparently arranged in one layer filling the space anterior to the ovarian lobes. Coils of vas deferens voluminous, extending to the mid-field of the proglottid. Cirrus-pouch short and relatively broad, 0.099 to 0.133 mm. long by 0.039 to 0.056 mm. broad, extending but little past the vitellaria. Cirrus and ductus ejaculatorius forming two or three coils within the cirrus-pouch. Ovarian lobes slender and long in much contracted proglottids, thickened, rounded or even bent back on themselves in some elongated proglottids. Vitelline follicles relatively coarse, closely packed together; vitellaria voluminous. Uterus with 7 to 9 lateral pouches on either side in less distended ovigerous proglottids, and as many as 15 or 16 in old elongate proglottids. Vagina anterior or slightly dorsal to cirrus-pouch. Sphincter vaginae small or lacking. Embryos of uterine eggs about 0.015 mm. in diameter.

*Habitat*: Adult form in intestine of *Perca flavescens* (Mitch.) and *Ambloplites rupestris* (Rafinesque).

*Distribution*: Lakes Mendota and Monona, Wisconsin; Hubbard Lake, Alcona County, and Douglas Lake, Cheboygan County, Michigan.

*Type Specimen*: Cat. No. 161, Museum of Zoology, University of Michigan; taken from *Perca flavescens* (Mitchell), Lake Monona, Wisconsin; Sept. 22, 1917; A. S. Pearse, collector.

*Description of Type Specimen*: This tapeworm is short but robust. Its length (end-proglottid missing) is about 24 mm., its greatest width about 0.9 mm. From the appearance of the worm it seems doubtful if individuals ever attain a much greater length. The head, figures 1 and 2, is relatively broad and short, measuring 0.310 mm. broad at the posterior margin of the suckers while its length from the tip of the head to the line along which the breadth was measured is 0.130 mm. At a distance of 0.375 mm. from the tip occurs an expansion which measures 0.423 mm. in width. The head is thin dorso-ventrally. The rather long neck region is not well defined since it is relatively broad and passes almost imperceptibly into the segmented portion of the body. Traces of internal segmentation begin at 3.5 mm. from the tip of the head, making the neck a little more than 3 mm. long. It has no marked constrictions. The earliest proglottids distinguishable in the preparation measure 0.489 mm. wide by 0.050 mm. long. The twenty-fourth proglottid measures 0.733 mm. broad by 0.359 mm. long. This proglottid is rapidly approaching maturity, testes are nearly grown and the ovary is evident. The thirty-fourth proglottid, figure 4, is mature. It measures 0.896 mm. broad by 0.245 mm. long. The thirty-sixth proglottid has eggs in the uterine branches. With the production of eggs and their storage in the uterus the proportions of the proglottids gradually change from broader than long to longer than broad. The forty-ninth proglottid, figure 5, is 0.880 mm. wide by 0.782 mm. long while the fifty-ninth and last proglottid in the chain, figure 6, measures 0.733 mm. broad by 1.304 mm. long. The terminal or

end proglottid has been lost. The segmentation is evident, the inter-proglottidal furrows being well marked.

The four suckers are muscular, deeply cupped, and 0.087 mm. in diameter with a cavity 0.056 to 0.06 mm. in diameter. An apical fifth sucker, figures 1 and 2, is present. It is considerably smaller and weaker than the four. It has a shallow cup, is muscular and has the appearance of being functional. Its diameter is 0.043 mm.

Genital organs, figures 4, 5, and 6, are arranged on the well known Proteocephalid plan. There is no genital papilla. The genital sinus is marginal, irregularly alternating, anterior to the middle, being situated in the anterior two-fifths of the proglottid. The cirrus-pouch is relatively short, reaching barely through the dense vitellaria. Five cirrus-pouches from ripe proglottids average 0.114 mm. long by 0.053 mm. broad. The longest of these measures 0.127 by 0.050 mm. and the shortest 0.099 by 0.050 mm. The maximum width of cirrus-pouch was 0.057 mm. The cirrus and ductus ejaculatorius form two or three coils within the cirrus-pouch. A completely protruded cirrus has not been seen but from the character of the nonextruded cirrus it is evident that it cannot be extended far. Coils of the vas deferens form a loose mass extending to the mid-field of the proglottid. There are about 60 to 64 testes which appear to lie in one layer filling the space anterior to the ovarian lobes and between the vitellaria. Testes measure about 0.035 by 0.027 mm. The largest ones measure about 0.040 by 0.037 mm. and the smaller 0.030 by 0.020 mm.

The vagina opens into the genital sinus anterior and somewhat dorsal to the cirrus-pouch. In its course to the mid-field of the proglottid it may lie anterior to the cirrus-pouch or it may cross the pouch dorsally. A sphincter vaginae seems to be lacking or if present is very weakly developed. It has not

been seen in whole mounts of the worm. Ovarian lobes of mature and of most ripe proglottids are long and relatively slender. Vitelline glands are lateral, composed of many large follicles, closely packed together. In mature proglottids the vitellaria form thick masses while in more elongate proglottids they form narrower masses. Uterine pouches appear early. In old proglottids these reach to the vitellaria and come to occupy the greater proportion of the proglottid. There are about seven to twelve well-marked uterine pouches on either side of the mid-line in most ripe proglottids but in older proglottids, well distended with eggs, the pouches are more irregular and more numerous. Smaller pouches seem to have been crowded in between larger pouches, especially in the region of the median stem of the uterus, while the walls of the uterus in some of the larger proglottids seem to have given way. Ducts within the interovarial space could not be completely followed out in the preparation.

The six-hooked embryo of uterine eggs measures about 0.015 mm. in diameter. No determination of the egg membranes could be made.

*Notes on Paratypes:* A specimen collected by A. S. Pearse clearly belongs in this species. It differs from the type in having a narrower head (a contraction state) and a narrower neck. Its suckers are somewhat smaller, figure 3. These suckers measure 0.070, 0.077, and 0.076 mm. respectively, and their cavities 0.04, 0.04, and 0.047 mm. respectively. The fifth sucker measures 0.04 mm. in diameter and its opening 0.023 mm. The head at the level of the posterior edge of the suckers measures 0.228 mm. in width and the neck at its narrowest part just equals the width of the head. Since the neck is broken off at 2.84 mm. back of the head and there may be a small portion of it missing its full length cannot be measured. The six

pieces on this slide appear to make up almost a complete worm. Their combined length is about 25 mm. In respects other than those mentioned this worm agrees with the type.

On the same slide is an immature worm with somewhat retracted head. Five suckers in fair agreement with the suckers of the type may be distinguished. This specimen is assigned to this species.

One small worm from perch, Lake Monona, Wisconsin, Pearse's No. 9/22/17-31, and another, No. 9/20/17-40, taken from Lake Mendota, Wisconsin, probably belong to this species. They are immature and the preparations are very poor making it impossible to secure all desirable diagnostic data.

Some headless fragments on another slide differ more widely from the type than do the preceding specimens. In these fragments the proglottids are narrower and longer, the ovarian lobes much shorter and more rounded, testes more numerous, intersegmental furrows less pronounced. Some of these fragments may be referred to this species but one fragment at least cannot.

In the material from *Perca flavescens* in Professor Ward's collection are a number of fragments which can be readily assigned to this species. Some of the larger specimens and complete worms have been studied in detail and their measurements are here given.

Specimen No. 12.147<sub>2</sub> of Ward's collection is immature. Its head is 0.134 mm. long and 0.178 mm. broad. Its four suckers measure 0.077 to 0.082 mm. in diameter and their cavities are from 0.046 to 0.056 mm. in diameter. The fifth sucker has a diameter of 0.034 mm. The neck, which is narrowest just back of the head, has a length of 1.26 mm. The first proglottids are 0.320 mm. broad by 0.012 mm. long.

A considerably more immature worm than the preceding is

No. 12.147<sub>3</sub> of Ward's collection. Five suckers are visible but the fifth is too indistinct to measure. One of the suckers measures 0.062 mm. and its cavity, 0.039 mm. in diameter. No mature or ripe proglottids are present.

Specimen 12.148<sub>1</sub> and 12.148<sub>2</sub> of Ward's collection are so nearly alike that data will be given only on No. 12.148<sub>2</sub> unless otherwise stated. The only sucker measured on specimen No. 12.148<sub>2</sub> is 0.065 mm. in diameter. On specimen No. 12.148<sub>1</sub> the suckers measure 0.051 to 0.062 mm., the neck, 1.41 mm. long by 0.260 mm. wide. Mature proglottids measure 0.446 by 0.498 mm. long; ripe proglottids, 0.461 by 0.595 mm. to 0.446 by 1.361 mm. long. A terminal proglottid is present. Its breadth is 0.446 and its length 1.265 mm. The position of the genital pore occurs from 0.3 to 0.46 of the length of the proglottid from the anterior end, with the average of ten falling at 0.35 of the proglottid length. The average length and breadth of ten cirrus-pouches is 0.112 and 0.047 mm. respectively. The minimum length and breadth in this lot of cirrus-pouches is 0.102 and 0.039 mm. respectively, while the maximum length and breadth in the lot are 0.021 and 0.056 mm. respectively.

The relations of the vagina to the cirrus-pouch are the same as in the type. In the region just anterior to the ovary the vagina is thrown into several coils. Counts of the number of uterine pouches in six old elongated proglottids were made. These counts are expressed in the form of fractions, the number of pouches on the porose side (side of the genital pore) being given as the numerator and the number of pouches on the aporose side as the denominator. The counts follow: 11/14, 11/11, 11/13, 10/14, 14/14, 15/16. It will be seen that there is a tendency for the greater number of pouches to occur on the aporose side. The ovarian lobes in quadrate proglottids are

elongated. As the proglottids get older and more elongated the ovarian lobes are turned back and become rounded. In the last proglottid this process has gone on so far that the ovarian lobes touch in the rear. The six hooked embryos of uterine eggs measure 0.015 to 0.017 mm.

One complete worm taken by the writer from perch at Douglas Lake in northern Michigan differs very little from the type. It is strongly contracted. The suckers, which are almost withdrawn into the head, are about 0.066 mm. in diameter. The fifth sucker is just distinguishable. The neck is broad and about 1.30 mm. long. Two headless fragments mounted on the same slide clearly belong to the same species as the type.

A complete specimen, La Rue's No. 357e, 13.4 mm. long and with a maximum width of 0.50 mm., was taken from a rock bass, *Ambloplites rupestris* (Raf.), at Douglas Lake, Michigan, by the writer in 1912. Studies of this worm mounted in toto show that it belongs in this species. Its measurements fall within the limits given in the diagnosis.

This species is much smaller than *P. cernuae*, *P. percae*, and *P. dubius* which infest the Percidae of Europe but resembles these in having a fifth sucker. In addition to differences in size of the worm there are many points of difference in the size of organs. This species is considerably smaller than *P. pinguis*. It is less fleshy and differs in many of its size relations. It somewhat resembles *P. exiguus* in size but is a slightly more robust worm than *P. exiguus*. This more robust appearance is particularly true of the head and neck. The genital pore of *P. pearsei* is differently located, the cirrus-pouch much smaller, testes more numerous, and the embryo smaller than in *P. exiguus*. The form more closely resembles *P. pusillus* than any other described species, but its suckers are



smaller, testes smaller, cirrus-pouch larger, and the relation of the vagina to the cirrus-pouch is somewhat different. This species is not to be confused with *P. ambloplitis* which also occurs in *Ambloplites rupestris* because of the great difference in size and in anatomical details.

BIBLIOGRAPHY

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## PLATE I

All outlines have been made with the aid of the camera lucida and details filled in at the same scale of magnification.

Abbreviations used: ci.p., cirrus-pouch; g.p., genital pore; tt., testes; ut.p., uterine pouch; v.d., vas deferens; vi., vitellaria.

Figs. 1 and 2. Head of type specimen seen from upper and lower surfaces respectively.

Fig. 3. Head of a smaller specimen found in Professor Pearse's material. Drawn to the same scale as figs. 1 and 2.

Fig. 4. Mature proglottid of type specimen.

Fig. 5. Ripe proglottid of type specimen.

Fig. 6. Last proglottid of type specimen.

Fig. 7. Mature proglottid from specimen 12.148<sub>2</sub> in Professor Ward's collection.

Fig. 8. Portion of proglottid showing the shape of ovarian lobes under certain conditions of contraction of the proglottid. Drawn to the same scale as fig. 7.



