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Supplement to the description of *Pseudobenedenia nototheniae* T.H. Johnston, 1931 (monogenetic trematode) parasite of a teleost of the genus *Notothenia* Richardson from the Kerguelen Island

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SUPPLEMENT TO THE DESCRIPTION OF PSEUDOBENEDENIA NOTOTHENIAE
T. H. JOHNSTON, 1931 (MONOGENETIC TREMATODE) PARASITE OF
A TELEOST OF THE GENUS NOTOTHENIA RICHARDSON FROM
THE KERGUELEN ISLAND

by

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Preface¹
to Translation

Translation of this paper was undertaken as part of a long-term research project on the systematics, host-specificity and zoogeography of monogenetic trematodes.²

A conscious effort has been made to keep this translation as near the original as possible. It is probably inevitable, however, that some of the nuances of meaning in the original have been distorted or lost. For this we apologize to the authors and the reader.

For convenience in referring to the French text the original pagination is given in the margin of the translation opposite the place where the new page begins. Tables have been removed from their original page location and inserted at the end of the translation; however, since they, themselves, are numbered sequentially no confusion should result.

This translation is intended as a service to researchers. Though effort has been made to make it comprehensible, accurate and useful, it is likely that improvements can be made. Should literary improvements or verification appear desirable it is suggested that the researcher make his own translation. Pagination is arranged to facilitate such activity. We will appreciate constructive suggestions for improvements in this and future translations.

Thanks are due to Mrs. Elena Burbidge of the Virginia Institute of Marine Science who typed and assembled the manuscript.

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SUPPLEMENT TO THE DESCRIPTION OF PSEUDOBENEDENIA NOTOTHENIAE
T. H. JOHNSTON, 1931 (MONOGENETIC TREMATODE) PARASITE OF
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Among the helminths collected by J. C. Hureau during his mission to the Kerguelens, the study of which he has entrusted to us, our attention has been attracted by a small portion of the monogeneids collected on the skin of Notothenia rossi Richardson. p.849

These monogeneids are identical anatomically to those of Pseudobenedenia nototheniae T. H. Johnston, 1931, but our individuals show a haptor with 7 muscular septa radiating around a central, roughly pentagonal loculus.

Johnston described his species with a haptor without "rays" but his drawings have not appeared convincing to us; therefore, we have requested Mrs. P. Thomas-Mawson to send us the type-specimens of Pseudobenedenia nototheniae. We would like to thank her here for the diligence with which she has put this material at our disposal.¹

Comparison of this original material with the individuals collected in the Kerguelens has proved to us that we are dealing with the same species.

Johnston gave a lengthy description of this species in 1937; in spite of that, certain characteristics, the haptor in particular, appear a little obscure to us. We give hereafter some supplementary information. This obliges us to question the systematic position of this parasite among the Capsalidae (Monopisthocotylea).

Pseudobenedenia nototheniae T. H. Johnston, 1931

Host: Notothenia rossi Richardson.

Habitat: Surface of the skin.

Locality: Kerguelens.

¹ The two specimens which were sent came from a Notothenia colbecki G. A. Boulenger, 1902, from the Island of Auckland. They were preserved under the number H. C. 3686 in the Helminthological Collection of the Zoological Department of Adelaide University.

Of the 16 individuals at our disposal, 3 have been cut up into serial sections to confirm the results of the study of specimens mounted in toto. p.850

Body oval, depressed, 4.8 - 6.8 mm in length, 3.0 - 4.5 mm in width.

At the anterior end, on each side of the median line, are found two muscular suckers of 0.7 - 0.8 mm diameter. These suckers, which the sections show very flattened, open ventrally. They are surmounted dorsally by a transverse, narrow band, extending from the outside edge of one sucker to the outside edge of the other and showing in front of each sucker a rather narrow glandular zone. These zones, which attain with regard to length the diameter of the suckers, resemble the glandular region that is found in the anterior region of the species of the genus Entobdella, but they are here less developed.

The mouth opens ventrally between the suckers. p.851

The genital pore, lateral but not marginal, is situated on the ventral surface under the posterior edge of the left sucker or a little behind it.

The vagina opens ventrally at the level of the anterior third of the body, to the left of the midline.

At the posterior end, the haptor, very slightly pedunculated, has the shape of a circular cup about 2 mm in diameter. It is bordered by a thin membrane 120 μ in width.

The internal surface, slightly concave, is subdivided into marginal loculi by 7 muscular septa radiating around a central heptagonal loculus, but whose 2 sides adjacent to the posterior base are so reduced that one can consider it as pentagonal.

The lateral sides of the pentagon are elongated by the posterior septa. A radiating septum leads off from each posterior angle of the central loculus, diverging toward the base (posterior-lateral septum), while from each anterior angle leads a radiating septum, diverging toward the front (anterior-lateral septum). From the anterior vertex of the pentagon leaves an odd anterior septum which blends with the plane of symmetry of the haptor.

In the musculature which forms the posterior-lateral side of the central pentagon, is found, on each side, a hook with a sharp anterior point projecting to the exterior. The body of this piece (called by G. C. Kearn, 1964, p. 234, accessory sclerite) is rectilinear, massive (375 μ long), with base bifurcated in a Y with blunt uneven branches. The ventral branch is much shorter than the dorsal. p.852

In each posterior septum there are two hooks: an anterior hamulus,

500 u long, with a thin anterior base and a posterior extremity recurved like a fish hook whose sharp point projects to the exterior at the posterior part of the septum. At the rear, a small posterior hamulus, 250 u long, flanks the anterior hamulus; it has a base enlarged into a blade and a posterior extremity forming a tiny fish-hook whose point projects exteriorly a little behind that of the anterior hamulus.

One finds, in addition, 14 marginal hooklets, small (11-12 u) and difficult to see, and arranged symmetrically on the periphery of the disc at the inside edge of the marginal membrane.

If we divide the haptor sagittally, we thus have on each side 1 hook in the posterior loculus between the median plane and the posterior septum, 2 hooks in the margin of the postero-lateral loculus, 1 hook opposite to the postero-lateral septum, 2 hooks in the margin of the lateral loculus; the most anterior of these is near the antero-lateral septum; finally, there is a hook on the edge of the antero-lateral loculus.

In Entobdella soleae (P. J. Van Beneden and Hesse, 1863), G. C. Kearn (1964, pp. 328-329, fig. 1) has pointed out 2 tendons coming from the musculature of the body and operating on the sclerified pieces of the haptor. These tendons are very clear in Pseudobenedenia; but while, in Entobdella, each tendon, after having passed through the posterior notch of the accessory sclerite, inserts at the base of the anterior hamulus, in Pseudobenedenia, the tendon, after having passed through the notch, comes to insert in the haptor along the postero-lateral septum. We have not observed the fiber attached to the base of the anterior hamulus.

The pharynx, without clear constriction, is wider (700 u) than long (500 u). The salivary glands, extremely well developed, form a large lateral triangle and empties at the base of the pharynx. The intestine is dendritic, with branches not confluent posteriorly.

Two pairs of dorsal eye spots are located in front of the pharynx, between the suckers.

The description of the genital organs by Johnston corresponds exactly to that which we have observed.

There are two testes, juxtaposed, one on each side of the sagittal plane of symmetry, just behind the middle of the body. Longer than wide, it measures around 1 mm in length and 0.75 mm in width. The cortical tissue forms folds in the interior of the testes, which therefore appears cut up and perforated.

The vas deferens winds around the ovary on the left side and forms a large loop on the right side, then describes numerous bends on the left side before penetrating into the cirrus sac.

The ovary, globular and median (around 900 x 600 u), is situated in front of the testes, midway of the body.

One observes a bundle of vitelline glands between the testes and the ovary, but, in this position, it never attains in our individuals, the importance noted by Johnston in his specimens.

Excessively developed, the vitelline glands accompany the intestinal branches on the sides and in the posterior part of the body. The vitelline follicles are found in front of the pharynx between the buccal suckers.

The lateral vitelline ducts are quite visible. The transverse vitelline ducts empty into a large vitelline reservoir extending transversely in front of the ovary. The Mehlis' glands, very large, are located in 4 zones which empty at the base of the ootype. The latter appears as a long, very contorted tube.

We have not observed any eggs.

Recently J. Llewellyn and L. Euzet (1963, p. 140; 1964, pp. 339-340, text fig. 1, Plate I, fig. 1-3, Plate II, fig. 1-4) have described in Entobdella diadema (Fr. Sav. Monticelli, 1902) some glands destined to form a spermatophore at the level of the cirrus sac.

We have not found, on the ventral surface of Pseudobenedia, the clear glands found in Entobdella, but the cirrus sac shows a structure which portends the existence of these glands. We have, in fact, reconstructed the structure of the cirrus sac according to our serial sections.

The vas deferens penetrates into the cirrus sac by the dorsal surface of the latter. On the interior of the sac it forms a posterior loop before emptying into the cirrus canal. p.355

A duct, which we compare to the duct of the spermatophore glands of Entobdella, parallel to the vas deferens, penetrates into the cirrus sac at the dorsal surface. On the inside, it empties into a dorsal vesicle (vesicle of the spermatophore?) which empties by a short tube into the cirrus canal behind the vas deferens.

The prostatic duct receives the secretions of the glands situated behind the cirrus sac. These secretions, which penetrate into the sac at the posterior extremity, collect in a ventral vesicle which we call the prostatic reservoir.

The duct continues forward into the thick walled and muscular cirrus. Free in its cavity, the cirrus can project to the exterior.

Discussion - As we said at the beginning of this work, the species collected on a Notothenia in the Kerguelens corresponds completely to that of Johnston. Examination of the original material has confirmed to us that the anatomy is identical. The ventral position of the vagina in the anterior third of the body and slightly to the left of the median sagittal plane, appears to us a clear, specific characteristic.

In addition we can affirm that the haptor is identical and that the radiating muscular septa exist in the specimens of Johnston that we have examined. Certainly, these septa are less clear because the individuals of Johnston have been very flattened. The flattening has caused the septa to disappear almost completely.

We have found on the cotypes of Pseudobenedenia, the 14 marginal hooks which Johnston failed to mention. The hooklets have, relative to the loculi and septa, an identical position to that of our specimens.

We are now obliged to modify the diagnosis of the genus Pseudobenedenia and we define it thus:

Capsalidae - Two anterior suckers surmounted by a narrow band furnished with a glandular zone above each sucker. Two pairs of eyes. Genital pore not marginal, situated ventrally under the posterior border of the left sucker or at a little distance behind the edge.

Vagina opening ventrally in the first anterior third of the body, slightly to the left of the median line. Haptor with 7 muscular, radiating septa, delimiting 7 marginal loculi and a central loculus with transverse posterior bar. Three pairs of longitudinal hooks. Fourteen marginal hooklets.

Up till now, the systematic position of the genus Pseudobenedenia has been disputed.

For Sproston, Baer and Euzet, and Yamaguti, the haptor being deprived of septa, according to Johnston, the genus belongs in the sub-family Benedeniinae among the Capsalidae.

In the classification of B. Bychowsky (1957, p. 340) the sub-family Benedeniinae does not exist, for, according to Bychowsky, all the species of the genus Benedenia must possess a haptor with muscular septa. For Bychowsky (1957, pp. 378-379) the genera Benedenia and Pseudobenedenia are to be transferred into the sub-family Trochopodinae. B. Bychowsky is then led to create a new sub-family, that of Entobdellinae, where he places the single genus Entobdella in which the haptor is without muscular septa. p.856

The supplement to the description, which we have just given of Pseudobenedenia, proves that the muscular septa exist in the haptor. We now place this genus among the Trochopodinae, agreeing in this matter with Bychowsky. But we maintain the sub-family Benedeniinae. In fact, it seems unlikely to us that, for all the species of the genus Benedenia currently described by others than by Bychowsky, the writers unanimously have omitted mentioning the presence of muscular septa or have not observed them.¹

¹B. Bychowsky (1957, p. 379), in regard to Benedenia, has shown that the septa may become invisible in stained specimens, mounted in Canada Balsam.

The sub-family Trochopodinae (E. W. Price, 1936) N. Sproston, 1946 then comprises actually 8 genera:

Trochopus K. M. Diesing, 1850.
Macrophyllida T. H. Johnston, 1923.
Sprostonia B. Bychowsky, 1957.
Allomegalocotyla S. Yamaguti, 1963.
Megalocotyle F. Folda, 1928.
Pseudobenedenia T. H. Johnston, 1931.
Trochopella L. Euzet and J. P. Trilles, 1962.
Pseudomegalocotyla S. Yamaguti, 1963.

In this sub-family, the genus Pseudobenedenia seems to make the passage between the genus Trochopus with 2 anterior muscular suckers and Macrophyllida with 2 anterior glandular zones.

SUMMARY

The study of several individuals of a monogeneid collected in the Kerguelens, on the skin of a Notothenia rossi Richardson (teleost), permitted a more complete and accurate description of Pseudobenedenia nototheniae T. H. Johnston, 1931.

The haptor of this species shows 7 muscular septa, dividing it into 7 marginal loculi and 1 central loculus. The haptor bears, in addition to 3 pairs of median hooks, 14 marginal hooklets.

As a result of these data, the genus Pseudobenedenia was redefined, and its systematic position among the Capsalidae and the Trochopodinae is discussed.

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EXPLANATION OF FIGURES

Pseudobenedenia nototherniae T. H. Johnston, 1931

Figures:

1. Whole mount, ventral view.
2. Haptor, ventral view. Individuals preserved in alcohol.
3. a. Accessory sclerite; b. anterior hamulus; c. posterior hamulus.
4. Anatomy of the genital ducts, ventral view. -- Cir., cirrus; Def., vas deferens; Meh., Mehlis' glands; Oot., ootype; Ov., ovary; Ph., pharynx; V. d., vitelloducts; Vg., vagina; Vit., vitellaria.
5. Schematic representation of the cirrus pouch with its various ducts and reservoirs. -- C. def., vas deferens; Cir., cirrus; Pro., duct from prostatic glands; R. pro., prostatic reservoir; Sph., duct from spermatophore glands; R. sph., reservoir of the spermatophore glands.

