A C T A I C H T H Y O L O G I C A E T P I S C A T O R I A

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Fish parasitology

A NEW MONOGENEAN SPECIES PARASITIC ON GILLS OF BIGMOUTH SOLE, *HIPPOGLOSSINA STOMATA* STEINDACHNER, 1876 FROM SOUTHERN CALIFORNIA

NOWY GATUNEK MONOGENEA PASOŻYTUJĄCY NA SKRZELACH SOLI WIELKOGĘBOWEJ, *HIPPOGLOSSINA STOMATA* STEINDACHNER, 1876 Z POŁUDNIOWEJ KALIFORNII

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A new monogenean species *Neoheterobothrium hippoglossini* sp. n. from the gill cavity of *Hippoglossina stomata* Steindachner, 1876 is described and illustrated. The new species differs from its seven congeners in a number of morphological features and in having a different host. The validity of the genus *Neoheterobothrium* is discussed. *Neoheterobothrium mcdonaldi* Payne, 1987 is relegated from the genus and from the subfamily Choricotylinae and placed in one of the remaining subfamilies of the family Diclidophoridae.

INTRODUCTION

Validity of the genus *Neoheterobothrium* Price, 1943 (Diclidophoridae) had been put into question many times. In 1946 Sproston considered it a junior synonym of the genus *Heterobothrium* Cerfontaine, 1895. A similar belief expressed Bychovskij (1957). On the other hand the validity of *Neoheterobothrium* was confirmed by Yamaguti (1961) and Mamaev (1976, 1987). According to Oliva and Luque (1995) the genus *Neoheterobothrium* comprises five species and two new ones species were recently added by Ogawa (1999) and Suriano and Labriola (1999). Their hosts are marine fishes representing the order Pleuronectiformes (cf. Mamaev 1987; Ogawa 1999) and also family Synodontidae (cf. Payne 1987). The type species is *N. affine* (Linton, 1898) Price, 1943, found on the palate of *Paralichthys dentatus* (family Paralichthyidae) from the Atlantic and *P. lethostomus* (*lethostigmus*?) from the Gulf of Mexico (Price 1943; Yamaguti 1963; Mamaev 1987). The second species, originally described as *Choricotyle exilis* Crane, 1972, found on the

palate of *Lyopsetta exilis* (family Pleuronectidae) from the Pacific, off Southern California, was recently transferred to the genus *Neoheterobothrium* by Mamaev (1987). Another species—*N. syacii* Mamaëv et Zhukov, 1987 in Mamaev, 1987, was found in *Syacium* sp. (family Paralichthyidae) in the Gulf of Mexico. Fourth species, *N. mcdonaldi* Payne, 1987, was recovered from the gills of *Synodus lucioceps* (Ayres) (family Synodontidae) collected in the Gulf of California. The fifth spcies is *N. insularis* Oliva et Luque, 1995, was found on the gills of *Paralichthys* sp. off the Chilean coast. The most recent members of the genus *Neoheterobothrium* were: *N. paralichthyi* Suriano et Labriola, 1999 and *N. hirame* Ogawa 1999. The former parasite was found on the gills of *Paralichthys patagonicus* Jordan, 1889 collected off Mar del Plata (Argentina), while the latter—on the buccal cavity wall of *Paralichthys olivaceus* caught in Wakasa Bay, Japan

Present paper contains description of monogeneans representing the genus *Neoheterobothrium* found in the gill cavity of a bigmouth sole *Hippoglossina stomata* Steindachner, 1876 collected off Southern California coast. The authors, taking into account that the above-mentioned parasites differ distinctly from all known congeners, decided to name it a new species.

MATERIAL AND METHODS

The material of the present study was a single specimen of the bigmouth sole *Hippoglossina stomata* caught on 30 January 1990 in the Pacific, near the shores of Huntington Beach in Southern California. The fish was collected by one of the authors (W.P.) during a short cruise of *R/V Yellowfin* of the Ocean Studies Institute. The host fish was necropsied in the laboratory of the Department of Biology, California State University Long Beach. A total of 5 specimens of monogeneans representing the genus *Neoheterobothrium* was recovered. The parasites were fixed in ethanol, stained with alum carmine, and mounted using Canada balsam. The parasites were studied and photographed using an Olympus BX-50 microscope with Nomarsky interference contrast.

RESULTS

***Neoheterobothrium hippoglossini* sp. n.**

Host: Bigmouth sole, *Hippolglossina stomata* Steindachner, 1876

Locality: Pacific Ocean, off Southern California (Huntington Beach)

Habitat: gill cavity

Types: Deposited in the Muzeum Przyrodnicze in Wrocław, Poland

(holotype and 4 paratypes)—MP 816.

Description: Body proper fusiform, linked directly to opisthohaptor equipped with four pairs of pedunculate clamps. Peduncles relatively long (Fig. 1). Dimensions of specimens

Fig. 1. *Neoheterobothrium hippoglossini* sp. n.; entire specimen, ventral

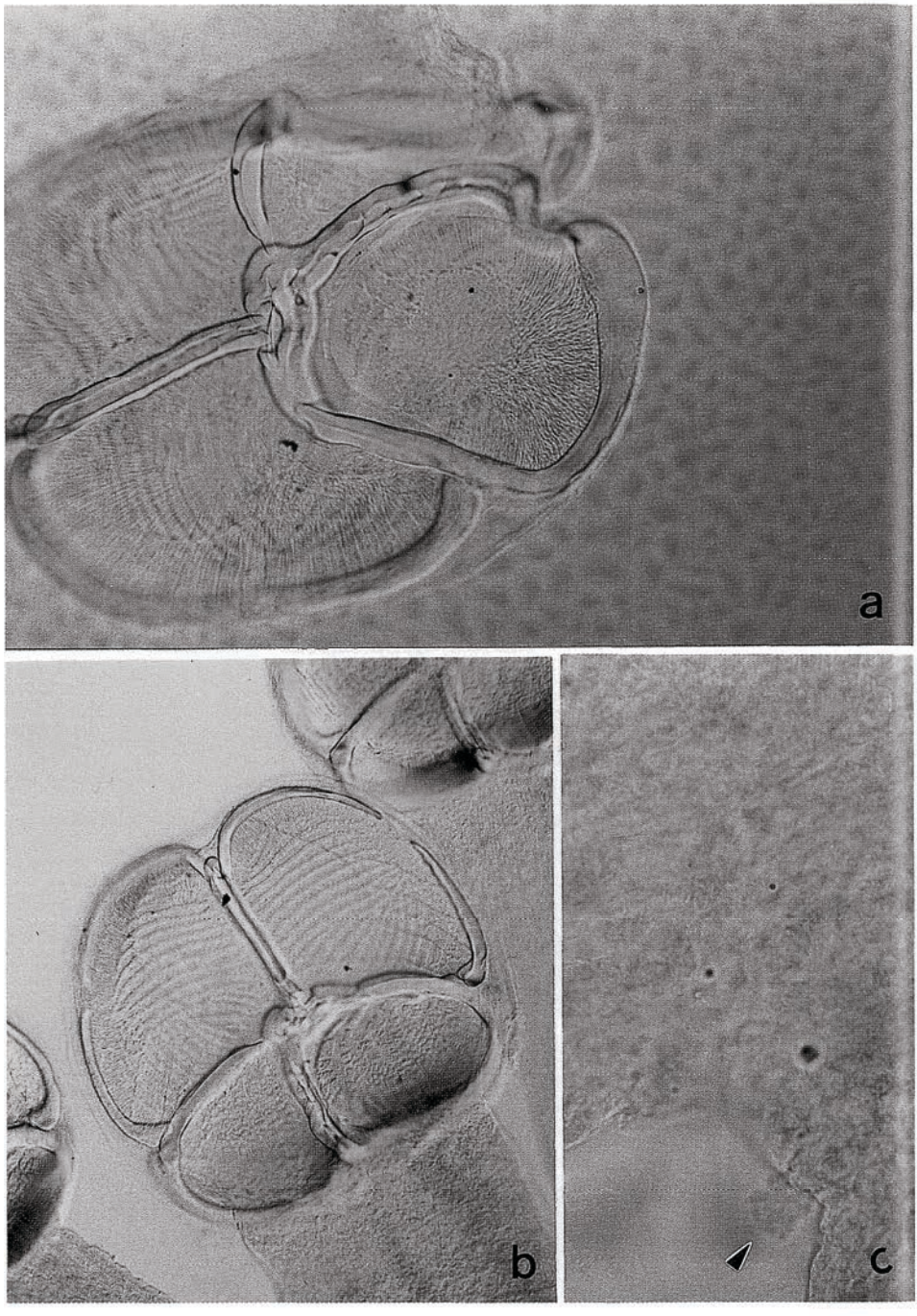

Fig. 2. *Neoheterobothrium hippoglossini* sp. n.; elements of opisthohaptor; a, b, clamps; c, terminal lappet

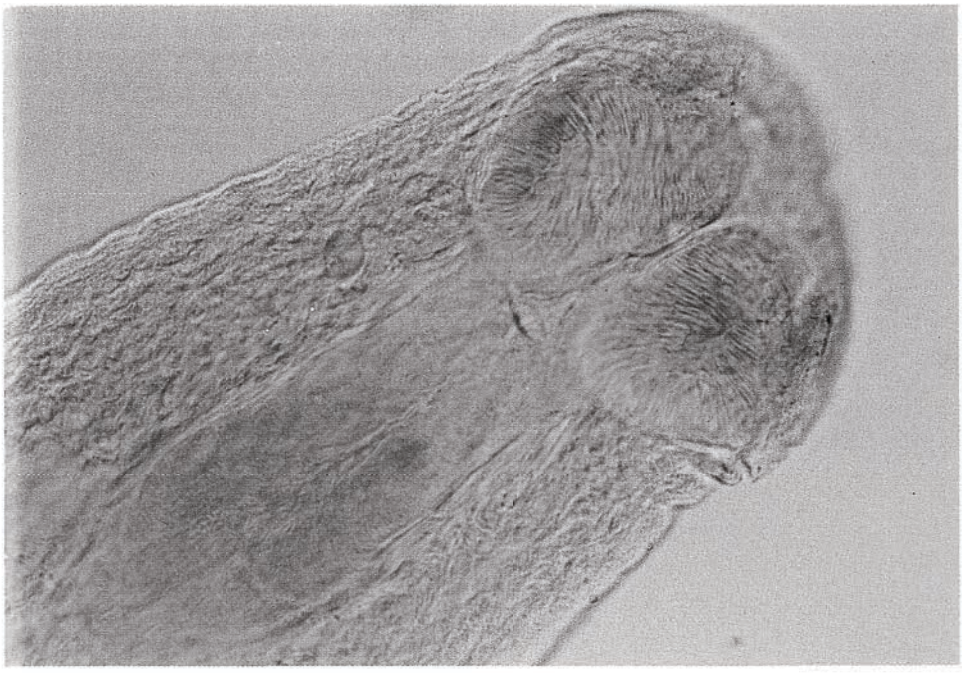

Fig. 3. *Neoheterobothrium hippoglossini* sp. n.; anterior part, with two suckers and pharynx

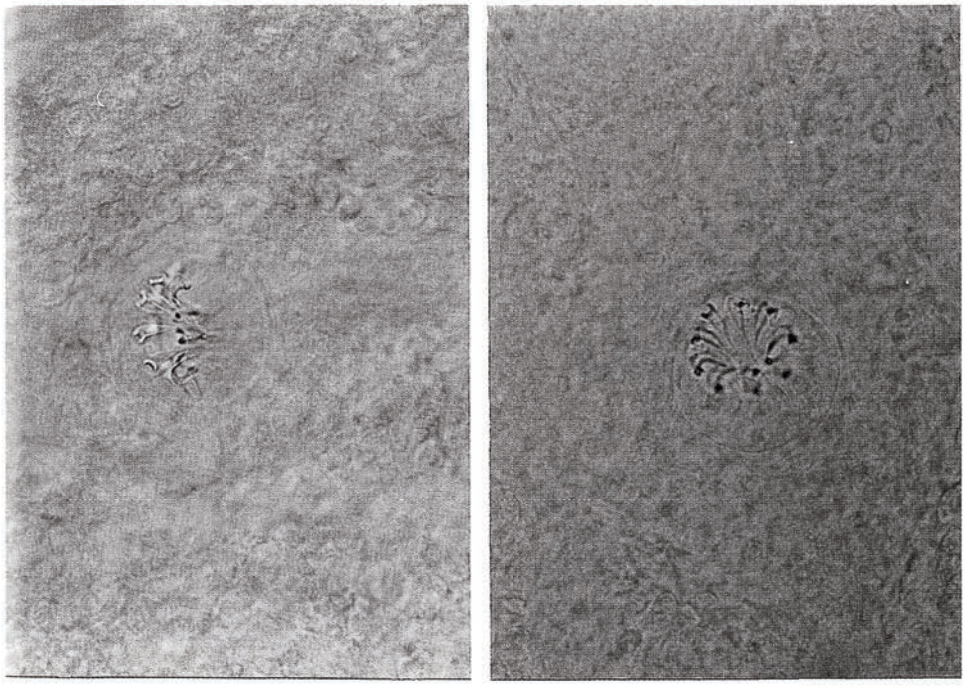

Fig. 4. *Neoheterobothrium hippoglossini* sp. n.; genital atrium of two different specimens

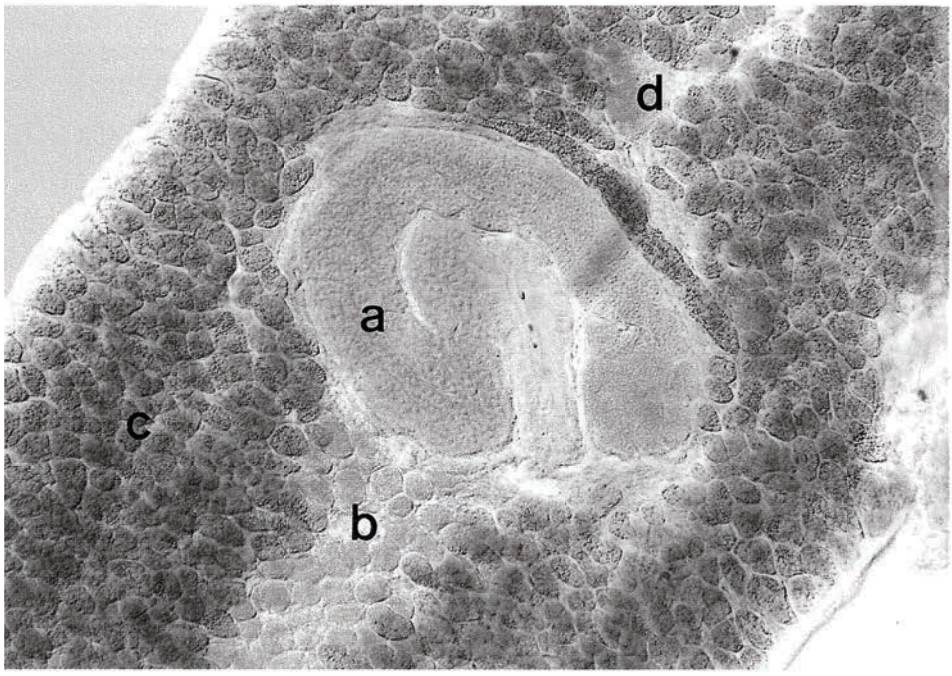

Fig. 5. *Neoheterobothrium hippoglossini* sp. n.; central part of the body; a, ovary; b, testes; c, vittelaria; d, receptaculum seminis

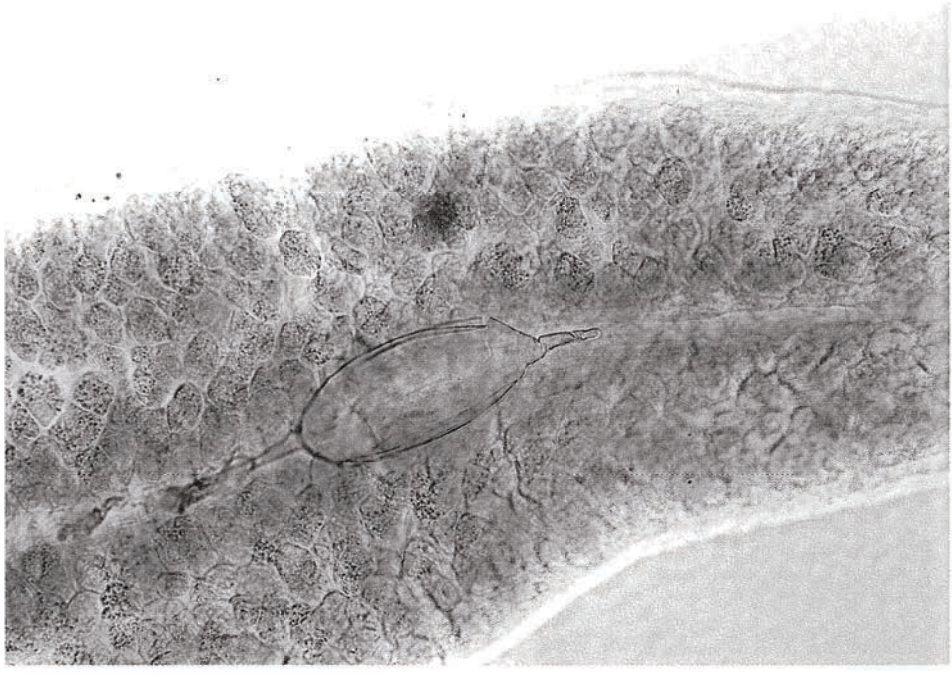

Fig. 6. *Neoheterobothrium hippoglossini* sp. n.; anterior part of the body; egg seen in the centre

and their details given in Tab. 1. Open structure of asymmetrical clamps typical for representatives of subfamily Choricotylinae. Each clamp armed with 6 free sclerites and ring formed of fused sclerites (Figs. 2a, b). Posterior field of clamp attachment surface equipped with parallel delicate corrugation. Radial corrugation of muscles visible inside ring of anterior field suggesting its good functional suction. (Figs. 2a, b). Terminal lappet with two pairs of very small, barely visible sclerites of uneven length present between two posteriormost clamps (Fig. 2c). Prohaptor equipped with two oval suckers located close to each other. Large, strongly elongate pharynx directly behind suckers. (Fig. 3). Numerous postovarian testes (Tab. 1) occupying one third of body proper length. Slightly oval male copulatory organ, armed with corona of 9 hooks, located in anterior part of body proper not far from pharynx (Fig. 4). Small, slightly elongate receptaculum seminis anterior to ovary (Fig. 5). Ovary relatively large resembling upside-down letter "e" (Fig. 5). Vitellaria very numerous filling entire body proper (Fig.1). Single egg found of elongate shape with one pole equipped with short (39 μm in length), stout process while opposite pole with longer 85-μm process tapering into very long, thin and extensively coiled filament (Fig.6).

Table 1

Checklist of meristic and metric features of *Neoheterobothrium hippoglossini* sp. n. and *N. exilis* (Crane, 1972) (dimensions in mm)

Feature	*Neoheterobothrium exilis* Crane, 1972	*Neoheterobothrium hippoglossini* sp. n.
Total length	5.10 (4.80–5.40)	5.984 (3.890–7.200)
Body width	1.09 (1.00–1.18)	0.926 (0.470–1.090)
Suckers: length	0.07 (0.06–0.08)	0.081 (0.076–0.085)
width	0.08 (0.07–0.09)	0.067 (0.059–0.076)
Pharynx: length	1.72*	0.180 (0.160–0.205)
width	0.08	0.066 (0.054–0.075)
Clamp: length	0.05 (0.04–0.07)*	0.470 (0.396–0.540)
width	0.04 (0.03–0.06)*	0.454 (0.346–0.547)
Length of peduncle	0.75 (0.05–1.10)	0.672 (0.216–1.296)
Terminal lappet:		
length	?	0.024 (0.017–0.034)
number of hooks		2 pairs
Genital atrium:		
length		0.054 (0.039–0.076)
width		0.051 (0.042–0.056)
number of hooks	8–10	9
length of hooks	0.009 (0.008–0.01)	0.016 (0.014–0.017)
Number of testes	30–45	78 (70–85)
Testis size		0.042 × 0.049 (0.034–0.058 × 0.036–0.068)
Egg length (without processes)		0.170 × 0.071

* probably a mistake in calculations.

DISCUSSION

Easily noticeable diagnostic feature of this monogenean genus, taken by some researchers as the main diagnostic feature of *Neoheterobothrium* has been the presence of isthmus between the body proper and the opisthohaptor. The newly described species and *N. exilis* definitely lack the isthmus. Five species: *N. affine*, *N. syacii*, *N. mcdonaldi*, *N. paralichthyi*, and *N. hirame* have this character well pronounced, while *N. insularis* represents an intermediate condition where it is impossible to define whether the isthmus is present or not. Another well visible difference is relative length of the clamp peduncles. Five species, namely *N. affine*, *N. syacii*, *N. paralichthyi*, *N. insularis*, and *N. hirame* have relatively short peduncles, with their length not exceeding two widths of the clamp. Three species: *N. exilis*, *N. mcdonaldi*, and *N. hippoglossini* sp. n. have much long peduncles (more than 3 widths of clamps). *N. mcdonaldi* substantially differs from all other species of the genus *Neoheterobothrium* in the structure of the clamp, which is of "clasping type" and in the connection between the opisthohaptor and the body proper (According to Mamaev (1976) all representatives of Choricotylinae have clamps of open type). In N. *mcdonaldi* the body is attached to the haptor dorso-anteriorly while in all remaining species—anteriorly (as can be concluded from the relevant drawings). The clamp structure of *N. mcdonaldi* is a sufficient difference to remove this species from the genus and from the subfamily Choricotylinae relocating it to one of the remaining subfamilies of the family Diclidophoridae. Moreover this species differs distinctly in the taxonomic position of its host. All remaining *Neoheterobothrium* species parasitize flat fishes while *N. mcdonaldi* was found in a quite unrelated synodontid fish. The importance of host specificity in this group of monogeneans was emphasised by Sproston (1946), Llewellyn (1958), and Mamaev (1976).

The species listed above differ in their dimensions, relative size of the body parts, number of testes, number of hooks in the genital atrium, presence or absence of certain structures. All relevant details are listed in Tab. 2. Some of the features had been proposed for the generic diagnosis of *Neoheterobothrium*. For instance the presence of the isthmus has long been considered a principal discriminant of the genus (Price 1943; Yamaguti 1963; Mamaev 1987; Ogawa 1999). Example of *N. insularis* shows that some of the species may show an intermediate condition where presence or absence of the isthmus cannot be univocally stated. Therefore it seems that this feature can no longer be useful. Similarly, the absence of receptaculum seminis and the presence of two pairs of intestinal crura were considered a generic feature of *Neoheterobothrium* by Ogawa (1999). His account, however, was based, on four species only including his new species and it seems that all species in question need to be re-examined in order to obtain sufficient data for further conclusions. The presence or absence of two pairs of longitudinal intestinal branches seems to be a very promising feature. Its value, however, may be influenced by the fact that bigger

monogenean species have more elaborate system of intestinal branches and their diverticula. Indeed *N. hirame* and *N. affine* are the largest representatives of the genus.

Suggestion of Ogawa (1999 and personal communication) that *N. exilis* may represent some other genus is interesting and it is quite apparent for the present authors that *N. exilis* and *N. hippoglossini* sp. n. are quite different from its current congeners. However, before a complex revision is done of the subfamily Choricotylinae, the above-mentioned two species have to remain in the genus *Neoheterobothrium*.

As mentioned before *N. hippoglossini* sp. n. found in the gill cavity of *Hippoglossina stomata* resembles the most *N. exilis* (Crane, 1972) found on the mouth roof of *Lyopsetta exilis*. The newly found monogenean, however, differs distinctly from *N. exilis*. The differences are not only in the host species and the locality, but also in some morphological characters. The principal discriminating feature is the number of testes. The newly described species had twice as many testes as *N. exilis* (Tab. 1). There are also some differences in the structure in the anterior field of attachment surface of the clamps. In the presently studied specimens, inside the sclerite ring there is a radial corrugation, while on the Crane's (1972) drawing the interior of the clamp ring in *N. exilis* has parallel corrugation like the rest of the clamp surface. Crane (1972) failed to specify if his new species had a terminal lappet. He also did not see receptaculum seminis. Ogawa (1999), however, who re-examined the types confirmed the presence of the latter detail.

CONCLUSIONS

1. The differences between the monogenean newly-found on bigmouth sole and all known representatives of the genus *Noeheterobothrium* suggest, that it is a representative of a new species for which the name *Neoheterobothrium hippoglossini* sp. n. is proposed.
2. Genus *Neoheterobothrium* is only a provisional location for this new species, because further extensive studies are needed to propose a reliable diagnosis for this genus. Moreover, a revision is needed also for the entire subfamily Choricotylinae.
3. Morphological features of *N. mcdonaldi* suggest, that it should be removed from the genus *Neoheterobothrium*, from the subfamily Choricotylinae and transferred to one of the remaining subfamilies of the family Diclidophoridae.

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Table 2

Diagnostic features on known representatives of the genus *Neoheterobothrium*

	N. affine	*N. exilis*	*N. syacii*	*N. mcdonaldi*	*N. insularis*	*N. paralichthyi*	*N. hirame*	*N. hippoglossini* sp. n.
Total length [mm]	11–20	4.8–5.4	5.94–6.25	2.5–3.7	15.6	8.4–15.1	14.0–32.9	3.89–7.2
Isthmus	present	absent	present	present	intermediate condition	present	present	absent
Clamp type	open	open	open	clasping	open	open	open	open
Relative length of clamp peduncle expressed in clamp width	< 2	> 3	≈ 2	> 3	≈ 2	< 2	≈ 2	> 3
Number of testes	50**	30–45	28–42	16–19	99	70–85	260–510	70–85
Receptaculum seminis	absent*	present*	preovarian	postovarian	paraovarian	preovarian	absent	preovarian
Vagina	?	absent	?	?	?	?	absent	
Terminal lappet	present	?	present	present	not observed	absent	present	present
Longitudinal intestinal branches	4*	2*	?	2, confluent in isthmus	2	2 confluent in isthmus	4 (2 parallel in isthmus)	2
Number of hooks in genital atrium	12–16	8–10	8	5–6	11	7–10	11–16	9
Host	*Paralichthys dentatus*	*Lyopsetta exilis*	*Syacium* sp.	*Synodus lucioceps*	*Paralichthys* sp.	*Paralichthys patagonicus*	*Paralichthys olivaceus*	*Hippoglossina stomata*
Host family	Paralichthyidae	Pleuronectidae	Paralichthyidae	Synodontidae	Paralichthyidae	Paralichthyidae	Paralichthyidae	Paralichthyidae

* according to Ogawa (1999)

** according to Oliva and Luque (1995)

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NOWY GATUNEK MONOGENEA PASOŻYTUJĄCY NA SKRZELACH SOLI WIELKOGĘBOWEJ, *HIPPOGLOSSINA STOMATA* STEINDACHNER, 1876 Z POŁUDNIOWEJ KALIFORNII

STRESZCZENIE

W jamie skrzelowej soli wielkogębowej *Hippoglossina stomata* Steindachner, 1876 złowionej w Pacyfiku, przy brzegu w okolicy miejscowości Huntington Beach znaleziono pięć osobników przywry monogenetycznej. Szczegółowe badania morfologiczne wykazały, że znaleziony pasożyt reprezentuje rodzaj *Neoheterobothrium* Price, 1943. Badane osobniki różniły się pod względem niektórych cech morfologicznych od innych gatunków należących do tego rodzaju, dlatego też autorzy zdecydowali się uznać go za nowy gatunek, nadając mu nazwę *Neoheterobothrium hippoglossini* sp. n. Niniejsza praca zawiera dyskusję dotyczącą rodzaju *Neoheterobothrium*. W wyniku tej dyskusji *Neoheterobothrium mcdonaldi* Payne, 1987, został usunięty z rodzaju oraz podrodziny Choricotylinae do jednej z pozostałych podrodzin rodziny Diclidophoridae.

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