



Description of a new species of *Neoechinorhynchus* (Acanthocephala: Neoechinorhynchidae) a parasite of *Dormitator latifrons* from Southwestern Mexico based on morphological and molecular characters

Carlos Daniel Pinacho-Pinacho, Gerardo Pérez-Ponce de León, Martín García-Varela*

Departamento de Zoología, Instituto de Biología, Universidad Nacional Autónoma de México, A. P. 70-153, C.P. 04510, México D.F., Mexico

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ABSTRACT

Neoechinorhynchus mamesi n. sp. is described from the estuarine fish *Dormitator latifrons* collected in 3 localities along the coast of Chiapas State in Southwestern Mexico. The new species is characterized by possessing a small trunk, a very small proboscis with relatively very long apical proboscis hooks and small middle and posterior hooks, 2 giant nuclei in the ventral body wall, and males with testes smaller than the cement gland. A multivariate analysis of variance (MANOVA) and a Principal Component Analysis (PCA) of 46 morphometric traits for 21 mature females and 18 males of *N. mamesi* n. sp., *N. brentnickoli* and *N. golvani*, revealed morphological variation among species. DNA sequences of 2 genes, cytochrome oxidase subunit 1 (*cox 1*) of the mitochondrial DNA and the domains D2 and D3 of the large subunit of the nuclear ribosomal RNA (LSU) were used to corroborate the morphological distinction. The genetic divergence estimated among populations of *N. brentnickoli* and *N. mamesi* n. sp. ranged from 10.14 to 10.55% for LSU and from 20.53 to 22.06% for *cox 1*, whereas the genetic divergence between *N. golvani* and *N. mamesi* n. sp. ranged from 20.31 to 21.03% for LSU and from 22.24 to 24.95% for *cox 1*. Maximum likelihood, maximum parsimony and Bayesian inference analyses were performed for the combined data sets (LSU+*cox 1*) and each data set alone. All the phylogenetic analyses showed that the specimens from 3 coastal lagoons of Chiapas State in Southwestern Mexico represented a monophyletic clade with strong bootstrap support and Bayesian posterior probabilities. The haplotype network based on the analysis of the *cox 1* sequences indicated that *N. mamesi* n. sp. is separated by 84 substitutions from *N. brentnickoli*, and with 69 substitutions from *N. golvani*. The morphological evidence, the multivariate analyses, in combination with the genetic divergence estimated with two genes, the reciprocal monophyly in all the phylogenetic analyses, and the haplotype network, suggested that the acanthocephalans found in the intestine of *D. latifrons* in Southwestern Mexico represent a new species, named *N. mamesi* n. sp., and it constitutes the second species of the genus *Neoechinorhynchus* associated with the Pacific fat sleeper along the Pacific Coast of Mexico.

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1. Introduction

Neoechinorhynchus Stiles and Hassall, 1905 is one of the most diverse genera within Acanthocephala with approximately 101 described species [1–8]. All these species are characterized by possessing a small globular or sub-cylindrical proboscis, armed with 3 circles of 6 hooks each, a single-walled proboscis receptacle and a cerebral ganglion located at the base of proboscis receptacle, males possessing 2 spherical to oblique testes, equatorial or post-equatorial, a single syncytial cement gland, genital pore terminal in both sexes or sub-terminal in females, and oval eggs, elliptical

or elongate, with concentric shells or with polar prolongation of fertilization membrane [2].

In Mexico, 6 species of the genus *Neoechinorhynchus* have been described, 2 of these occur in freshwater turtles, *i.e.*, *N. schmidti* Barger, Thatcher and Nickol, 2004 and *N. emyditoides* Fisher, 1960, and the other 4 species occur in marine, brackish and freshwater fishes, *i.e.*, *N. roseus* Salgado-Maldonado, 1978, *N. golvani*, Salgado-Maldonado, 1978, *N. chimalapasensis* Salgado-Maldonado, Caspeta-Mandujano and Martínez-Ramírez, 2010, and *N. brentnickoli* Monks, Pulido-Flores and Violante-González, 2011 [7,9,10]. Recently, molecular and morphological data revealed that the acanthocephalan *N. golvani* actually comprises a complex of cryptic species [9]. One lineage corresponded with *N. golvani sensu stricto* and is associated with cichlid fishes in strictly freshwater environments. Another two lineages are distributed in brackish water systems along the Gulf of Mexico and Pacific Sea slopes, and are associated with eleotrid fishes, *i.e.*, *Dormitator maculatus* and *Dormitator latifrons*, respectively [9]. A

* Corresponding author at: Departamento de Zoología, Instituto de Biología, UNAM, 04510, México D.F., Mexico. Tel.: +52 5 56229130; fax: +52 5 5550 0164.

E-mail addresses: danyboy_jd26@hotmail.com (C.D. Pinacho-Pinacho), ppdleon@ibunam2.ibiologia.unam.mx (G. Pérez-Ponce de León), garcia@servidor.unam.mx (M. García-Varela).

Table 1

Specimen information, collection sites (CS), sample number, species analyzed, specimen analyzed (N), host species, locality name, geographical coordinates, GenBank accession number, and catalog number (CNHE) for specimens studied in this work. Sequences marked with an asterisk were obtained in the current study. Nd = not determined. The sample number for each locality corresponds with the same number in Figs. 1, 4 and 5.

CS	Sample	Species	N	Host	Locality/sampling date	Coordinates		GenBank		Specimens deposited (CNHE)
						North	West	Cox 1	LSU	
1	1–5	<i>N. mamesi</i> n. sp.	5	<i>Dormitator latifrons</i>	Rion Pijijapan Lagoon, Chiapas/June, 2010	15° 31' 54.3"	93° 09' 39.4"	JN830787* JN830788* JN830789* JN830790* JN830791*	JN830763* JN830764* JN830765*	8180, 8181, 8182
2	6–10	<i>N. mamesi</i> n. sp.	5	<i>Dormitator latifrons</i>	La Conquista Lagoon, Chiapas/June, 2010	15° 40' 00.20"	93° 24' 51.61"	JN830792* JN830793* JN830794* JN830795* JN830796*	JN830766* JN830767* JN830768* JN830769*	8184
3	11–15	<i>N. mamesi</i> n. sp.	5	<i>Dormitator latifrons</i>	Joaquín Amaro Estuary, Chiapas/June, 2010	15° 46' 16.19"	93° 24' 30.11"	JN830797* JN830798* JN830799* JN830800* JN830801*	JN830770* JN830771* JN830772* JN830773* JN830774*	8183
4	16–20	<i>N. brentnickoli</i>	5	<i>Dormitator latifrons</i>	Tamarindo River, Guerrero/June, 2010	16° 38' 07.5"	99° 08' 26.4"	JN830802* JN830803* JN830804* JN830805* JN830806*		8179
5	21–28	<i>N. brentnickoli</i>	8	<i>Dormitator latifrons</i>	Tres Palos Lagoon, Guerrero/September, 2008	16° 48' 00"	99° 47' 00"	JN830807* JN830808* JN830809* JN830810* JN830811* JN830812* JN830813* JN830814*	FJ968157 FJ968156 FJ968158 FJ968159 FJ388991	8178
6	29–33	<i>N. brentnickoli</i>	5	<i>Dormitator latifrons</i>	Coyuca Lagoon, Guerrero/September, 2008	16° 57' 00"	100° 02' 00"	JN830815* JN830816* JN830817* JN830818* JN830819*	JN830775* JN830776*	8175
7	34–38	<i>N. brentnickoli</i>	5	<i>Dormitator latifrons</i>	Barra de Pichi Estuary, Michoacán/July, 2010	17° 58' 41.5"	102° 19' 30.0"	JN830820* JN830821* JN830822* JN830823* JN830824*		8174
8	39–43	<i>N. brentnickoli</i>	5	<i>Dormitator latifrons</i>	Mexcalhuacan Estuary, Michoacán/June, 2010	18° 03' 21.5"	102° 39' 29.8"	JN830825* JN830826* JN830827* JN830828* JN830829*	JN830777* JN830778* JN830779* JN830780* JN830781*	8173
9	44–48	<i>N. brentnickoli</i>	5	<i>Dormitator latifrons</i>	Huahuca Estuary, Michoacán/July, 2010	18° 10' 39.7"	103° 00' 26.3"	JN830830* JN830831* JN830832* JN830833* JN830834*		8177
10	49–58	<i>N. brentnickoli</i>	10	<i>Dormitator latifrons</i>	Boca de Apiza Estuary, Michoacán/July, 2010	18° 41' 14.46"	103° 44' 04.96"	JN830835* JN830836* JN830837* JN830838* JN830839* JN830840* JN830841* JN830842* JN830843* JN830844*	JN830782* JN830783* JN830784* JN830785* JN830786*	8176
11	59–63	<i>N. brentnickoli</i>	5	<i>Dormitator latifrons</i>	Cuyutlan Lagoon, Colima/October, 2010	19° 02' 58.6"	104° 15' 58.2"	JN830845* JN830846* JN830847* JN830848* JN830849*		
12	64–66	<i>N. golvani</i>	3	<i>Paraneetroplus fenestratus</i>	Catemaco Lake, Veracruz/June, 2006	18° 25'	95° 07'	JN830850* JN830851* JN830852*	FJ388986 FJ968145 FJ968146	601, 603, 604, 606, 631, 632
13	67–69	<i>N. golvani</i>	3	<i>Cichlasoma pearsei</i>	Nezahualcoyolt Dam, Chiapas/June, 2007	17° 10' 49"	93° 36' 49"	JN830853* JN830854* JN830855*	FJ388996 FJ968141 FJ968142	6756
14	70–72	<i>N. golvani</i>	3	<i>Cichlasoma pearsei</i>	Chicoasen Dam, Chiapas/June, 2007	16° 56' 02"	93° 05' 16"	JN830856* JN830857* JN830858*	FJ388995 FJ968136	6755

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