**New *Echinocephalus* species from an Amazonian stingray suggests co-origin of host and parasite in late Oligocene to early Miocene**

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**SUPPLEMENTARY MATERIAL**

Supplementary Table 1: Nematodes included in the phylogenetic analyses from SSU and COI. New sequences obtained for the present study are in bold.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Species** | ***Host species*** | **Collection site** | **Gene** | **GenBank Acession No.** | **Source** |
| *Acanthocheilus rotundatus* | *Rhizoprionodon acutus* | China | SSU | MF072699 | Li et al. 2018 |
| *Anguillicola crassus* |  |  | SSU | DQ118535 | unpublished |
| *Anguillicola crassus* |  | Czech Republic | SSU | DQ490223 | Wijova et al. 2005 |
| *Anguillicola crassus* | *Ameiurus nebulosus* | USA | COI | MF458546 | El-Shehabi et al. 2018 |
| *Anguillicola crassus* | *Ameiurus nebulosus* | USA | COI | MF458547 | El-Shehabi et al. 2018 |
| *Anisakis simplex* | *Carcharhinus sorrah* | China | SSU | MF072711 | Li et al. 2018 |
| *Anisakis pregreffi* | *Caretta caretta* | Italy | SSU | EF180082 | Nadler et al 2007 |
| *Anisakis pregreffi* | *Conger myriaster* | China | SSU | MF072697 | Li et al. 2018 |
| *Ascaris suum* | *Canis lupus familiares* | China | SSU | MN558962 | Xie et al. 2020 |
| *Ascarophis arctica* |  |  | SSU | DQ094172 | unpublished |
| *Aspiculuris tetraptera* | *Mus musculus* | Saudi Arabia | SSU | MT755640 | Omer et al. 2020 |
| *Baylisascaris transfuga* | *Ursus maritimus* | China | SSU | JN256988 | Li et al. 2012 |
| *Baylisascaris schroederi* | *Ailuropoda melanoleuca* | China | SSU | JN256992 | Li et al. 2012 |
| *Brugia malayi* | *Canis lupus familiares* | Thailand | COI | MK250753 | unpublished |
| *Cosmocercoides tonkiensis* | *Acanthosaura lepidogaster* | Vietnan | SSU | AB908160 | Tran et al. 2015 |
| *Cosmocercoides qingtianens* | *Bufo gargarizans* | China | SSU | MH178321 | Chen et al. 2018 |
| *Cosmocercoides pulcher* | *Bufo japonicus* | Japan | SSU | MH178326 | Chen et al. 2018 |
| *Cucullanus baylisi* | *Synodontis* sp. | Sudan | SSU | JF803935 | Moravec 2007 |
| *Cucullanus dodsworthi* | *Sphoeroides testudineus* | Mexico | SSU | HQ241923 | Mejia-Madrid and Aguirre-Macedo 2011 |
| *Cucullanus robustus* |  |  | SSU | JF934726 | Laetsch et al. 2012 |
| *Dentostomella sp.*  |  |  |  | AF036590 | Blaxter et al. 1998 |
| *Dujardinascaris gigantea* | *Alligator sinensis* | China | SSU | MF072701 | Li et al. 2018 |
| *Echinocephalus overstreeti* | *Heterodontus portusjacksoni* | Australia | SSU | JF934729 | Laetsch et al. 2012 |
| *Echinocephalus* cf. *pseudouncinatus* | *Atrina maura* | Mexico | SSU | MN514178 | unpublished |
| *Echinocephalus sp.1* |  | Egypt | SSU | KY911549 | unpublished |
| *Echinocephalus sp.2* | *Saurida undosquamis* | Egypt | SSU | KY972321 | unpublished |
| ***Echinocephalus spinosus n. sp.*** | ***Potamotrygon motoro*** | **Brazil** | **SSU** | **Xxxx****xxxxx** | **This study** |
| ***Echinocephalus spinosus n. sp.*** | ***Potamotrygon motoro*** | **Brazil** | **COI** | **Xxxxxxxx****Xxxxxxx****Xxxxxx****xxxxxxx** | **This study** |
| *Gnathostoma binucleatum* |  |  | SSU | Z96946 | unpublished |
| *Gnathostoma binucleatum* |  |  | COI | AB037131 | unpublished |
| *Gnathostoma neoprocyonis* |  |  | SSU | Z96947 | unpublished |
| *Gnathostoma spinigerum* |  |  | COI | AB037132 | unpublished |
| *Gnathostoma turgidum* |  |  | SSU | Z96948 | unpublished |
| *Heligmosomoides polygyrus* | *Apodemus mystacinus* | Turkey | COI | AF303153 | Zalesny et al. 2014 |
| *Hysterotylacium deardorffoverstreetorum* | *Paralichthys isosceles* | Brazil | SSU | JF718550 | Knoff et al. 2012 |
| *Hysterotylacium tetrapteri* | *Kajikia audax* | China | SSU | MF072705 | Li et al. 2018 |
| *Ichtyobronema hamulatum* | *Lota lota* | Russia | SSU | KY476351 | Sokolov et al. 2017 |
| *Mawsonascaris zhoui* | *Glaucostegus granulatus* | China | SSU | MF072706 | Li et al. 2018 |
| *Necator americanus* | Human | China | COI | AF303153 | Hawdon et al. 2001 |
| *Neoascarophis macrouri* |  |  | SSU | DQ442660 | Wijova et al 2006 |
| *Oxiurys equi*  | *Equus caballus* | USA | SSU | EF180062 | Nadler et al. 2007 |
| *Physaloptera alata* |  |  | SSU | AY702703 | unpublished |
| *Physaloptera hispida* | *Sigmodon hispidus* | USA | COI | MH782845 | unpublished |
| *Physaloptera thalacomys* | *Perameles gunnii* | Australia | SSU | JF934734 | Laetsch et al. 2012 |
| *Plectus aquatilis* |  | South Africa | SSU | GQ892827 | unpublished |
| *Porrocaecum reticulatum* | *Egretta garzetta* | China | SSU | MF072700 | Li et al. 2018 |
| *Procamallanus spiculogubernaculus* | *Heteropneustes fossilis* | India | COI | KU292358 | unpublished |
| *Proleptus trygonorrhini* | *Trygonorrhina fasciata* | Australia | SSU | JF934733 | Laetsch et al. 2012 |
| *Pseudanisakis rajae* | *Raja pulchra* | China | SSU | MF072707 | Li et al. 2018 |
| *Raphidascaroides brasiliensis* | *Platydoras costatus* | Brazil | SSU | KP726276 | Pereira et al. 2015 |
| *Raphidascaroides moraveci* | *Platydoras armatulus* | Brazil | SSU | KP726278 | Pereira et al. 2015 |
| *Rhadochona acuminatus* | *Brycon guatemalensis* | Mexico | COI | MK341636 | SantaCruz et al. 2019 |
| *Rhabdochona guerreroensis* | *Sicydium multipunctatum* | Mexico | SSU | JF934732 | Laetsch et al. 2012 |
| *Spiroxys hanzaki* | *Andrias japonicus* | Japan | SSU | AB818383 | Hasegawa et al. 2013 |
| *Spiroxys japonica* | *Rana nigromaculata* | Japan | SSU | AB818382 | Hasegawa et al. 2013 |
| *Spinitectus humbertoi* | *Profundulus punctatus* | Guatemala | COI | MK024434 | Barrios-Gutierrez et al. 2019 |
| *Tanqua tiara* | *Varanus indicus* | Australia | SSU | JF934728 | Laetsch et al. 2012 |
| *Terranova caballeroi* |  |  | SSU | U94381 | unpublished |
| *Toxocara canis* | *Alopex lagopus* | China | SSU | JN256976 | Li et al. 2012 |
| *Toxocara cati* | *Felis domesticus* | USA | SSU | EF180059 | Nadler et al. 2007 |
| *Toxocara vitulorum* | *buffalo* | Sri Lanka | SSU | EF180078 | Nadler et al. 2007 |
| *Toxascaris leonina* | *Panthera tigris altaica* | China | SSU | JN256979 | Li et al. 2012 |
| *Truttaedactinis clitellari* | *Acipenser fulvescens* | USA | SSU | KP275681 | Choudhury & Nadler 2015 |
| *Truttaedactinis heterodonti* | *Heterodontus francisci* | USA | SSU | KP275680 | Choudhury & Nadler 2016 |
| *Truttaedactinis truttae* | *Onchorhynchus mykiss* | USA | SSU | EF180063 | Nadler et al. 2007 |
| *Turgida* sp. |  | Mexico | COI | KC130680 | Prosser et al. 2013 |
| *Tylocephalus auriculatus* |  |  | SSU | AF202155 | unpublished |

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Figure S1: Maximum Likelihood topology based on COI mitDNA sequences of Nematoda (Spirurina). GenBank accession numbers are indicated next to species names. Numbers above nodes represent supported nodes by posterior probabilities for Bayesiananalyses and bootstrap for maximum likelihood analyses respectively (posterior probabilities > 0.90 and bootstrap scores > 70). Branch length scale bar indicates number of substitutions per site.