***Echinostoma chankensis* nom. nov., other *Echinostoma* spp. and *Isthmiophora hortensis* in East Asia: Morphology, molecular data and phylogeny within Echinostomatidae**

Anna V. Izrailskaia, Vladimir V. Besprozvannykh, Yulia V. Tatonova

**Supporting Information (Document S2)**

**References for nucleotide sequences from Table 1**

**Alberson, NR, Rosser, TG, Buddenborg, SK, Khoo, LH, Loker, ES, Richardson, TD, Woodyard, ET, Wise, DJ, Pote, LM and Griffin, MJ** (2017) North and South American haplotypes of *Drepanocephalus auritus* (Digenea: Echinostomatidae) are released from *Biomphalaria havanensis* inhabiting catfish aquaculture ponds in Mississippi, U.S.A. *Comparative Parasitology* **84**, 87-101. doi:10.1654/1525-2647-84.2.87

**Cech, G, Molnar, K and Szekely, C** (2017) Molecular biological studies of adult and metacercarial stages of *Petasiger exaeretus* Dietz, 1909 (Digenea: Echinostomatidae). *Acta Veterinaria Hungarica* **65**, 198-207. doi:10.1556/004.2017.020

**Detwiler, JT, Bos, DH and Minchella, DJ** (2010) Revealing the secret lives of cryptic species: Examining the phylogenetic relationships of echinostoma parasites in North America. *Molecular Phylogenetics and Evolution* **55**, 611-620. doi:10.1016/j.ympev.2010.01.004

**Detwiler, JT, Zajac, AM, Minchella, DJ and Belden, LK** (2012) Revealing cryptic parasite diversity in a definitive host: echinostomes in muskrats. *Journal of Parasitology* **98**, 1148-1155. doi:10.1645/GE-3117.1

**Dzikowski, R, Levy, MG, Poore, MF, Flowers, JR and Paperna, I** (2004) Use of rDNA polymorphism for identification of Heterophyidae infecting freshwater fishes. *Diseases of Aquatic Organisms* **59**, 35-41. doi:10.3354/dao059035

**Fu, YT., Jin, YC, Li, F and Liu, GH** (2019) Characterization of the complete mitochondrial genome of the echinostome *Echinostoma miyagawai* and phylogenetic implications. *Parasitology Research* **118**, 3091-3097. doi:10.1007/s00436-019-06417-4

**Georgieva, S, Kostadinova, A and Skirnisson, K** (2012) The life-cycle of *Petasiger islandicus* Kostadinova, Skirnisson, 2007 (Digenea: Echinostomatidae) elucidated with the aid of molecular data. *Systematic Parasitology* **82**, 177-183. doi:10.1007/s11230-012-9354-y

**Georgieva, S, Selbach, C, Faltynkova A, Soldanova, M, Sures, B, Skirnisson, K and Kostadinova, A** (2013) New cryptic species of the 'revolutum' group of *Echinostoma* (Digenea: Echinostomatidae) revealed by molecular and morphological data. *Parasites & Vectors* **6**, 64. doi:10.1186/1756-3305-6-64

**Georgieva, S, Faltynkova, A, Brown, R, Blasco-Costa, I, Soldanova, M, Sitko, J, Scholz1, T and Kostadinova, A** (2014) *Echinostoma* *'revolutum'* (Digenea: Echinostomatidae) species complex revisited: species delimitation based on novel molecular and morphological data gathered in Europe. *Parasites & Vectors* **7**, 520. doi:10.1186/s13071-014-0520-8

**Georgieva, S, Blasco-Costa, I and Kostadinova, A** (2017) Molecular characterisation of four echinostomes (Digenea: Echinostomatidae) from birds in New Zealand, with descriptions of *Echinostoma novaezealandense* n. sp. and *Echinoparyphium poulini* n. sp. *Systematic Parasitology* **94**, 477-497. doi:10.1007/s11230-017-9712-x

**Gomez-Puerta, LA, Angulo-Tisoc, JM, Pacheco, JI, Lopez-Urbina, MT and Gonzalez, AE** (2019) Natural infection of *Fasciola hepatica* in cervids from Peru. *Revista Peruana de Biología* **26**, 143-148. doi:10.15381/rpb.v26i1.15918

**Gordy, MA and Hanington, PC** (2019) A fine-scale phylogenetic assessment of digenean trematodes in central Alberta reveals we have yet to uncover their total diversity. *Ecology and Evolution* **9**, 3153-3238. doi:10.1002/ece3.4939

**Greben, OB, Kudlai, O, Korol, EN, Kornyushin, VV, Vasilkovska, IB and Kobylinsky, VV** (2016) A New Record of *Chaunocephalus ferox* (Digenea, Echinostomatidae) from Ciconia nigra in Ukraine Including Morphological and Molecular Data. *Vestnik Zoologii* **50**, 99-104. doi:10.1515/vzoo-2016-0012

**Griffin, MJ, Khoo, LH, Quiniou, SM, O'Hear, MM, Pote, LM, Greenway, TE and Wise, DJ** (2012) Genetic sequence data identifies the cercaria of *Drepanocephalus spathans* (Digenea: Echinostomatidae), a parasite of the double-crested cormorant (*Phalacrocorax auritus*), with notes on its pathology in juvenile channel catfish (*Ictalurus punctatus*). *Journal of Parasitology* **98**, 967-972. doi:10.1645/GE-3039.1

**Hernandez-Cruz, E, Hernandez-Orts, JS, Sereno-Uribe, AL, Perez-Ponce de Leon, G Garcia-Varela, M** (2017) Multilocus phylogenetic analysis and morphological data reveal a new species composition of the genus *Drepanocephalus* Dietz, 1909 (Digenea: Echinostomatidae), parasites of fish-eating birds in the Americas. *Journal of Helminthology* **92**, 572-595. doi:10.1017/S0022149X17000815

**Hildebrand, J, Adamczyk, M, Laskowski and Z Zalesny, G** (2015) Host-dependent morphology of *Isthmiophora melis* (Schrank, 1788) Luhe, 1909 (Digenea, Echinostomatinae) – morphological variation vs. molecular stability. *Parasites & Vectors* **8**, 481. doi:10.1186/s13071-015-1095-8

**Huguenin, A, Depaquit, J, Villena, I and Ferte, H** (2019) MALDI-TOF mass spectrometry: a new tool for rapid identification of cercariae (Trematoda, Digenea). *Parasite* **26**, 11. doi:10.1051/parasite/2019011

**Kostadinova, A, Herniou, EA, Barrett, J and Littlewood, DT** (2003) Phylogenetic relationships of *Echinostoma* Rudolphi, 1809 (Digenea:Echinostomatidae) and related genera re-assessed via DNA and morphological analyses. *Systematic Parasitology* **54**, 159-176. doi:10.1023/a:1022681123340

**Kudlai, O, Kostadinova, A, Pulis, EE and Tkach, VV** (2015) A new species of *Drepanocephalus* Dietz, 1909 (Digenea: Echinostomatidae) from the double-crested cormorant *Phalacrocorax auritus* (Lesson) (Aves: Phalacrocoracidae) in North America. *Systematic Parasitology* **90**, 221-230. doi:10.1007/s11230-015-9550-7

**Laidemitt, MR, Brant, SV, Mutuku, MW, Mkoji, GM and Loker, ES** (2019) The diverse echinostomes from East Africa: With a focus on species that use *Biomphalaria* and *Bulinus* as intermediate hosts. *Acta Tropica* **193**, 38-49. doi:10.1016/j.actatropica.2019.01.025

**Ledwon, A, Dolka, B, Piasecki, T, Dolka, I and Szeleszczuk, P** (2016) Invasion of Flukes of the Echinostomatidae Family in Racing Pigeon (*Columba livia* var. domestica) Lofts. *Avian Diseases* **60**, 523-527. doi:10.1637/11343-120715-CaseR

**Lee, SU, Chung, JY and Huh, S** (2007) Molecular phylogeny of parasitic Platyhelminthes based on sequences of partial 28S rDNA D1 and mitochondrial cytochrome c oxidase subunit I Korean. *Journal of Parasitology* **45**, 181-189. doi:10.3347/kjp.2007.45.3.181

**Lia, Y, Qiua, Y-Y, Zenga, M-H, Diaoa, P-W, Changa, Q-Ch, Gaoa, Y, Zhanga, Y and Wanga, C-R** (2019) The complete mitochondrial genome of *Echinostoma miyagawai*: Comparisons with closely related species and phylogenetic implications. *Infection, Genetics and Evolution* **75**, 103961. doi:10.1016/j.meegid.2019.103961

**Lotfy, WM, Brant, SV, DeJong, RJ, Le, TH, Demiaszkiewicz, A, Rajapakse, RP, Perera, VB, Laursen, JR and Loker, ES** (2008) Evolutionary origins, diversification, and biogeography of liver flukes (Digenea, Fasciolidae). *The American Journal of Tropical Medicine and Hygiene* **79**, 248-255. doi:10.4269/ajtmh.2008.79.248

**Maldonado, AJr, Loker, ES, Morgan, JA, Rey, L and Lanfredi, RM** (2001) Description of the adult worms of a new Brazilian isolate of *Echinostoma paraensei* (Platyhelminthes:Digenea) from its natural vertebrate host *Nectomys squamipes* by light and scanning electron microscopy and molecular analysis. *Parasitology Research* **87**, 840-848. doi:10.1007/s004360100451

**Mas-Coma, S, Funatsu, IR and Bargues, MD** (2001) *Fasciola hepatica* and lymnaeid snails occurring at very high altitude in South America. *Parasitology* **123**, 115-127. doi:10.1017/S0031182001008034

**Miquel, J, Martellet, MR, Acosta, L, Toledo, R and Petavy, AF** (2018) Reinvestigation of the sperm ultrastructure of *Hypoderaeum conoideum* (Digenea: Echinostomatidae). *Parasitology Research* **117**, 3725-3732. doi:10.1007/s00436-018-6071-8

**Mohanta, UK, Watanabe, T, Anisuzzaman, Ohari, Y and Itagaki, T** (2019) Characterization of *Echinostoma revolutum* and *Echinostoma robustum* from ducks in Bangladesh based on morphology, nuclear ribosomal ITS2 and mitochondrial nad1 sequences. *Parasitology International* **69**, 1-7. doi:10.1016/j.parint.2018.11.002

**Moema, EBE, King, PH and Rakgole, JN** (2019) Phylogenetic studies of larval digenean trematodes from freshwater systems in the proximity of Tshwane metropolitan, South Africa. *Journal of Veterinary* **86**, 1-7. doi:10.4102/ojvr.v86i1.1729

**Molnar, K, Gibson, DI, Cech, G, Papp, M, Deak-Paulus, P, Juhasz, L, Toth, N and Szekely, C** (2015) The occurrence of metacercariae of *Petasiger* (Digenea: Echinostomatidae) in an unusual site, within the lateral line scales of cyprinid fishes. *Folia Parasitologica* **62**, 17. doi:10.14411/fp.2015.017

**Morgan, JAT and Blair, D** (1998a) Relative merits of nuclear ribosomal internal transcribed spacers and mitochondrial CO1 and ND1 genes for distinguishing among *Echinostoma* species (Trematoda). *Parasitology* **16**, 289-297. doi:10.1017/s0031182097002217

**Nagataki, M, Tantrawatpan, C, Agatsuma, T, Sugiura, T, Duenngai, K, Sithithaworn, P, Andrews, RH, Petney, TN and Saijuntha, W** (2015) Mitochondrial DNA sequences of 37 collar-spined echinostomes (Digenea: Echinostomatidae) in Thailand and Lao PDR reveals presence of two species: *Echinostoma revolutum* and *E. miyagawai*. *Infection, Genetics and Evolution* **35**, 56-62. doi:10.1016/j.meegid.2015.07.022

**Nugaraite, D, Mazeika, V and Paulauskas, A** (2017) Molecular and morphological characterization of *Isthmiophora melis* (Schrank, 1788) Luhe, 1909 (Digenea: Echinostomatidae) from American mink (*Neovison vison*) and European polecat (*Mustela putorius*) in Lithuania. *Helminthologia* **54**, 97-104. doi:10.1515/helm-2017-0012

**Olson, PD, Cribb, TH, Tkach, VV, Bray, RA and Littlewood, DTJ** (2003) Phylogeny and classification of the Digenea (Platyhelminthes, Trematoda). *International Journal for Parasitology* **33**, 733-755. doi:10.1016/s0020-7519(03)00049-3

**Omar, MA, Metwally, AM and Sultan, K** (2013) Molecular and phylogenetic status of *Fasciola* sp., of cattle in Qena, Upper Egypt. *Pakistan Journal of Biological Sciences* **16**, 726-730. doi:10.3923/pjbs.2013.726.730

**Pinto, HA, Griffin, MJ, Quiniou, SM, Ware, C and Melo, AL** (2016) *Biomphalaria straminea* (Mollusca: Planorbidae) as an intermediate host of *Drepanocephalus* spp. (Trematoda: Echinostomatidae) in Brazil: a morphological and molecular study. *Parasitology Research* **115**, 51-62. doi:10.1007/s00436-015-4469-0

**Pulis, EE, Tkach, VV and Newman, RA** (2011) Helminth parasites of the wood frog, *Lithobates sylvaticus*, in Prairie Pothole wetlands of the northern Great Plains. *Wetlands* **31**, 675-685. doi:10.1007/s13157-011-0183-6

**Saijuntha, W, Sithithaworn, P, Duenngai, K, Kiatsopit, N, Andrews, RH and Petney, TN** (2011) Genetic variation and relationships of four species of medically important echinostomes (Trematoda: Echinostomatidae) in South-East Asia Infect. *Infection, Genetics and Evolution* **11**, 375-381. doi:10.1016/j.meegid.2010.11.009

**Saijuntha, W, Tantrawatpan, C, Sithithaworn, P, Duenngai, K, Agatsuma, T, Andrews, RH and Petney, TN** (2014) Genetic characterization and phylogenetic analysis of echinostomes. *The Southeast Asian Journal of Tropical Medicine and Public Health* **45**, 1003-1010.

**Sato, H, Suzuki, K, Osanai, A, Kamiya, H and Furuoka, H** (2006) Identification and characterization of the threadworm, *Strongyloides procyonis*, from feral raccoons (*Procyon lotor*) in Japan. *Journal of Parasitology* **92**, 63-68. doi:10.1645/GE-623R.1

**Sereno-Uribe, AL, Pinacho-Pinacho, CD, Sanchez Cordero, V and Garcia-Varela, M** (2015) Morphological and molecular analyses of larval and adult stages of *Echinoparyphium recurvatum* von Linstow 1873 (Digenea: Echinostomatidae) from central Mexico. *Journal of Helminthology* **89**, 458-464. doi:10.1017/S0022149X14000297

**Soldanova, M, Georgieva, S, Rohacova, J, Knudsen, R, Kuhn, JA, Henriksen, EH, Siwertsson, A, Shaw, JC, Kuris, AM, Amundsen, PA, Scholz, T, Lafferty, KD and Kostadinova, A** (2016) Molecular analyses reveal high species diversity of trematodes in a sub-Arctic lake. *International Journal for Parasitology* **47**, 327-345. doi:10.1016/j.ijpara.2016.12.008

**Sorensen, RE, Curtis, J and Minchella, DJ** (1998) Intraspecific variation in the rDNA its loci of 37-collar-spined echinostomes from North America: implications for sequence-based diagnoses and phylogenetics. *Journal of Parasitology* **84**, 992-997. doi:10.2307/3284633

**Staneviciute, G, Stunzenas, V and Petkeviciute, R** (2015) Phylogenetic relationships of some species of the family Echinostomatidae Odner, 1910 (Trematoda), inferred from nuclear rDNA sequences and karyological analysis. *Comparative Cytogenetics* **9**, 257-270. doi:10.3897/CompCytogen.v9i2.4846

**Tantrawatpan, C, Saijuntha, W, Sithithaworn, P, Andrews, RH and Petney, TN** (2013) Genetic differentiation of *Artyfechinostomum malayanum* and *A. sufrartyfex* (Trematoda: Echinostomatidae) based on internal transcribed spacer sequences. *Parasitology Research* **112**, 437-441. doi:10.1007/s00436-012-3065-9

**Tkach, V, Pawlowski, J and Mariaux, J** (2000) Phylogenetic analysis of the suborder plagiorchiata (Platyhelminthes, Digenea) based on partial lsrDNA sequences. *International Journal for Parasitology* **30**, 83-93. doi:10.1016/s0020-7519(99)00163-0

**Tkach, V, Pawlowski, J, Mariaux, J and Swiderski, Z** (2001) Molecular phylogeny of the suborder Plagiorchiata and its position in the system of Digenea. In D.T.J. Littlewood, & R.A. Bray (Eds.), *Interrelationships of Platyhelminthes* (pp. 186-193). Taylor and Francis, London.

**Tkach, VV, Schroeder, JA, Greiman, SE and Vaughan, JA** (2012) New genetic lineages, host associations and circulation pathways of *Neorickettsia* endosymbionts of digeneans. *Acta Parasitologica* **573**, 285-292. doi:10.2478/s11686-012-0043-4

**Tkach, VV, Kudlai, O and Kostadinova, A** (2016) Molecular phylogeny and systematics of the Echinostomatoidea Looss, 1899 (Platyhelminthes: Digenea). *International Journal for Parasitology* **46**, 171-185. doi:10.1016/j.ijpara.2015.11.001

**Yang, X, Gasser, RB, Koehler, AV, Wang, L, Zhu, K, Chen, L, Feng, H, Hu, M and Fang, R** (2015) Mitochondrial genome of *Hypoderaeum conoideum* - comparison with selected trematodes. *Parasites & Vectors* **8**, 720. doi:10.1186/s13071-015-0720-x

**Wilson, WD, Johnson, PT, Sutherland, DR, Mone, H and Loker, ES** (2005) A molecular phylogenetic study of the genus *Ribeiroia* (Digenea): trematodes known to cause limb malformations in amphibians. *Journal of Parasitology* **91**, 1040-1045. doi:10.1645/GE-465R.1