Records of the parasitic worm *Aspidogaster conchicola* (Baer 1827) in the Chinese pond mussel *Sinanodonta woodiana* (Lea 1834) in Poland and Ukraine

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Abstract

This paper presents a short review of published data and the authors’ own observations related to the occurrence of the parasitic worm *Aspidogaster conchicola* (Baer 1827) in the Chinese pond mussel *Sinanodonta woodiana* (Lea 1834). Infections were found in some fresh-water bodies in Poland (Konin Lakes System) and Ukraine (Danube Basin). The prevalence of infection ranged from 5 to 30%, intensity of infection – 1-2 specimens/mollusk. Free-living species of ciliates, nematodes and chironomides were also discovered during the investigation of *S. woodiana* in the Konin Lakes System (Poland).

Key words: *Sinanodonta woodiana*, *Aspidogaster conchicola*, symbiotic ciliates, host specificity

The Chinese pond mussel *Sinanodonta woodiana* (Lea 1834) (Figure 1) is an invasive species of fresh-water bivalve that has been introduced into surface water bodies in Europe (Petro 1984; Sarkany-Kiss 1986; Girardi and Ledoux 1989; Kraszewski and Zdanowski 2001; Yurishinents and Korinushin 2001; Manganelli et al. 1998), Central America and Indonesia (Watters 1997). The natural habitats of mollusks of the genus *Sinanodonta* are the water-bodies of the large Eastern Asian rivers basins, particularly those of the Amur and Yangtze Rivers (Bogatov and Zatravkin 1988). Most authors correlate the invasion of this bivalve species in the recipient ecosystems with the introduction of some Far Eastern fishes (Silver Carp – *Hypophthalmichthys molitrix* Valenciennes, Bighead Carp – *Hypophthalmichthys nobilis* Richardson, and Grass Carp – *Ctenopharyngodon idella* Valenciennes and some other species) into natural and artificial water bodies with the aim of increasing their productivity (Welcomme 1981). It is likely that some specimens of the transferred carp were infected with the species’ parasitic larvae (glochidia) that invaded the new water bodies after metamorphosis.

The transfer of *S. woodiana* larvae into the recipient ecosystems resulted in the expected absence of native symbiotic organisms that are normally found in adult clams in their natural habitats. Data on the structure of the symbiotic community of *S. woodiana* in the donor ecosys-
tems are rare (Zhao and Tang 2007). The main goal of the present study was to investigate the symbiotic community of *S. woodiana* in various recipient water ecosystems and make some suggestions and hypothesis concerning its formation.

The parasitological investigations of *S. woodiana* in the recipient ecosystems were carried out in some water-bodies in Ukraine (the Danube Basin) and Poland (the Konin Lakes System). The list of the surveyed water bodies, some data on the biotopes and samples is presented in Table 1.

Parasitic aspidogastrean worms *Aspidogaster conchicola* (Baer 1827) (Figure 2) (Platyhelminthes, Aspidogastridae) were observed in the pericardial cavity of *S. woodiana* in some locations (Table 1, Figure 3). The infection indexes were as follows: prevalence ranged from 5 to 27.3%, while the number of specimens found per mollusk (intensity of infection) was either 1 or 2 (Yuryshynets 2004; Pavlyuchenko 2005). This aspidogastrean species is a common element of symbiotic communities of native European unionid species. Moreover, *A. conchicola* has a circumpolar Holarctic area of distribution and has been described as a parasite of European and North American bivalve species with a wide range of host specificity – at least on the level of superfamily Unionioidea (Skryabin 1952; Dvodryadkin 1967; Fuller 1974). This platyhelminthes species has also been found in snails of the family Viviparidae (Skryabin 1952; Dvodryadkin 1967) and in the intestines of some Far Eastern molluskvorous fishes (Dvodryadkin 1967; Gao et al. 2003). *A. conchicola* represents an archaic group of Platyhelmintes, which need only a single host to complete their life cycle as eggs carrying larvae infect mollusks, develop as larvae and grow into adult worms (Bakker and Davids 1973; Rohde 1994, 2001). *A. conchicola* specimens are typically found in the pericardial or renal cavities of bivalve mollusks where they feed on blood cells and hemolymph (Bakker and Davids 1973).

Finding *A. conchicola* in *S. woodiana* suggests that this alien species has become a host to symbiotic species in their new habitats, normally

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**Table 1.** Data on surveyed water bodies, number of dissected clams and parameters of infection by *Aspidogaster conchicola*

| Record number | Location name and coordinates | Some biotope characteristics | Record date | Number of dissected mollusks | Prevalence of infection, % | Intensity of infection, sp./mollusk | References |
|---------------|--------------------------------|----------------------------|-------------|-----------------------------|---------------------------|-----------------------------------|------------|
| 1             | Kugurluy Lake (Danube Basin, Ukraine) 45°20'27"N, 28°40'24"E | Depth – 1.8 m; population density – 2 specimens/m² | Summer 2004 | 29* | 27.3* | 1.5* | Pavlyuchenko (2005) |
| 2             | Rapida River (Danube Basin, Ukraine) 45°20'15"N, 28°45'44"E | Depth – 1.8 m; population density – 2 specimens/m² | Summer 2004 | 2 |
| 3             | Channel Danube-Sasyk reservoir (Danube Basin, Ukraine) 45°33'04"N, 29°35'45"E | Depth – 1 m; current velocity – 0.0-0.5 m/s; population density – 2 specimens/m² | Autumn 2003 | 15 | 13.3 | 1 | Yuryshynets (2004), present study |
| 4             | Goslawske Lake (Konin Lakes, Poland) 52°18'10"N, 18°15'33"E | Depth – 0.5-1 m, t - 24°C; population density – 10 specimens/m² | July 2007 | 39 | 5.13 | 1 | Present study |
| 5             | Patnowskie Lake (Poland) 52°18'22"N, 18°15'46"E | Depth – 01 m, t -28°C; population density – 2 specimens/m² | July 2007 | 7 | - | - | Present study |
| 6             | Hot water discharge channel (Patnow Power Plant, Poland) 52°17'40"N, 18°16'03"E | Depth – 0.5 m, t - 34°C; population density – 85 specimens/m², current velocity – 0.3 m/s | July 2007 | 32 | - | - | Present study |

* - average data for 1st and 2nd map refs
characteristic to native unionid species. But our observations show that the process of integration of a native symbiotic species in the invasive community of *S. woodiana* has some peculiarities. Oligochaetes *Chaetogaster limnaei* (Baer 1827) have also been identified in the mantle cavities of *S. woodiana* collected from the studied localities. This species is a common symbiont of fresh water bivalves and snails (Kurandina and Ovcharenko 1993; Piechocki and Dyduch-Falniowska 1993) and has been reported both in Europe and North America (Molloy et al. 1997). Being invasive in North American water bodies, *Dreissena polymorpha* (Pallas 1771) is also a host of *Ch. limnaei*. In addition, free-living species of ciliates, nematodes and chironomids were revealed during the investigation of *S. woodiana* in the Konin Lakes system (Poland).

However, commensal ciliates of the Conchoptiridae family, which are characteristic of aboriginal unionid species, have never been discovered in *S. woodiana* mollusks. At the same time, these ciliate species (*Conchophthirus curtus* Eng. 1862, *Conchophthirus unionis* Raabe 1932, *Conchophthirus anodontae* Ehrbg. 1861) have demonstrated high infection rates in native unionid species (*Anodonta anatina* O.F. Müller 1774, *Unio pictorum* Linnaeus 1758) where they were found in the mantle cavities, when in joint biotopes with *S. woodiana* (Krasutska 2008).

Our preliminary laboratory investigations show that mucus on the surface of the mantle cavity of *S. woodiana* has a deleterious effect of on ciliates of the *Conchophthirus* genus as indicated by decreased motility and a shortened life span when compared to those commensal in aboriginal unionid clams.

Thus, the symbiotic community of the invasive species *S. woodiana* in the studied recipient ecosystems included some elements of native symbiotic fauna of the fresh-water mollusks.

**Figure 2.** The parasitic worm *Aspidogaster conchicola* from *S. woodiana* mollusks, scale ~100 µm (Goslawskie Lake, Poland). Photo: Natalya Krasutska

**Figure 3.** Presence of *Aspidogaster conchicola* from *Sinanodonta woodiana* in some water bodies of Poland and Ukraine [yellow circles: Pavlyuchenko (2005); red circle: present study. A – location in Poland, B – locations in Ukrainian section of the lower reaches of the Danube. See Table 1 for additional information]
The absence of obligate commensal ciliates in the mantle cavity of S. woodiana should be verified in further investigations, but preliminary findings could hypothetically be explained by the difference in the chemical content of the mantle cavity mucous.

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References

Bakker K, Davids C (1973) Notes on the life history of Aspidogaster conchicola Baer, 1826 (Trematoda: Aspidogastridae). Journal of Helminthology 47: 269-276

Bogatov V, Zatravkin M (1988) New species of the order Unioniformes (Mollusca, Bivalvia) from the south of Far East of USSR. Systematic and fauna of gastropods, bivalves and cephalopods mollusks. Trudy Zoologicheskogo Instituta Akademii Nauk SSSR 187: 155-168

Dvodryadkin V (1976) About hosts of Aspidogaster conchicola Baer in the Amur River Basin. II All-Union symposium of fish diseases and parasites of the water invertebrates (28-30 January 1976). Nauka, Leningrad, Russia, pp 23-24

Fuller S (1974) Clams and Mussels (Mollusca: Bivalvia). In: Hart CW, Fuller SL (eds), Pollution Ecology of Freshwater Invertebrates. Academic Press, New York, USA, pp 215-273

Gao Q, Nie P, Yao W (2003) Scanning electron microscopy of Aspidogaster taimai Kawamura, 1913 and Aspidogaster conchicola Baer, 1827 (Aspidogastridae, Aspidogastridae) with reference to their fish definitive-host specificity. Parasitology Research 91(6): 439-443 doi:10.1007/s00436-003-1002-7

Girardi H, Ledoux J (1989) Présence d’Anodonta woodiana (Lea) en France. (Mollusques, Lamellibranches, Unionidae). Bulletin mensuel de la Société Linnéenne de Lyon 58: 186-290

Kraszewski A, Zdanowski B (2001) The distribution and abundance of the Chinese mussel Anodonta woodiana (Lea, 1834) in the heated Konin lakes. Archives of Polish Fisheries 9(2): 253-265

Krasutska N (2008) The symbiotic organisms of dominant bivalves and snails species of the Konin lakes system. In: The Scientific messages of the Ternopil’skogo national pedagogical university the name of Vladimir Gnatyuk. Series: Biology 2(36). Ukraine, pp 77-83

Kurandina D, Ovcharenko N (1993) Parasites and commensals of the water animals. In: Hydroecology of Ukrainian part of the Danube River and adjacent water bodies. Naukova Dumka, Kiev, Ukraine, pp 179-189

Manganelli G, Bodon M, Favilli L, Castagnolo L, Giusti F (1998) Checklist delle specie della fauna d’Italia, molluschi terrestri e d’acqua dolce. Errata ed addenda, 1. Bollettino Malacologico 33(9-12): 151-156

Molloy D, Karatayev A, Burlakova L, Kurandina D, Laruelle F (1997) Natural Enemies Of Zebra Mussels: Predators, Parasites, and Ecological. Competitors. Reviews in Fisheries Science 5(1): 17-97 doi:10.1080/1064126970938593

Pavlyuchenko O (2005) The first record of the helminth Aspidogaster conchicola (Aspidogastrea) in Sinanodonta woodiana (Mollusca, Bivalvia) from Ukraine. Vestnik zoologii 39(3): 50

Petro E (1984) Occurrence of Anodonta woodiana (Lea, 1834) (Bivalvia: Unionacea) in Hungary. Allatani kozmlemények 49(4): 181-191

Piechocki A, Dyudach-Falinovska A (1993) Mollusks. Bivalves. Warshawa, Poland, 204 pp

Rohde K (1994) The minor groups of parasitic Platyhelminthes. Advances in Parasitology 33: 145-234 doi:10.1016/S0065-308X(08)60413-3

Rohde K (2001) The Aspidogastrea, an archaic group of Platyhelminthes. Interrelationships of the Platyhelminthes (eds. Littlewood D and Bray R), Taylor and Francis, London and New York, pp 159-167

Sarkany-Kiss A (1986) Anodonta woodiana (Lea, 1834) a new species in Romania (Bivalvia: Unionacea). Travaux du Museum National d’Histoire Naturelle “Grigore Antipa” 28: 15-17

Skryabin K (1952) Trematodes of subclass Aspidogastrea Faust et Tang, 1936. Trematodes of human and animals. Basics of trematodology. Moscow, AN SSSR, VI: 7-147

Yuryshynets V (2004) First observation of parasitic organisms in invasive bivalve species Sinanodonta woodiana (Bivalvia, Unionidae) in the water-bodies of Europe. Proceedings of XX Krajowe seminarium malakologiczne, 30 March – 2 April 2004, Book of Abstracts, Wroclaw, Poland, 36 pp

Yurishinets V, Korniushin A (2001) The new species in the fauna of Ukraine Sinanodonta woodiana (Bivalvia, Unionidae), its diagnostics and possible ways of introduction. Vestnik zoologii 35: 79-84

Watters G (1997) A synthesis and review of the expanding range of the Asian freshwater mussel Anodonta woodiana (Bivalvia: Unionidae) Veliger 40: 152-156

Welcomme R (1981) Register of international transfers of inland fish species. FAO Fisheries Technical Paper 213: 1-120

Zhao Y, Tang F (2007) Trichodinid ectoparasites (Ciliophora: Peritrichida) from Misgurnus anguillicaudatus (Cantor) and Anodonta woodiana (Lea) in China, with descriptions of two new species of Trichodina Ehrenberg, 1838. Systematic Parasitology 67(1): 65-72 doi:10.1007/s11230-006-9070-6