DIPLOMARBEIT

Parasites of *Apollonia melanostoma* (Pallas, 1814) and *Neogobius kessleri* (Guenther, 1861) (Osteichthyes, Gobiidae) from the Danube River in Austria.

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PARASITES OF *APOLLONIA MELANOSTOMA* (PALLAS, 1814) AND *NEOGOBIUS KESSLERI* (GUENTHER, 1861) (OSTEICHTHYES, GOBIIDAE) FROM THE DANUBE RIVER IN AUSTRIA

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Abstract

The two invasive fish species, the round goby *Apollonia melanostoma* syn. *Neogobius melanostomus* (Pallas, 1814) and the bighead goby *Neogobius kessleri* (Günther, 1861) have established a firm population in Austrian waters during the last 15 years. As there has been no record of the parasite community from these populations, a total of 79 specimens of *A. melanostoma* and 12 specimens of *N. kessleri* have been examined for parasites between May and October 2007 from three different sampling sites from the Danube River in Austria.

In total 12 parasite taxa could be recovered. The protozoans *Trichodina sp*., and *Ichtyophthirius multifiliis* from the gills, two crustacean species *Paraergasilus brevidigitus* and *Ergasilus sieboldi* from the gills and the two monogenean genera *Gyrodactylus sp*. and *Dactylogyrus sp*. from the skin and gills as well, all occurring in low prevalence and intensities. Furthermore cystacanths of the acanthocephalan *Acanthocephalus lucii* could be recovered from the body cavity. Metacercariae of the digenean species *Diplostomum spathaceum* and *Thylodelphys clavata* were found in the lens of the eye and the vitreous humour, respectively. The two digeneans *Nicolla skrjabini* and *Bunodera nodulosa* could be recovered from the intestine. Most striking seems the finding of metacercariae of the holarctic digenean *Bucephalus polymorphus* encysted in the skin and fins with prevalence up to 78 %, which is the first record of this parasite in Austrian waters.

Introduction

The round goby *Apollonia melanostoma* (Pallas, 1814) (formerly *Neogobius melanostomus*; see Stepien & Tumeo, 2006) is a gobiid fish species, native in the near shore areas of the Black and Caspian Sea, the Sea of Azov and the Sea of Marmara, also ascending into the tributaries of the Black and Caspian Sea, including Dnejster and Dnepr rivers. In the late 1950's it was antropogenically introduced with stocks into the Aral Sea (Charlebois *et al.*, 1997) and in the 1970's, gobies began to expand their range upstream the Volga River (Copp *et al.*, 2005). In the 1990's it had reached many parts of Europe, for example the Baltic Sea at the polish coast (Skóra & Stolarski, 1993), the Northern Sea of the Netherlands (van Beek, 2006), and the large European freshwater systems like the Danube river (Erös *et al.*, 2005; Stráňai & Andreji, 2004) and the river Rhine (Freyhof, 2003). The successful spread of this benthivorous fish species is believed to be closely related to human activities like river regulation, the connection of contiguous basins by canals and ballast water transport by ships (Copp *et al.*, 2005). With such ballast water *A. melanostoma* is also believed to have crossed the Atlantic Ocean and has been able to establish a firm population in the Great Lakes of North America (Charlebois *et al.*, 1997; Jude *et al.*, 1992). In Austria it was recorded in the year 2000 for the first time by Wiesner *et al.*(2000). In addition two other non-indigenous Ponto-Caspian goby species had arrived in Austrian waters only a few years earlier: the bighead goby *Neogobius kessleri* (Günther 1861) was recorded in 1994 (Zweimüller *et al.*, 1996) and the racer goby *Neogobius gymnotrachelus* (Kessler 1857) in 1999 (Zweimüller *et al.*, 2000; revised Ahnelt *et al.*, 2001).

As described for other Neobiota, the newly invaded gobies seem to have a massive effect on the population development of native fish species: (Jude *et al.*, 1995) showed a decrease of native fish populations in the St. Clair River (Great Lakes Area, North America) which appeared clearly related to the increase of the round goby population. The reason for the success in displacing native fish species from optimal habitats (Jude *et al.*, 1992) is believed to be due to a greater mean body length, higher fecundity and enhanced aggression compared to other benthic feeders, dwellers and spawners (Charlebois *et al.*, 1997). Furthermore the round goby, as an opportunistic feeder, prays on eggs and juveniles of other fish (Jude *et al.*, 1995) and therefore increases the pressure on sympatric species.

Describing the influence of neobiota on the native fauna, it has been show in the past that not only the specific properties of the alien species may have an impact on native species, but also the parasites accompanying the invaders may cause severe damage among the natives. Torchin *et al.* (2003) describes a loss in parasite species diversity and parasite prevalence in exotic host populations caused amongst others by the absence of required hosts in the new location. On the other hand not all exported parasite species go extinct in newly invaded habitats but stay stable, or even manage to establish themselves in the native populations enlarging their host range. Most impressive examples are *Anguillicola crassus* (Kuwahara, Niimi and Hagaki, 1974) (Nematoda, Dracunculidae) and its impact on the European eel *Anguilla anguilla* L., (Kennedy & Fitch, 1990) and *Dactylogyrus vastator* Nybelin, 1924 (Monogenea, Dactylogyridae) causing severe damages in European cyprinid fish (Schäperclaus, 1990), both parasites were antropogenically introduced with their hosts into Europe during the last decades.

The parasite fauna of Ponto-Caspian gobies, especially of *A. melanostoma*, has been well examined in their native habitat, the Black Sea, by Özer (2007) and Kvach (2005; 2004; 2001). From their newly invaded regions studies have been done in North America (Kvach & Stepien, 2008; Camp *et al.*, 1999) and the Baltic Sea (Kvach

& Skóra, 2007; Rolbiecki, 2006). For the Danube, parasitological examinations have been published for Hungary by Molnár (2006) and for Slovakia by Ondračková *et al.* (2005), but there are no reports for Austria yet.

The goal of this study was to examine the proto- and metazoan parasites of the Ponto-Caspian gobies from the Danube in Austria, to match the results with existing reports from other regions, and to compare the composition of the gobie’s parasites with parasites of indigenous fish species.

Sampling sites

The fish were sampled between May and October 2007 from three different sites at the river Danube, which is one of the largest river systems in Europe with a total length of 2850 km. The Austrian part accounts to approximately 350 km and represents the most important river in Austria (Schiemer & Spindler, 1989). A total of 55 fish and lamprey species have been reported from the main stream and its tributaries, which constitutes about three quarters of the 74 fish species described from Austrian waters (Spindler, 1997). The Danube is one of the main axes in European transport, with over 70 ports and transhipment sites. Since the opening of the Rhine-Main-Danube Chanel in 1992 the Danube is part of the longest water way in Europe, linking eleven countries, from the North Sea to the Black Sea with a total length of over 4000 km (Amlacher *et al.*, 2007). Numerous reports of animal species invading the Danube from the Rhine and vice versa have been published (Galil *et al.*, 2007).

The three chosen sites for this report show significant differences in their anthropogenic influence. The geographical distribution of the sampling sites is given in figure 1. Two sampling sites are located within the township of Vienna, one a basin of a river-port in Vienna the “Winterhafen”, the other one “Neue Donau”, an artificial anabranch of the Danube. The third sampling site “Ybbs” is the estuary of the Ybbs River in Lower Austria approximately 90 km upstream of Vienna. Neue Donau, opened in 1988, is an artificial flood protection channel in Vienna with a total length of 21.1 km, and a projected maximum flow of 5200 m^3/s. Water levels and the flow rate are antropogenically controlled by a floodgate and two hydraulic barrages (Chovanec *et al.*, 2000). The riverbed is covered with large stones and its banks are covered with vegetation which is maintained by the Vienna Government, as the whole area is used for recreational purposes. Fish samples were taken near the second barrage at river-kilometre 1918.31. The Winterhafen-site is a rectangular harbour basin constructed in the early 19th century, app. 2.1 km long and 100 to 180 m wide, situated parallel to the Danube River and directly opening to it at river-kilometre 1920.1. The depth averages to 5 m and the expanse of water is approximately 43.5 ha. Only in one part of the basin the embankment is covered with large stones. Fish samples were taken at this side. The rest of the borders are enclosed by vertical concrete walls, except for the side that opens to the river. Vegetation along the basin is missing (Sailer, 1959).

The sampling site at the Ybbs River is about 2.5 km downstream of the power plant Persenbeug. Within the framework of the Natura 2000, the project “Donau-Ybbs Linkage” with the project-number “LIFE04 NAT/AT/000006” for renaturation of the estuary has been started in 2004. The construction of a fish migration channel of 22 km on the Danube and 13 km on the Ybbs at Melk power station and the restoration of typical but increasingly rare river habitats at the mouth of river Ybbs such as gravel banks, gravel islands, natural bank areas and lateral interactions will be finished until June 2009 (Donau-Ybbs, 2004). In the time of the survey the working process at the estuary was finished. Parts of the old regulated estuary were dug off and the water stream formed a new estuary with islands, pebble zones and embankments with vegetation.

Material and methods

Fish were collected using hooks from the Neue Donau and the Winterhafen site and by electro fishing from the Ybbs site. A total of 79 specimens (25 female, 49 male and five not detected) of *A. melanostoma* and 12 specimens (two female, ten male) of *N. kessleri* were caught. In addition, one male specimen of the racer goby *Neogobius gymnotrachelus* from the Winterhafen-site was recovered. Fish were transported to the laboratory, kept in aerated tanks for up to 36 hours, killed by cervical dislocation and then examined for parasites using conventional techniques described by Amlacher (1992) and Schäperclaus (1990). Parasites were identified to the lowest possible taxonomic level using Moravec (2001), Schäperclaus (1990) and Bykhovskaya - Pavlovskaya *et al.* (1964). The total length (cm), weight (g) and sex were recorded for each fish. Parasitological terms were used according to Bush *et al.* (1997).

It has to be remarked that *Diplostomum spathaceum* and *Thylodelphys. clavata* are very similar in their morphology and a determination with standard microscopical methods is difficult, as well as the mere identification on their location in the host is unreliable (Hoole *et al.*, 2001). We are well aware of the present discussion on species differentiation of digeneans identified as *D. spathaceum* in different fish species, but awaiting the clarification of this discussion all recovered eye flukes from the lens were classified as *D. spathaceum* and all recovered eye flukes from the vitreous humour were identified as *T. clavata* after Bykhovskaya - Pavlovskaya *et al.* (1964).

Results

The statistical data of total length, weight and sex for both fish species are given in table 1.

A total of 12 parasite taxa were found including two protozoans (*Trichodina sp*., *Ichtyophthirius multifiliis*), two crustaceans (*Paraergasilus brevidigitus*, *Ergasilus sieboldi*), two monogeneans (*Gyrodactylus sp*., *Dactylogyrus sp*.), five digeneans (*Diplostomum spathaceum*, *Thylodelphys clavata*, *Nicolla skrjabini*, *Bunodera nodulosa*, *Bucephalus polymorphus*) and one acanthocephalan (*Acanthocephalus lucii*). In the round goby, all of the mentioned parasite taxa except *Trichodina sp.* could be detected, an overview of the parasite taxa in relation to the sampling sites and host species is given in table 2.

Protozoans were rare in both gobies. *Trichodina sp*. was detected on only one specimen of *N. kessleri* from Winterhafen in June. *I. multifiliis* was found on the gills of three specimens of *A. melanostoma* from Neue Donau in October. Monogeneans were completely absent in the bighead goby. *Gyrodactylus sp.* and *Dactylogyrus sp.* were only found on one specimen of round goby, *Gyrodactylus sp.* at Neue Donau in May and *Dactylogyrus sp.* in Winterhafen.

The cystacanths of *A. lucii* were found in Ybbs with a prevalence of 33.3% but were rare in Neue Donau. In the Winterhafen-site this parasite could not be detected.

Metacercariae of *D. spathaceum* were recovered at Winterhafen and Neue Donau, with a higher prevalence in Winterhafen. However this parasite could not be recovered from the third sampling site Ybbs.

Only the trematode *N. skrjabini* was found in the bighead goby from all three sampling sites. In the round goby it was only detected in Winterhafen.

Metacercariae of *B. polymorphus* were found in skin, fins and gills of round goby with prevalences up to 78.3%. This parasite was missing in the bighead goby.

The two crustaceans *P. brevidigitus* and *E. sieboldi* were found on gills of the round goby and the bighead goby from Neue Donau only. In the one specimen of *N. gymnotrachelus*, which was found in Winterhafen, one specimen of *Gyrodactylus sp*. and a total number of 85 *N. skrjabini* were found. Because of this high number of *N. skrjabini* it seemed fittingly to report the result of this examination.

The parasitological indices were only calculated for *A. melanostoma* and are given in table 3. Due to the small sample size of *N. kessleri* it did not seem appropriate to calculate statistics.

Discussion

Except *B. polymorphus* which could be detected for the first time in Austrian waters, all other parasites have already been detected in the river Danube near Vienna in different fish species (Laimgruber *et al.* 2005; Jirsa, 2004; Konecny, 1998; Moravec *et al.*; 1997). Both gobies show a similar parasite community at the different sampling sites. The parasites which could not be detected on the bighead goby respectively *Trichodina sp.,* which could not be found on the round goby, were only rare findings on one or few host specimens. The exception is *B. polymorphus* with a prevalence up to 78.3% in *A. melanostoma* and no records for *N. kessleri.* This result is well comparable with the findings of a study from the Dnjestr estuary (Ukraine) by Kvach (2004), where metacercariae of *B. polymorphus* were also absent in the bighead goby but quite abundant in the round goby population. The reason for this difference might be due to different alimentation patters of the two fish species. *A. melanostoma* is described as an essentially molluscivorous fish, *N. kessleri* on the other hand does not rely on molluscs (Miller, 2003). So it seems possible that round gobies are more intensively exposed to cercariae of *B. polymorphus* than bighead gobies. But it also has to be noted that in both studies the sampling size of *A. melanostoma* was several times over that of *N. kessleri* and therefore the chances of finding metacercariae in *N. kessleri* much lesser.

N. skrjabini was the only parasite, which could be detected from all three sampling sites in *N. kessleri,* in *A. melanostoma* it was only recovered from Winterhafen. This result is also well fitting with the study of Kvach (2004) from the Dnjestr River in Ukraine, where *N. skrjabini* could not be detected in the round goby but was found in the sympatric bighead goby. The occurrence of this parasite in the Danube near Vienna was reported by Konecny (1998) from one specimen of zingel *Zingel zingel*.

Comparing the studies of Molnár (2006) from the Hungarian, and Ondračková *et al.* (2005) from the Slovak section of the Danube, well connecting results for the parasite community could be described in this survey, although some differences in the composition on species-level could be discovered. In the round goby and the bighead goby, 12 parasite taxa were found in Slovakia and Austria, nine in Hungary (table 4). In total 21 different species and additional five genera could be detected in *A. melanostoma* and *N. kessleri* in the Danube so far.

Regarding *A. melanostoma* the three different sampling sites show significant differences in their parasite composition. Neue Donau shows the highest diversity in the parasite community in this study while the Ybbs-site appears poor in species, where only one species, the acanthocephalan *A. lucii* (cystacaths) could be recovered there. This is an exceptional result, because former studies from the neighbouring Melk section of the Danube on the barbel *Barbus barbus* (Laimgruber *et al.*, 2005) and the nase *Chondrostoma nasus* (Jirsa, 2004) showed remarkably more parasite species occurring also in high prevalences. Especially the absence of *D. spathaceum* and the acanthocephalan *Pomphorhynchus laevis* from the Ybbs-site is surprising. *P. laevis* is not only one of the most abundant parasite species with prevalences up to 100% in these former studies of this area, but also a parasite quite frequently reported from the round goby in the Danube (Molnár, 2006; Ondračková *et al.*, 2005). *D. spathaceum* is highly abundant in *A. melanostoma* at the Viennese-sites in this study and occurred in high prevalences at other sites (Kvach & Stepien, 2008; Rolbiecki, 2006; Ondračková *et al.*, 2005; Kvach, 2002). It was also present in the two cyprinid fish species in the studies mentioned above. In addition, studies of the diet composition of *A. melanostoma* by Kudrenko & Kvach (2005), Wandzel (2003) and Kvach & Zamorov (2001) showed a preference for molluscs and crustaceans, which are the intermediate hosts of *D. spathaceum* and *P. laevis* respectively. Therefore the reasons for the absence of *P. laevis* and *D. spathaceum* can not be well explained. Together with the occurrence of *A. lucii* this is an ominous result, which could indicate potential water pollution. *A. lucii* uses the asselid *Asellus aquaticus* as intermediate host (Bykhovskaya - Pavlovskaya *et al.*, 1964). Galli *et al.* (2001) showed positive correlations between high prevalences of *Acanthocephalus anquillae*, an acanthocephalan, which also uses *A. aquaticus* as intermediate host, and water pollution. The latest water quality report from the Austrian Government classifies the Ybbs River in this region with water quality II in a five class ranking, which means good (Philippitsch & Grath, 2006). The occurrence of *N. skrjabini*, which uses gammarids as second intermediate host (Bykhovskaya - Pavlovskaya *et al.*, 1964) in the bighead goby does not speak for water pollution as well. It rather seems that the execution of the renaturation on the Ybbs has produced disturbance in the natural conditions which had not recovered at the time of this survey. Further investigations on water parameters and benthos organisms could show the reasons for the poorness of the parasite community reported in this study.

The results for the eye flukes *D. spathaceum* and *T. clavata* show clear differences in prevalence of the Viennese-sites. Other surveys show similar results with much lower prevalence for *T. clavata* than *D. spathaceum* (Kvach & Skóra, 2007; Rolbiecki, 2006; Ondračková *et al.*, 2005) or no records for *T. clavata* (Kvach & Stepien, 2008). Because of the morphological similarity of these parasites it could be possible that the only one detected specimen of *T. clavata* is a *D. spaethaceum* individual, which has not reached the lens of the eye.

The most striking result of this survey seems to be the first appearance of *B. polymorphus* in Austrian waters, from *A. melanostoma*. This parasite has a life-cycle including two intermediate hosts and piscivorous fish as final hosts. The first intermediate host is the mollusc *Dreissena polymorpha* with the greatest emergence of cercariae of *B. polymorphus* between June and September (Baturo, 1977). As second intermediate host a large variation of fish species has been described. Metacercariae develop in epidermal cysts, with no specific location on the fish body. The final hosts are diverse piscivorous fish (Moravec, 2001). Highest pathogenicity is described for the cercariae penetrating the fish body, due to the mechanical damage causing death of fish and fry has been reported (Baturo, 1978). Hyperaemia and haemorrhage are also frequent pathological symptoms (Baturo, 1980). The anthropogenic introduction of parasites has shown very different consequences for the autochthonous fish population. Long term investigations have shown that *Anguillicola crassus,* which has been imported to Europe with the Japanese eel, has developed to be a severe problem for the European eel (Kennedy & Fitch, 1990) and *Dactylogyrus vastator,* brought to Europe with the grass carp *Ctenopharyngodon idella*, causes losses in carp cultures (Schäperclaus, 1990). On the other hand possible consequences of the newly invaded crustacean gill parasite *Lamproglena pulchella* are unknown yet (Jirsa *et al.*, 2006). Therefore also the influence of the newly introduced *B. polymorphus* is not known yet. *B. polymorphus* was found in the Danube from the Czech and Slovak Republic, both metacercariae and adults from diverse fish species but not from *A. melanostoma* (Moravec, 2001) and has been reported from gobies from the Black sea by Kvach (2004; 2002). In this survey it was only found from the Viennese sites but not from the Ybbs. It occurs that the parasite wanders westwards and has not reached the Ybbs River yet. Future investigation of possible final hosts and *D. polymorpha* will show if the parasites can establish a firm population in the Danube River and if this introduction puts additional pressure on the native fish populations.

All together it could be shown that the newly invaded gobies, *A. melanostomus* and *N. kessleri*, seem to follow the pattern described by Torchin *et al.* (2003), by adopting indigenous parasite species as well as importing new ones with them. It is quite likely that *B. polymorphus* has been introduced by the gobies following the invasion of the first intermediate host *D. polymorpha* into Mid-European waters. Future investigations will show a possible impact of this newly established parasite as well as the impact of the invaded fish species on the Danube ecosystem.

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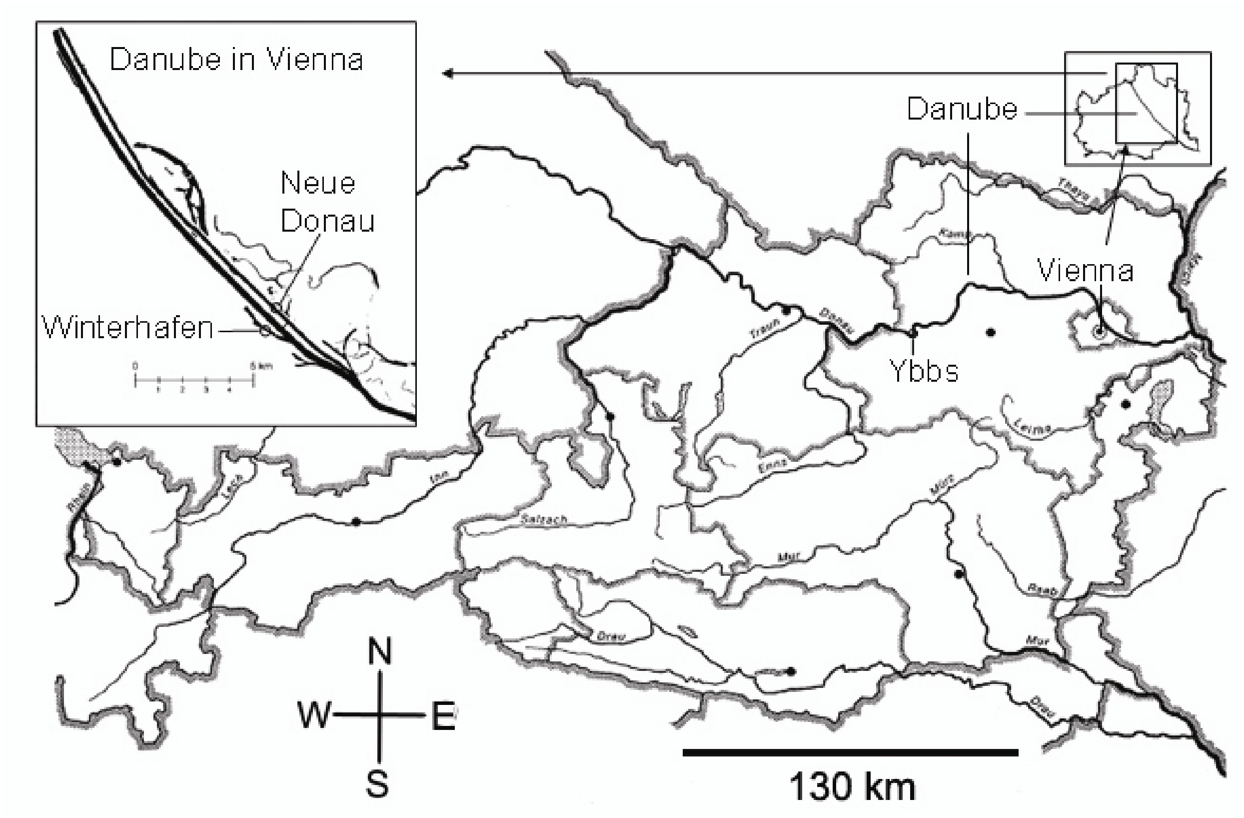

Figure 1: Sampling sites at the Danube River in Austria.
Map of Austria after Jirsa *et al*. (2008), maps of Vienna after Chovanec *et al*. (2000).

Table 1: Statistical data of fish sampled between May and October 2007: nd: not determined
sd: standard deviation

site	date	number (sex m/f)		total lenght [cm] mean ± sd		weight [g] mean ± sd	
		A. melanostoma	*N. kessleri*	*A. melanostoma*	*N. kessleri*	*A. melanostoma*	*N. kessleri*
Neue Donau	May	21 (7/10/nd)	-	10.1 ± 2.3	-	12.5 ± 7.2	-
Winterhafen	June	11 (9/1/nd)	1 (0/1)	12.2 ± 1.2	13.5	24.9 ± 9.1	29.6
Ybbs	July	9 (6/3)	3 (3/0)	8.7 ± 1.1	12.9 ± 1.0	9.6 ± 4.0	26.6 ± 5.5
Winterhafen	Sept	23 (18/5)	2 (1/1)	12.5 ± 1.5	14.2 ± 1.0	27.6 ± 10.2	36.6 ± 9.3
Neue Donau	Oct	15 (9/6)	6 (6/0)	10.7 ± 1.6	10.6 ± 0.3	16.6 ± 7.9	11.1 ± 1.1
total		79	12	11.0 ± 2.1	12.0 ± 1.6	19.1 ± 10.7	20.7 ± 11.1

Table 2: Statistical data for the infection with parasites for *A. melanostoma* from different sampling sites of the river Danube: Prevalence (%) (mean intensity; range of intensity, minimum - maximum)

Parasite species	Location	Sampling sites				
		Neue Donau May (n=21)	Neue Donau Oct. (n=15)	Winterhafen June (n=11)	Winterhafen Sept. (n=23)	Ybbs July (n=9)
Ichtyophthirius multifiliis	gills	n.d.	20.0 (1.0;1)	n.d.	n.d.	n.d.
Paraergasilus brevidigitus	gills	4.8 (1.0;1)	n.d.	n.d.	n.d.	n.d.
Ergasilus sieboldi	gills	19.1 (1.5;1-2)	6.6 (1.0;1)	n.d.	n.d.	n.d.
Dactylogyrus sp.	gills	n.d.	n.d.	n.d.	4.4 (1.0;1)	n.d.
Gyrodactylus sp.	skin, fin	4.8 (1.0;1)	n.d.	n.d.	n.d.	n.d.
Bucephalus polymorphus (metc.)	fin, skin, gills	n.d.	6.7 (1.0;1)	n.d.	78.3(17.4;2-54)	n.d.
Diplostomum spathaceum (metc.)	eye lens	19.1 (1.7;1-3)	20.0 (3.6;1-8)	45.5 (3.8;1-8)	52.2 (2.9;1-9)	n.d.
Thylodelphys clavata (metc.)	vit. humour	n.d.	n.d.	n.d.	4.4 (1.0;1)	n.d.
Nicolla skrjabini	intestine	n.d.	n.d.	18.2 (4.0;2-6)	n.d.	n.d.
Bunodera nodulosa	intestine	4.8 (2.0;2)	n.d.	n.d.	n.d.	n.d.
Acanthocephalus lucii (cystac.)	abd. cavity	4.8 (2.0;2)	6.7 (2.0;2)	n.d.	n.d.	33.3 (30.3;1-89)

n.d.: not detected; metc.: metacercariae; cystac.: cystacanth; vit. humour: vitreous humour; abd. cavity: abdominal cavity

Table 3: Detected parasites of *A. melanostoma* and *N. kessleri* from the three different sampling sites

Parasite taxon	Location	Sampling site		
		Neue Donau	Winterhafen	Ybbs
Trichodina sp.	gills	◊		
Ichtyophthirius multifiliis	gills	•		
Paraergasilus brevidigitus	gills	•		
Ergasilus sieboldi	gills	•◊		
Dactylogyrus sp.	gills		•	
Gyrodactylus sp.	skin, fin	•		
Bucephalus polymorphus (metc.)	fin, skin, gills	•	•	
Diplostomum spathaceum (metc.)	eye lens	•◊	•	
Thylodelphys clavata (metc.)	vit. humour		•	
Nicolla skrjabini	intestine	◊	•◊	◊
Bunodera nodulosa	intestine	•		
Acanthocephalus lucii (cystac.)	abd. cavity	•◊		•◊

A. melanostoma: • *N. kessleri*: ◊
metc.: metacercariae; cystac.: cystacanth; vit. humour: vitreous humour; abd. cavity: abdominal cavity

Table 4: Detected parasites of *A. melanostoma* and *N. kessleri* from the Slovak (Ondračková *et al.*, 2005), the Hungarian (Molnár, 2006) and the Austrian (present study, 2007) part of the river Danube

Author	Ondračková *et al.*, 2005	Molnár, 2006	Present study 2007
Parasite species			
Ciliophora			
Ichtyophtirius multifiliis		•◊	•
Trichodina sp.			◊
Apicomplexa			
Eimeria daviesae		◊	
Goussia kessleri		•◊	
Goussia szekelyi		•	
Trematoda			
Diplostomum sp.	•◊		
Diplostomum spathaceum			•◊
Tylodelphys clavata	◊		•
Nicolla skrjabini	•◊	•◊	•◊
Bunodera nodulosa			•
Bucephalus polymorphus			•
Apatemon cobitidis		•◊	
Metagonimus yokogawai		•◊	
Monogenea			
Gyrodactylus proterorhini	◊		
Gyrodactylus sp.			•
Dactylogyrus sp.			•
Acanthocephala			
Acanthocephalus lucii			•◊
Pomphorynchus laevis	•◊	•◊	
Nematoda			
Angiullicola crassus	◊		
Rhaphidascaris acus	•◊		
Crustacea			
Ergasilus sieboldi			•◊
Paraergasilus brevidigitus			•
Bivalvia			
Anodonta anatina	•◊		
Anodonta sp.		•	

A. melanostoma: • *N. kessleri*: ◊

Zusammenfassung

Ziel dieser Arbeit war eine Bestandsaufnahme der Ecto- und Endoparasitengemeinschaft der beiden invasiven Fischarten *Apollonia melanostoma* (Pallas, 1814) und *Neogobius kessleri* (Guenther, 1861) (Osteichthyes, Gobiidae). *A. melanostoma,* zu Deutsch die Schwarzmundgrundel, und *N. kessleri,* die Kesslergrundel, konnten sich in den letzten Jahren von ihrem ursprünglichen Verbreitungsgebiet, dem Schwarzen Meer, in viele europäische Gewässersysteme ausbreiten. Vor allem die Schwarzmundgrundel konnte ihr Vorkommen auf fast ganz Europa ausdehnen und wurde - wahrscheinlich mittels Ballastwasser - von Schiffen sogar in die Großen Seen in Nord Amerika eingeschleppt, wo sie eine stabile Population gebildet hat.

In Österreich konnte die Kesslergrundel zum ersten Mal 1994 nachgewiesen werden. Die erste Schwarzmundgrundel wurde im Jahr 2000 gefangen. Neben diesen beiden Arten ist noch die Nackthalsgrundel *Neogobius gymnotrachelus* (Kessler, 1857) anzutreffen, welche 1999 zum ersten Mal nachgewiesen werden konnte.

Für die vorliegende Arbeit wurden zwischen Mai und Oktober 2007 insgesamt 79 Exemplare von *A. melanostoma*, 12 von *N. kessleri* und ein Individuum von *N. gymnotrachelus* an drei sehr unterschiedlich anthropogen beeinflussten Standorten an der Donau gefangen und parasitologisch untersucht. Zwei Standorte sind in Wien lokalisiert, der eine ist das Hafenbecken des „Winterhafens Freudenau“ der andere die „Neue Donau“ in der Nähe des Wehres 2. Der dritte Standort liegt ungefähr 90 km stromaufwärts von Wien an der Ybbsmündung. Dieser Standort stellt insofern eine Besonderheit dar, als er Teil eines Natura 2000 Projekts ist und in den letzten Jahren renaturiert wurde.

Insgesamt konnten 12 Parasitentaxa nachgewiesen werden: die beiden Protozoa *Ichtyophtirius multifiliis* und *Trichodina sp*. sowie die beiden Crustacea *Ergasilus*

sieboldi und *Paraergasilus brevidigitus* auf den Kiemen, die Monogenea *Dactylogyrus sp*. auf den Kiemen und *Gyrodactylus sp*. auf der Haut und den Flossen, Metacercarien von *Bucephalus polymorphus* auf der Haut, den Flossen und den Kiemen, Metacercarien von *Diplostomum spathaceum* und *Tylodelphys clavata* in der Linse bzw. im Glaskörper der Augen, die adulten digenen Trematoden *Bunodera nodulosa* und *Nicolla skrjabini* im Darm sowie Zystakanthen des Kratzers *Acanthocephalus lucii* in der Körperhöhle.

Besonders auffällig war die Situation an der Ybbsmündung, wo mit *N. skrjabini* und *A. lucii* nur 2 Parasitenarten nachgewiesen werden konnten. Diese geringe Diversität steht im Widerspruch zu anderen Untersuchungen in dieser Region. Weiters ist für *A. lucii* die Wasserassel *Asellus aquaticus*, eine Leitart für geringe Wasserqualität, als erster Zwischenwirt beschrieben. Im Gegensatz dazu steht das Auftreten von *N. skrjabini*, für die Gammariden, Crustacenarten, die sehr empfindlich auf Wasserverschmutzung reagieren, als Zwischenwirte fungieren. Die Gründe für dieses divergierende Ergebnis und die geringe Diversität der Parasitengemeinschaft konnten im Rahmen dieser Arbeit nicht geklärt werden und bedürfen somit weiterführender Untersuchungen.

Das Auftreten von *B. polymorphus* stellt eine Besonderheit dar, da es sich hierbei um den Erstnachweis dieses Fischparasiten in österreichischen Gewässern handelt. Der Entwicklungszyklus dieses Trematoden ist an *Dreissena polymorpha* (Pallas, 1771) (Bivalvia, Dreissenidae), eine andere invasive Art, gebunden. Die Ergebnisse dieser Untersuchung lassen keinen Rückschluss zu, ob die Invasion von *B. polymorphus* mit jener der Ponto-Kaspischen Grundeln oder bereits früher mit der von *D. polymorpha* einhergegangen ist. Weiters kann die Frage, ob der Entwicklungszyklus dieses Parasiten geschlossen ist und dieser somit eigenständige

Populationen aufrechterhalten kann, nur aufgrund weiterer Untersuchungen geklärt werden.

Die Ergebnisse und Schlussfolgerungen dieser Arbeit sind im vorherigen Artikel, welcher für die Einreichung im „Journal of Helminthology“ Cambridge Press vorbereitet ist, dargelegt. Darüber hinaus wurden sowohl licht- als auch rasterelektronenmikroskopische Fotos angefertigt, welche zur Erläuterung hilfreich sind und im Anhang dargestellt werden.

Summary

The aim of this study was a survey of the ecto- and endoparasites of the two non-indigenous fish species *Apollonia melanostoma* (Pallas, 1814) and *Neogobius kessleri* (Guenther, 1861) (Osteichthyes, Gobiidae). *A. melanostoma*, the round goby, and *N. kessleri*, the bighead goby, have extend their range in the last years based from their native habitat, the Black Sea area, into many European freshwater systems. Primarily the round goby could establish in almost whole Europe and was – presumably by ballast water of ships – introduced into the Great Lakes of Northern America and could establish a firm population there.

In Austria, the bighead goby was detected for the first time in 1994. The first round goby was found in Austria in the year 2000. In addition, *Neogobius gymnotrachelus* (Kessler, 1857), the racer goby, occurs since 1999.

For this study, a total of 79 specimens of *A. melanostoma*, 12 of *N. kessleri* and one of *N. gymnotrachelus* were sampled from three different sampling sites from the Danube River with different anthropogenic influence and examined for parasites. Two sampling sites were located in the township of Vienna, one is the basin of the river port “Winterhafen Freudenau” and the other one is the “Neue Donau” near the “Wehr 2”. The third sampling site is the estuary of the Ybbs River approximately 90 km upstream of Vienna. This site is part of the framework “Natura 2000” und became renaturated in the last years.

In total, 12 parasite taxa could be recovered: the protozoans *Trichodina sp*. and *Ichtyophthirius multifiliis* from the gills, the two crustacean species *Paraergasilus brevidigitus* and *Ergasilus sieboldi* from the gills, the two monogenean genera *Gyrodactylus sp*. and *Dactylogyrus sp*. from the skin and gills as well, metacercariae of the eye flukes *Diplostomum spathaceum* and *Thylodelphys clavata* from the lens of the eye and the vitreous humour, metacercariae of *Bucephalus polymorphus* from

the skin, the fins and the gills, the two adult digeneans *Nicolla skrjabini* and *Bunodera nodulosa* from the intestine and cystacanths of the acanthocephalan *Acanthocephalus lucii* from the body cavity.

Noticeable was the situation at the estuary of the Ybbs. At this site *N. skrjabini* and *A. lucii* were the only parasite species which could be detected. This low diversity is oppositional to other surveys in this region. Furthermore, the asselid *Asellus aquaticus*, an indicator for low water quality, is described as the first intermediate host for *A. lucii.* The occurrence of *N. skrjabini*, which uses gammarids, Crustaceans, which are sensitive to water pollution, as first intermediate hosts, is contrary to the occurrence of *A. lucii*. The reasons for this divergent result and the low parasite diversity are unknown and need further investigations.

The occurrence of *B. polymorphus* is an exceptional result, because this is the first record of this parasite in Austria. The life cycle of this parasite is bound *on Dreissena polymorpha* (Pallas, 1771) (Bivalvia, Dreissenidae), another invasive species. The results of this study don't admit the conclusion if the invasion of *B. polymorphus* is linked with the invasion of the gobies or with the invasion of *D. polymorpha*. Furthermore it is not known if the life cycle is closed and *B. polymorphus* could establish autochthonous populations. This question needs further investigations.

The results and conclusions of this study are demonstrated in this article, which is prepared for submitting in the "Journal of Helminthology" Cambridge Press. Furthermore light microscopic and scanning electron microscopic pictures were prepared. These photographs are useful for explanation and therefore they are given in the appendix.

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Anhang

Abbildungsverzeichnis

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Stelle der Fänge, vom gegenüberliegenden Ufer aus fotografiert.

Abb. 2: Ufer am Standort Neue Donau

Uferböschung mit Vegetation

Abb. 3: Standort Winterhafen

Seite des Hafenbeckens, an der Fischproben genommen wurden

Abb. 4: Ufer am Standort Winterhafen

Ufer ohne Vegetation, große Steine am Beckenrand

Abb. 5: Übersicht über Winterhafen

Einfahrt zum Hafenbecken, von gegenüberliegender Brücke aus fotografiert

Abb. 6: Standort Ybbs

Mündung der Ybbs (links) in die Donau (rechts)

Abb. 7: ***Apollonia melanostoma***

Die Gesamtlänge des Tieres beträgt etwa 13 cm.

Abb. 8: Enzystierte Metazerkarien von *Bucephalus polymorphus*

Zyste zwischen zwei Flossenstrahlen der Dorsalis 1; Maßstab: 500 µm

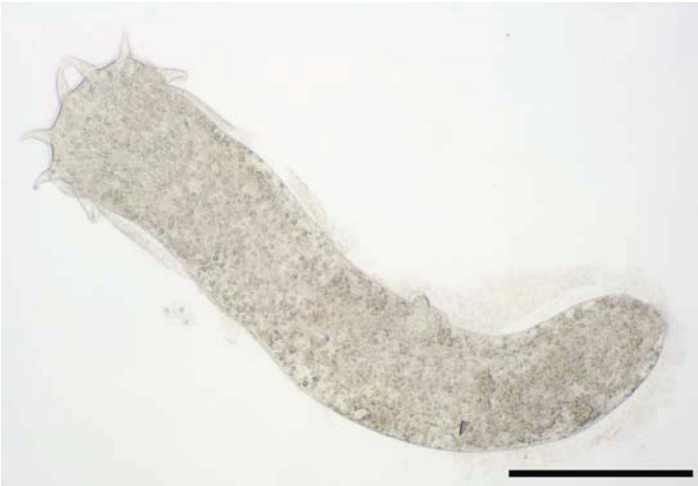

Abb. 9: Metazerkarie von *B. polymorphus*

Metazerkarie mit sieben charakteristischen, kontraktilen Kopfanhängen; Maßstab: 200 µm

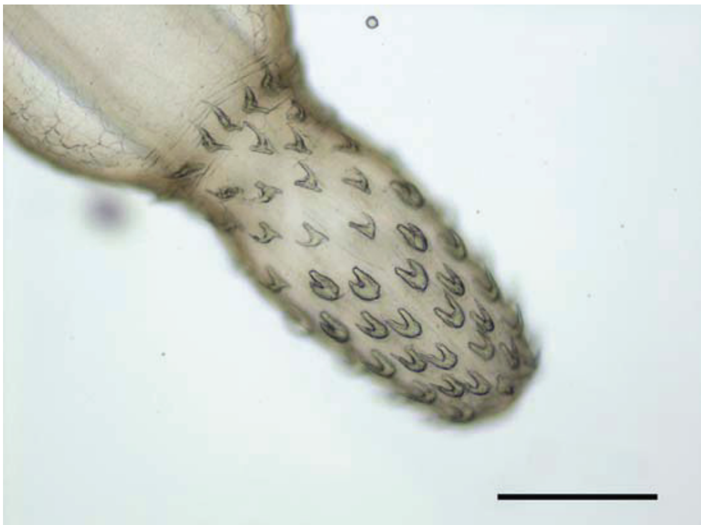

Abb. 10: ***Acanthocephalus lucii***

Hakenbesetzte Proboscis; Maßstab: 0,3 mm

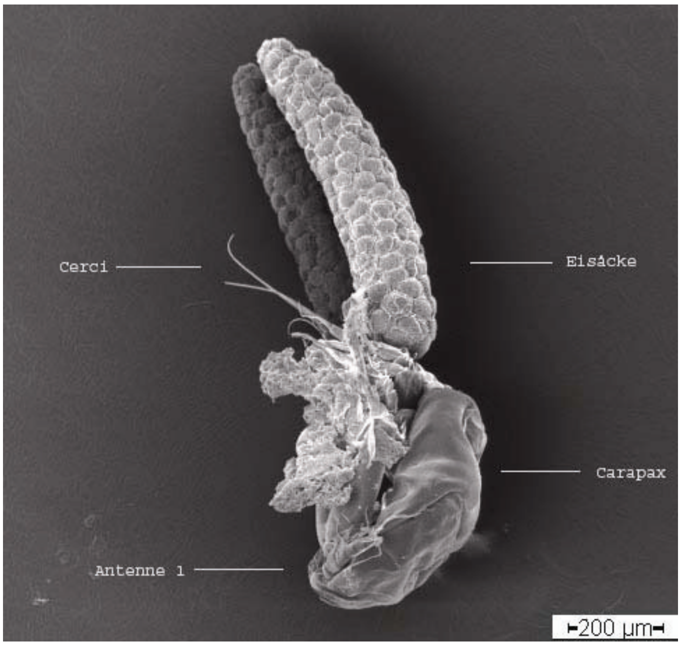

Abb. 11: ***Ergasilus sieboldi***

Rasterelektronenmikroskopische Übersichtsaufnahme

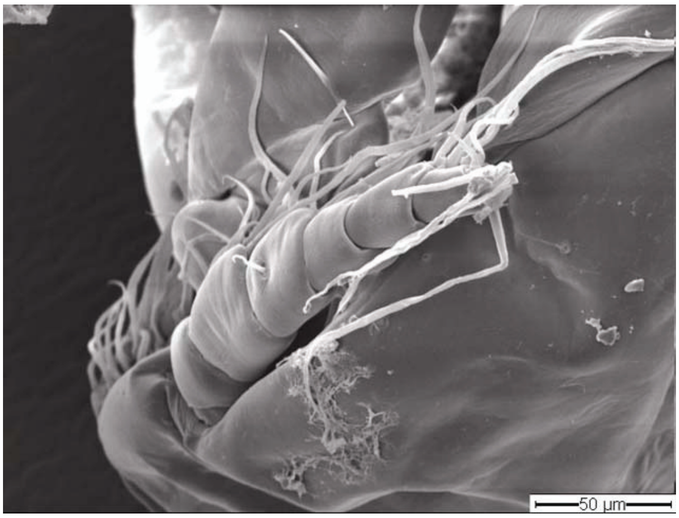

Abb. 12: Antenne 1 von *E. sieboldi*

Antennenspitze mit Sinnesborsten

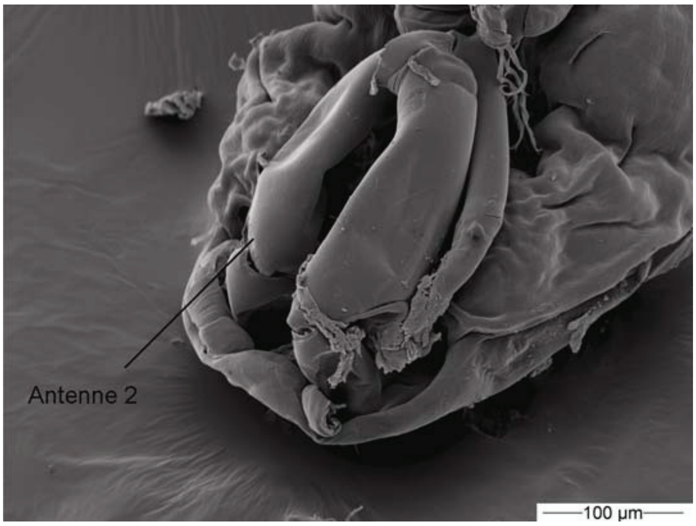

Abb. 13: Antenne 2 von *E. sieboldi*

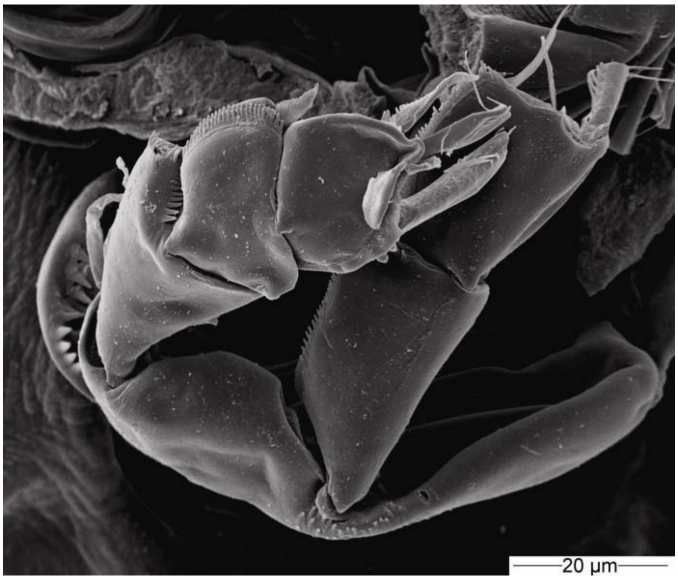

Abb. 14: Extremität von *E. sieboldi*

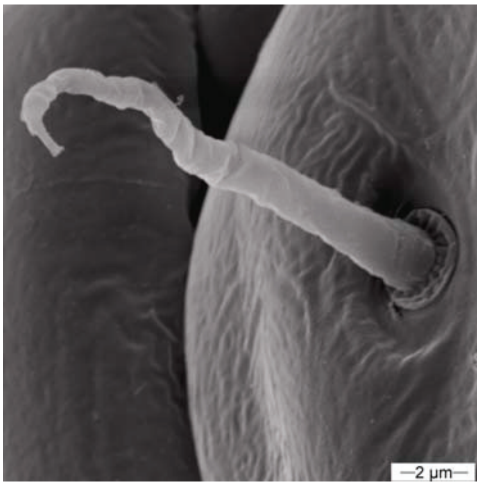

Abb. 15: Sinnesborste von *E. sieboldi*

Sinnesborste auf Antenne 1

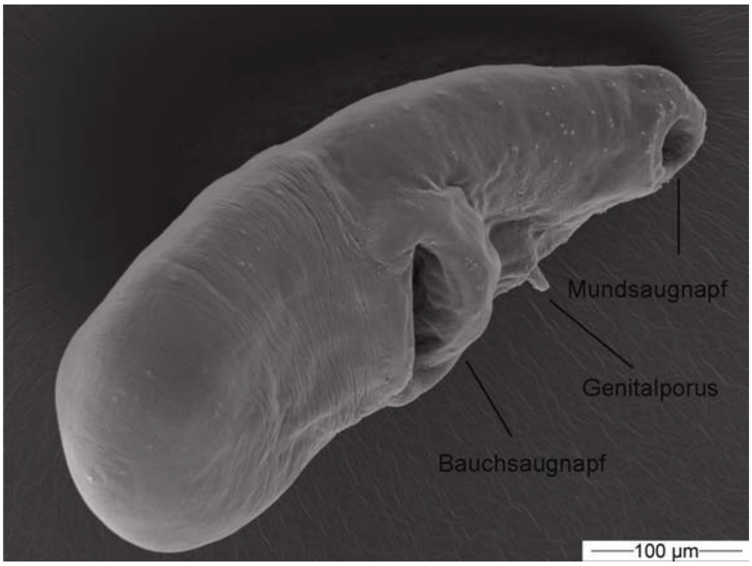

Abb. 16: *Nicolla skrjabini*
Rasterelektronische Übersichtsaufnahme

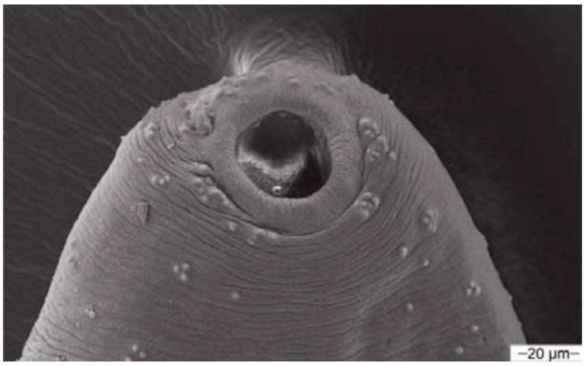

Abb. 17: Mundsaugnapf von *N. skrjabini*
Mundsaugnapf, von Papillengruben umgeben

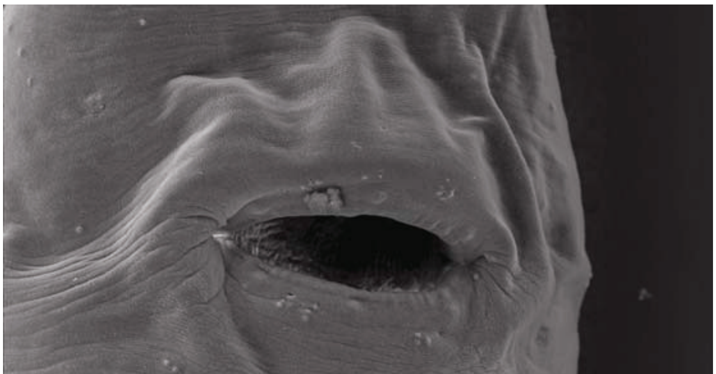

Abb. 18: Bauchsaugnapf von *N. skrjabini*

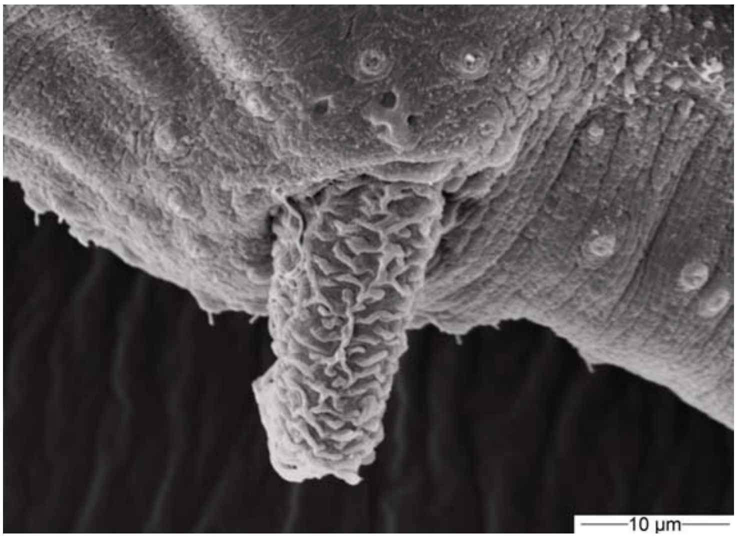

Abb. 19: Genitalporus mit ausgestülpten Penis von *N. skrjabini*

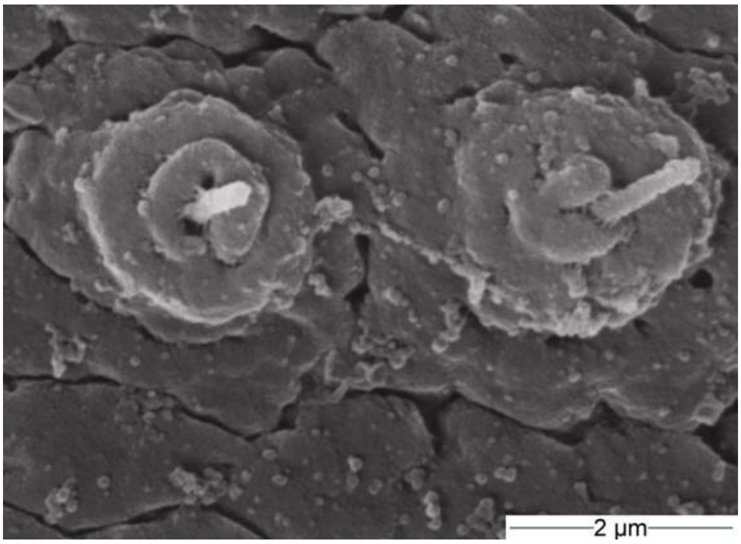

Abb. 20: Sensorische Papillen von *N. skrjabini*

In der Nähe des Genitalporus gelegen

Abb. 21: Gruppen von Papillen von *N. skrjabini*

In Gruppen angeordnete sensorische Papillen auf der Körperoberfläche

Lebenslauf

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6.11.2006-laufend	Seminarbetreuer bei Linde Verlag

Fremdsprachen

Deutsch (Muttersprache)

Englisch (Maturaniveau)

Wissenschaftliche Präsentationen

Mühlegger, J.M., Jirsa, F., Konecny, R., Frank, C. Parasites of *Apollonia melanostoma* (*Neogobius melanostomus*) (Pallas) and *Neogobius kessleri* (Günther, 1861) (Gobiidae: Osteichtyhes) from the Danube River in Austria.
Xth Multicolloquium of Parasitology, August 24th-28th, 2008, Paris, France.

Posterpräsentationen

Mühlegger J.M., Jirsa F., Konecny R. & Frank C. First record of *Bucephalus polymorphus* Bear 1827 (Digenea) from Austrian waters.
NEOBIOTA: Towards a Synthesis, 5th European Conference on Biological Invasions, September 23rd – 26th, Prague, Czech Republic.